NARRATIVE SKILLS FOLLOWING TRAUMATIC BRAIN INJURY IN CHILDREN AND ADULTS

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Personal narratives serve an important function in virtually all societies (Peterson & McCabe, 1991). Through narratives individuals make sense of their experiences and represent themselves to others (Bruner, 1990). The ability to produce narratives has been linked to academic success (Feagans, 1982). Persons who have sustained a traumatic brain injury (TBI) are at risk for impaired narrative ability (Dennis, 1991). However, a paucity of information exists on the discourse abilities of persons with TBI. This is partly due to a lack of reliable tools with which to assess narrative discourse. The present study utilized dependency analysis (Deese, 1984) to document and describe the narrative discourse impairments of children and adults with TBI. Ten children (mean age 12;0) and 10 adults (mean age 35;2) were compared with matched controls. Dependency analysis reliably differentiated the discourse of the individuals with TBI from their controls. Individuals with TBI were significantly more dysfluent than their matched controls. Furthermore, their performance on the narrative task revealed a striking listener burden. © 1996 Elsevier Science Inc.

Educational Objectives: (1) Readers will acquire knowledge and understanding of the importance of assessing spontaneous personal narrative ability of individuals with traumatic brain injury; (2) develop knowledge of the use of dependency analysis to assess personal narrative skill; (3) understand the relationship between traumatic brain injury and functional communication outcomes in children and adults with TBI; and (4) recognize potential for developmental differences in language outcomes for children versus adults with traumatic brain injury.

INTRODUCTION

Traumatic brain injury (TBI) is a complex impairment that affects linguistic, cognitive and pragmatic functioning. Previous research has shown that tradi-
tional language measures do not adequately describe the deficits of individuals with TBI (Chapman et al., 1992; Jordan, Cannon, & Murdoch, 1992; McDonald 1992, 1993). They tend to score within normal limits on traditional tests of aphasia, despite the presence of significant communicative impairments (Chapman et al., 1992; Jordan et al., 1992; Jordan & Murdoch, 1990; Levin, Benton, & Grossman, 1982; McDonald, 1993; Mentis & Prutting, 1987; Wyckoff, 1984). Their recovery of linguistic skills, as shown by conventional language measures, masks a more complex and functional disorder of language usage (Dennis & Barnes, 1990; Dennis & Lovett, 1990; Ylvisaker, 1986, 1993).

Language assessment measures of aphasia are generally ineffective as a means of studying the deficits associated with TBI for several reasons. First, the lesions associated with TBI often involve frontal lobe damage (Katz, 1992). The frontal lobes are involved in the planning, execution and control of many behaviors including language functioning (Alexander, Benson, & Stuss, 1989). Tests of aphasia do not assess this aspect of language ability (Ylvisaker, 1986). In fact, formal language testing may provide cuing and structure from which individuals with TBI may benefit, thus, giving them inflated scores (Ylvisaker, 1986). In addition, language tests, which emphasize decontextualized skills and ignore complex cognitive processing demands, are unlikely to reveal communicative impairments that individuals with TBI exhibit (Ewing-Cobbs, & Fletcher, 1987; Wyckoff, 1984; Ylvisaker, 1993). As a consequence, standard assessment procedures, based on models and tests for aphasia, are limited in their usefulness in planning intervention or predicting functional outcomes for individuals with TBI (Benton, 1987; Erlich, 1988; Wyckoff, 1984; Ylvisaker, 1986, 1993).

A more promising avenue of research lies in the realm of narrative discourse. Narrative skills tax the linguistic, cognitive and communicative abilities of speakers (Peterson & McCabe, 1983). The executive functions of planning and control are required for an individual to construct a coherent narrative. Narrative analysis accounts for the dynamic interaction between language and cognition and is relevant to both children and adults with TBI (Chapman et al., 1990; Hartley & Jensen, 1991, 1992; Jordan et al., 1992; Liles, Coehlo, Duffy, & Zalagens, 1989; McDonald, 1993; Marsh & Knight, 1991; Mentis & Prutting, 1987, 1991). In Table 1, a summary of the research describing the narrative and discourse abilities of adults and children with TBI is presented. This review will highlight some of the major findings pertinent to TBI.

The discourse of adults with TBI has been described as reduced in coherence, completeness and fluency (Hartley & Jensen, 1991; 1992; Marsh & Knight, 1991, Liles, et al., 1989; Mentis & Prutting, 1991). Their fictional narratives are generally incomplete, characterized by a reduced number of complete idea units, episodes, subjects and verbs (Glosser & Deser, 1990; Hartley

Cohesion ability has been one area in which agreement has not been obtained regarding the narrative abilities of adults with TBI. Mentis and Prutting (1987) and Hartley and Jensen (1991, 1992) documented fewer cohesive ties in the discourse of adults with TBI than a control group. In contrast, Glosser and Deser (1990) and McDonald (1993) found no evidence of impairments in cohesion with the adults in their investigation. Liles and her colleagues (1989) reported that cohesive ability varied with discourse task; narrative retelling was not associated with cohesion impairments while spontaneous narrative tasks revealed a reduced number of cohesive ties in comparison to a control group. Different methods of elicitation and analyses may have resulted in these conflicting data. In contrast, manner of production by adults with TBI has been consistently shown to be impaired. Deficiencies in rate, fluency and redundancy have been documented (Hartley & Jensen, 1991, 1992; Marsh & Knight, 1991; McDonald, 1993). In particular, increased hesitations, pauses, and false starts have been reported (Hartley & Jensen, 1991, 1992).

There is a paucity of research describing the discourse and narrative abilities of children with TBI. Only two studies have been reported in the literature. Chapman and her colleagues (1990) employed a retelling paradigm in order to investigate the narrative abilities of children and adolescents who had sustained mild, moderate or severe TBI. Their stories were analyzed for language and information structure as well as information flow. Children with mild and moderate TBI did not show narrative deficits while subjects with severe injury were impaired in their abilities to present critical story information and delineate episodes in narratives. In contrast, Jordan, Murdoch and Buttsworth (1991) did not find differences in the production of story grammar and cohesive elements when their subjects with TBI were asked to tell a story about a doll. However, all the subjects produced a few complete episodes, thereby limiting the data for analysis. The task limitations in this investigation may have contributed to their results. These two studies differ in their methodology, one a retelling task and one a spontaneous generation. The variations in elicitation may have resulted in the differences in the results. In addition, although Chapman and her colleagues (1990) did include a working memory measure in their investigation, it is possible that some of the differences they found may have been due to memory rather than discourse ability, since list recall may place different demands on working memory than the recall of a complex adventure story. Their procedure may not have tapped children's ability to organize and spontaneously produce complex narratives. The task of
### Table 1. Summary of Studies of Discourse and Narrative Skills of Adults and Children with TBI

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>X Age (years)</th>
<th>Methods</th>
<th>Analysis</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adult studies</strong></td>
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<tr>
<td>Erlich, 1988</td>
<td>n = 10</td>
<td>29.5</td>
<td>Narrate in response to “Cookie Theft picture”</td>
<td>Content units (CU); # syllables/minute; CU’s/minute</td>
<td>Fewer CU/min&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>TSI = 7–36 mos.</td>
<td></td>
<td></td>
<td>Redundancy index</td>
<td>Reduced efficiency</td>
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<td></td>
<td></td>
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<td></td>
<td>Syntactic complexity</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Coherence (local and global)</td>
<td>Omissions of subject and verb&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cohesion (Halliday &amp; Hasan, 1976)</td>
<td>Impaired local and global coherence&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td>Single word production</td>
<td>More lexical errors&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
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<td></td>
<td>No difference in cohesion</td>
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<td>No difference in syntactic complexity</td>
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<td></td>
<td></td>
<td>TBI fewer cohesive ties&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Glosser &amp; Deser, 1990</td>
<td>n = 9</td>
<td>24.3</td>
<td>Describe family</td>
<td></td>
<td>TBI fewer target content units&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>TSI = 2–14 mos.</td>
<td></td>
<td>Describe a work experience</td>
<td></td>
<td>TBI more inaccurate content units&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
<td>TBI slower rate of speech, less speech&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
<td>TBI higher percentage of dysfluencies&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
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<td></td>
<td></td>
<td>TBI more problems with reference</td>
</tr>
<tr>
<td>Hartley &amp; Jensen, 1991</td>
<td>n = 11</td>
<td>26.7</td>
<td>Narrate comic strip</td>
<td>Productivity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TSI = 1–20 mos.</td>
<td></td>
<td>Retell oral story</td>
<td>Quantity</td>
<td></td>
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<td></td>
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<td>Tell how to buy groceries</td>
<td>Rate</td>
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<td></td>
<td>Content inaccuracy</td>
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<td>Target content units</td>
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<td></td>
<td></td>
<td>Inaccurate units</td>
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<td>Problems of reference</td>
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<td></td>
<td></td>
<td>Cohesion (Halliday &amp; Hasan, 1976)</td>
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<tr>
<td>Study</td>
<td>n</td>
<td>TSI</td>
<td>Task Description</td>
<td>Productivity</td>
<td>Cohesion (Halliday &amp; Hasan, 1976)</td>
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<td></td>
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<td></td>
<td>Retell oral story</td>
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<tr>
<td>Liles, Coelho, Duffy, &amp;</td>
<td>4</td>
<td>TSI = 5–14 mos.</td>
<td>Retell filmstrip</td>
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<tr>
<td>Zalagens, 1989</td>
<td></td>
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<td>Generate story for picture</td>
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<tr>
<td>Marsh &amp; Knight, 1991</td>
<td>18</td>
<td>TSI = 20–146 mos.</td>
<td>Engage in 5 problem solving tasks with known person 10 min. conversation with stranger</td>
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<td></td>
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<td></td>
<td>Describe procedure to blindfolded person</td>
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<tr>
<td>McDonald, 1993</td>
<td>2</td>
<td>TSI = 36 mos. and 108 mos.</td>
<td>Describe procedure to blindfolded person</td>
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<td></td>
<td>42</td>
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Three profiles:
- Confused — High # clarity problems high # inaccurate content units
- Impoverished — marked density in productivity and content, low cohesion
- Inefficient — output > controls, high # dysfluencies

Retell—no differences
Generate—TBI fewer cohesive ties
TBI fewer complete episodes
Lack fluency, clarity, continuity
Less appropriate in use of language and delivery of speech
Repetitive, disorganized, ineffective
Irrelevant propositions
Outside range for # propositions
No difference in cohesion

continued
<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>X Age (years)</th>
<th>Methods</th>
<th>Analysis</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentis &amp; Prutting, 1987</td>
<td>n = 3</td>
<td>32</td>
<td>Conversation with partner Describe your work, how to play a sport change a tire, or bake a cake</td>
<td>Cohesion (Halliday &amp; Hasan, 1976); added &quot;incomplete cohesive&quot;</td>
<td>Fewer ties in the narrative&lt;sup&gt;b&lt;/sup&gt; High % incomplete ties&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>TSI = 12-44 mos.</td>
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<tr>
<td>Mentis &amp; Prutting, 1991</td>
<td>n = 1</td>
<td>24</td>
<td>Ten samples: 6 Conversations, concrete and abstract 4 Monologues, concrete and abstract (e.g., Halloween, greed)</td>
<td>Topic management ability Topic and subtopics; introduction, reintroduction, related, noncoherent or new information</td>
<td>Noncoherent changes Ambiguous units Incomplete units Reduced coherence and continuity</td>
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<tr>
<td></td>
<td>TSI = 58 mos.</td>
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<tr>
<td>Children Studies Chapman, et al. 1992</td>
<td>n = 19</td>
<td>12.6</td>
<td>Retell oral story</td>
<td>Language structure Information structure (Labov, 1972; VanDijk, 1985) Information flow (i.e., efficiency)</td>
<td>Group effect for language and information structure&lt;sup&gt;b&lt;/sup&gt; Severe TBI: Less language&lt;sup&gt;b&lt;/sup&gt; Fewer essential story components&lt;sup&gt;b&lt;/sup&gt; of setting and complicating action Failure to signal new episode&lt;sup&gt;b&lt;/sup&gt; Omit essential action information&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>TSI = 12-26 mos.</td>
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<tr>
<td>Study</td>
<td>Sample Size</td>
<td>Time since Injury</td>
<td>Test/Measure</td>
<td>Subtest/Score/Correlation</td>
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<tr>
<td>Dennis &amp; Barnes, 1990</td>
<td>n = 33</td>
<td>TSI = 10–111 mos.</td>
<td>Test of language competence, expanded edition (Wiig &amp; Secord, 1989)</td>
<td>Subtest scores, Composite scores, Intercorrelation of subtest scores, Correlation of subtest scores to non-discourse measures</td>
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<td>Additional non-discourse measures</td>
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<td>9.2</td>
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<td></td>
<td></td>
<td>11.6</td>
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</table>

Problems with global content
No difference in information flow
Little difference between mild/moderate
79% at least one subtest score—impaired range
67% composite score—impaired range
Higher intercorrelation between making inferences and re-creating sentences
Working memory predicts inferencing ability
Vocabulary knowledge predicts metaphor comprehension and ability to understand ambiguity
No significant differences

* TBI denotes traumatic brain injury (this term is being used interchangeably with CHI, the terminology which was previously used to describe individuals with a closed head injury);
  TSI denotes time since injury.
* Denotes significant finding.
Jordan and her colleagues (1991) may have been too abstract for the children since fantasy narratives are rarely used by children in their spontaneous discourse (Preece, 1987).

The purpose of the present investigation was to expand on the literature concerning the narrative discourse abilities of children and adults with TBI. This study differs from previous ones by using spontaneous personal narratives for assessment as well as a unique discourse analysis approach. Personal narratives merit study because they are used so frequently in social (Bruner, 1990; Preece, 1987) and educational (Feagans, 1982) settings. Competent discourse ability is required in daily life. Spontaneous generation tasks provide a more accurate index of functional communication ability than retelling tasks (Liles, 1993). Because of the increased demands for spontaneous organization and production of discourse in this investigation, additional differences in the narrative discourse abilities of individuals with TBI versus control subjects should be apparent. Dependency analysis (Deese, 1984) has never been used to study the discourse abilities of individuals with TBI. This approach will identify and quantify elements which may be impaired in the discourse of individuals with TBI, such as omission of critical information, redundancy and fluency.

METHOD

Subjects

There were 40 participants in this study, 20 individuals with TBI and 20 control group members. The adults and children with TBI were matched on the basis of age, gender, ethnicity, educational level, and region of the United States with a comparison group of individuals who had no history of head injury.

The 10 children with TBI who participated in this study included seven boys and three girls, ranging in age from 7:4 to 16:2 years. Their mean age was 12:0 years ($SD = 3:2$). These children were selected and recruited from a larger sample of children who are involved in a prospective study of injury impact being conducted by a medical center in the Northeastern United States. One criterion for inclusion was that the children had no premorbid history of learning or emotional difficulties. The time since injury for the children with TBI ranged from 22 to 46 months ($M = 33:1$ months, $SD = 8:8$ months). Glasgow coma scale (GCS) scores (Teasdale & Jennett, 1974), taken at the time of injury, were available for all but one of the children. Based on the GSC scores, seven of the 10 children were classified as having a mild to moderate injury (GCS $> 8$). Two of the children were in the severe TBI range (GCS $> 8$). The mean GCS score for the group was 9:6. Of the 10 children, five were receiving resource room support services. Three of those five children were also receiving speech-language services. With the exception of one child, these children did not have any obvious physical handicaps.
Ten children were in the comparison group. They ranged in age from 7;1 to 16;2 years \((M = 12;1, SD = 3;2)\). These children were of average intellectual ability and were not receiving special educational services for any reason including giftedness. Every child received a small gift for participating in the study.

The five women and five men with TBI who participated in the study ranged in age from 20 to 52 years, with a mean age of 35;2 years \((SD = 9.89)\). They represented a range of educational levels from high school through graduate school. It was not possible to obtain the medical records of these individuals. However, all were within 12 months of the injury at the time of the interview.

The 10 adults in the control group ranged in age from 19 to 52 years \((M = 34;4, SD = 9.98)\): All of the adult control participants were high school graduates. Some of the adults had attended college or trade school.

**Procedure**

The children’s narratives were collected by the first author in a home setting. The narratives were elicited using the conversational map technique developed by Peterson and McCabe (1983). A generation task was selected because the goal of the study was to examine the participant’s ability to spontaneously organize discourse on demand with minimal contextual support (see Liles, 1993).

Using this procedure, the interviewer related a personal experience and then asked the participant if she/he had had a similar experience. Once the individual began recounting that experience, the interviewer responded to the narrative in a manner designed to encourage elaboration (e.g., “Uh huh”). The interviewer did not evaluate the speaker’s experience, nor did she request specific details of the event. Each child received four narrative prompts including, “A pet does something funny,” “A trip to an amusement park,” “Getting lost,” and “Being stung by a bee.”

The adult narratives used in this study were collected and transcribed under the direction of the third author. Clinicians elicited the narratives using the same conversational map technique (Peterson and McCabe, 1983) used with the children. The story prompts were modified in order to make them appropriate for adults. The adult prompts included “Getting lost,” “A broken bone,” “A favorite experience with a child,” and “Having a car accident.” For both the children and the adults, each narrative was recorded and was later transcribed for analysis.

**Measures**

The narratives were analyzed according to the principles of dependency analysis (Deese, 1984). This method has been described in detail with examples by Peterson and McCabe (1983). Unlike High Point analysis (Labov, 1972), which assesses independent clauses and their informational content,
dependency analysis focuses on the story's syntax (Peterson and McCabe, 1983). It also provides quantitative measures of dysfluency and listener burden. Propositions were the units of analysis and the relationships between propositions illustrated the basic form of the narrative, that is, its complexity. For example the sentence, "I just got lost last week at the beach" was divided into the main proposition "I got lost," with dependent propositions "just," "last week," and "at the beach" as modifiers of "got lost."

Because length is an excellent index of narrative complexity (McCabe and Peterson, 1990), the longest narrative of each participant which was un-rehearsed and not a retelling was selected for analysis. The goal was to view the upper limits of each participant's performance. Each story was divided into propositions. Absolute counts and ratios were coded in the categories defined by Deese (1984) and described by Peterson and McCabe (1983). There was one additional category added to the analysis. The categories and examples of each are listed below.

Absolute Measures/Frequencies

**Explicit Propositions.** All propositions provided by the speaker.

**Implicit Propositions.** Information which had to be inferred by the listener.

Implicitness was coded when a definite article was used without a previous referent. For example, "So we were walking around the lake," when a lake had never been mentioned. In this case the coder would add "There was a lake" to the narrative in parentheses. Partial implicitness was coded when a portion of a sentence was not supplied by the speaker. For example, "Went to the beach." The implicit propositions were divided into complete (subject and verb) or partial propositions.

**Repeated Propositions.** e.g., "It was so hot." "It was so hot." A repeated proposition could occur anywhere in the text and need not be verbatim.

**Total Dysfluencies.** False starts, internal corrections, and fillers were combined for a total dysfluency measure.

**False Starts.** e.g., "We it was so . . ."

**Fillers.** This was added to the list of absolute measures and included pauses, hesitations (such as "um"), fillers, and colloquialisms (e.g., "like," "you know"), and mispronunciations (e.g., "supposes" for supposed).

**Internal Corrections.** e.g., "... nights, I mean weekends."

Ratio Measures/Proportions

**Listener Burden Ratio.** The total number of implicit propositions divided by the total number of explicit propositions provides the listener burden ratio. Ratio measures were also calculated for the number of complete implicit propositions and the number of partial implicit propositions relative to the total number of explicit propositions.

**Redundancy Ratio.** To calculate this ratio, the total number of repeated propositions was divided by the total number of explicit propositions.
Table 2. Results of Dependency Analysis

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>TBI</th>
<th>Controls</th>
<th>F Value (df 1, 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicit propositions</td>
<td>33.70 (29.12)</td>
<td>33.40 (18.10)</td>
<td>0.00</td>
</tr>
<tr>
<td>Implicit propositions</td>
<td>5.25 (3.71)</td>
<td>3.15 (2.20)</td>
<td>7.68*</td>
</tr>
<tr>
<td>Partial implicit</td>
<td>3.35 (3.42)</td>
<td>2.00 (1.95)</td>
<td>3.16</td>
</tr>
<tr>
<td>Complete implicit</td>
<td>1.90 (1.25)</td>
<td>1.15 (1.14)</td>
<td>3.95</td>
</tr>
<tr>
<td>Repeated propositions</td>
<td>1.30 (1.66)</td>
<td>0.15 (0.37)</td>
<td>9.50**</td>
</tr>
<tr>
<td>Total dysfluencies</td>
<td>6.55 (7.55)</td>
<td>2.25 (2.02)</td>
<td>7.25*</td>
</tr>
<tr>
<td>False starts</td>
<td>1.50 (2.20)</td>
<td>0.20 (0.52)</td>
<td>9.66**</td>
</tr>
<tr>
<td>Fillers</td>
<td>4.75 (5.5)</td>
<td>1.80 (1.60)</td>
<td>6.65*</td>
</tr>
<tr>
<td>Internal correct</td>
<td>0.45 (0.69)</td>
<td>0.35 (0.64)</td>
<td>0.71</td>
</tr>
<tr>
<td>Listener burden radio (implicit/explicit)</td>
<td>.230 (.195)</td>
<td>.097 (.072)</td>
<td>8.58**</td>
</tr>
<tr>
<td>Partial ratio</td>
<td>.129 (.125)</td>
<td>.058 (.061)</td>
<td>4.98*</td>
</tr>
<tr>
<td>Complete ratio</td>
<td>.099 (.104)</td>
<td>.038 (.039)</td>
<td>5.87*</td>
</tr>
<tr>
<td>Redundancy ratio</td>
<td>.035 (.104)</td>
<td>.010 (.031)</td>
<td>3.30</td>
</tr>
<tr>
<td>Dysfluency ratio</td>
<td>.211 (.232)</td>
<td>.068 (.045)</td>
<td>7.77*</td>
</tr>
<tr>
<td>False start ratio</td>
<td>.036 (.042)</td>
<td>.004 (.009)</td>
<td>11.61**</td>
</tr>
<tr>
<td>Filler ratio</td>
<td>.160 (2.02)</td>
<td>.055 (.039)</td>
<td>6.13*</td>
</tr>
<tr>
<td>Internal correct ratio</td>
<td>.016 (.027)</td>
<td>.007 (.020)</td>
<td>1.20</td>
</tr>
</tbody>
</table>

*p < .05.

**p < .01.

*Dysfluency Ratio.* For this ratio the total number of false starts, internal corrections, and additional dysfluencies was divided by the total number of explicit propositions.

*False Start Ratio.* The total number of false starts was divided by the total number of explicit propositions for this measure.

*Internal Corrections Ratio.* This ratio was the total number of internal corrections divided by the total number of explicit propositions.

*Filler Ratio.* To calculate this ratio, the total number of fillers was divided by the total number of explicit propositions.

The ratio measures provided an index of the coherence of the narrative in addition to its syntactic complexity. Higher scores than normal in dysfluency, redundancy, and listener burden would have implied a less coherent narrative.

**Reliability of Narrative Measures**

Thirty percent of the data was coded by an independent rater who had received extensive training in dependency analysis. Reliability was calculated using a Pearson correlation for measures of total explicit propositions and total implicit propositions. The results were an \( r = .99 \) \( (p < .001) \) for explicit propositions and \( r = .95 \) \( (p = .003) \) for implicit propositions. Disagreements about the coding were resolved through discussions.
RESULTS

On a variety of measures, the individuals with TBI were substantially less articulate than their peers. Dependency analysis differentiated the discourse of the TBI participants from that of the comparison group in a series of two way anovas using matched groups for the head injury control variable. Table 2 summarizes the results of the analysis and presents means and standard deviations for each group. As is standard procedure, a p value of .05 was chosen to determine the significance of the results. There were large standard deviations for the group with TBI on several measures. This was not the case for the comparison group.

Absolute Measures/Frequencies

Total Explicit Propositions. On the measure of total number of explicit propositions, individuals with TBI did not differ from members of the comparison group. In fact, the mean number of propositions generated by each group was nearly equal.

Total Implicit Propositions. There was a significant main effect for injury status on this count \[ F(1, 18) = 7.68, p < .05 \]. In their narratives, persons with TBI left out more information than their non-injured peers.

Complete Implicit Propositions. Individuals with TBI omitted complete propositions more often than their controls. However, group differences related to injury injury status were not significant.

Partial Implicit Propositions. Group differences were not significant for the absolute amount of partial information omitted in the narratives of individuals with TBI as compared to the controls.

Repeated Propositions. Significant group differences demonstrated that TBI individuals repeated themselves more often than did individuals in the comparison group \[ F(1, 18) = 9.50, p < .01 \].

Total Dysfluencies. TBI individuals generated more dysfluencies than the control group. These differences were significant \[ F(1, 18) = 7.25, p < .05 \].

False Starts. Significant differences were noted in the number of false starts made by members of each group \[ F(1, 18) = 9.66, p < .01 \]. Persons with TBI produced more false starts than their matched peers.

Fillers. TBI individuals used more pauses, hesitations, and fillers than their non-impaired counterparts. The differences between the groups were significant \[ F(1, 18) = 6.65, p < .05 \].

Internal Corrections. Group differences were not significant for the number of internal corrections made by the participants.

Ratio Measures/Proportions

Listener Burden Ratio. There was a significant main effect for injury status \[ F(1, 18) = 8.58, p < .01 \]. TBI individuals left more information im-
explic in their narratives relative to their explicit propositions than did members of the control group.

**Complete Implicit Proposition Ratios.** TBI participants omitted more complete propositions than members of the comparison group. The group differences were significant \( F(1, 18) = 5.87, p < .05 \).

**Partial Implicit Proposition Ratios.** In addition to omitting complete propositions, TBI individuals left out parts of propositions in their narratives more often than their non-injured matches. Again, the differences were significant \( F(1, 18) = 4.98, p < .05 \).

**Redundancy Ratio.** Group differences were not significant on this measure.

**Dysfluency Ratio.** There was a significant main effect for injury status on this measure \( F(1, 18) = 7.77, p > .05 \). TBI individuals were more dysfluent relative to their total output of speech than their control group.

**False Start Ratio.** This measure of dysfluency also distinguished the TBI participants from their matched counterparts. There was a main effect for injury status which was significant \( F(1, 18) = 11.61, p > .01 \).

**Fillers Ratio.** In their use of fillers, one type of dysfluency, TBI participants were significantly different than their peers \( F(1, 18) = 6.13, p > .05 \). Individuals with TBI produced more fillers in their narratives than the comparison group members.

**Internal Corrections Ratio.** Group differences were not significant on this measure.

**Age Effects.** Significant main effects for age were found for the following variables, \( p > .05 \): explicit propositions \( F(1, 18) = 4.70 \); fillers \( F(1, 18) = 8.57 \); total dysfluencies \( F(1, 18) = 8.91 \). In other words, children produced more explicit propositions than adults. However, the children also used more fillers than the adults and their total number of dysfluencies was greater than the total for the adult participants. In addition, the children omitted more partial information from their stories than the adults, \( F(1, 18) = 4.37, p = .05 \).

**Interaction Effects.** Significant interactions occurred on the absolute measures of fillers \( F(1, 18) = 4.59 \) and total implicit propositions \( F(1, 18) = 4.46, p > .05 \). Head injury had a more profound impact on children than on adults with respect to the number of fillers they used and the amount of information omitted. Children with TBI were vastly more dysfluent than all other groups in the study and omitted substantially more information.

**DISCUSSION**

The results of this investigation provide information concerning the narrative discourse abilities of children and adults with TBI. The findings will be discussed first with reference to differences in the narrative abilities of children...
and adults with TBI in comparison to their uninjured peers. Following that, the differences between the children and adults with TBI will be reviewed.

On 11 of the 17 dependent variables, the children and adults with TBI performed significantly worse than their matched controls. These findings supported Dennis’ (1991) assertion that children and adults are at risk for disrupted discourse ability following TBI. Dependency analysis identified those impairments and reliably distinguished the narratives of individuals with TBI from those of the comparison group. These quantitative differences are illustrated in the examples of narratives in Table 3.

Interestingly, the children and adults with TBI did not differ from their comparison groups in their mean number of explicit propositions. Unlike the adult participants in Hartley and Jensens’ (1991) study and contrary to the findings of Chapman et al. (1992) with children with severe TBI, the individuals with TBI in this study produced almost exactly as much discourse as their matched peers. Despite this fact, however, the participants with TBI were substantially less efficient and less effective in accomplishing their communicative goals. This study confirms previous findings of an inefficient style of discourse among individuals with TBI (Erlich, 1988; Hartley & Jensen, 1992) and illustrates that discourse deficits persist past the initial injury period.

The individuals with TBI in this study did not appear to adequately monitor their narratives. In both the absolute measures and in proportion to their total output, individuals with TBI failed to include critical information in their narratives. Sometimes the children and adults with TBI omitted partial information. Other times, however, they neglected to include entire units of information which were necessary in order to make sense of their narratives. Omissions in the narratives of individuals with TBI have been noted in the literature (Mentis & Prutting, 1991; Glosser & Deser, 1990; Hartley & Jensen, 1991, 1992). However, this study extends those findings to demonstrate that individuals with mild to moderate TBI habitually omit information from their stories.

The gaps in the stories of the participants with TBI resulted in a striking listener burden. That is, the onus was on the listener to make sense of the narrative. For example, listeners may attempt to fill in the missing information. Alternatively, listeners may simply be left wondering just exactly what the speaker was attempting to convey. As Hartley and Jensen (1991) have hypothesized, it appeared that children and adults with TBI in this study were unable to adequately take the listener’s perspective and did not deliver their discourse in an effective manner.

In addition to omissions, the individuals with TBI, like McDonalds’ (1993) participants, made numerous repetitions. Although the redundancy ratio was not significant, it is worth noting that the average listener would not correct for length when hearing a story. Consequently, most listeners would likely find the discourse of these individuals overly repetitive. The results of the
Table 3.  Examples of Narratives

Female child with TBI, age: 7 years, 4 months

Umm, I, once, there was a, we went. There was a fort. There was this umm fort. A tree fell down. And there was dirt, all kinds of stuff there. It was our fort. And one day, I have a friend named Jude. She’s umm grown up. She has a kid. She has a cat named Gus, a kitten. It’s so cute. But once, when she didn’t have that kitten, one day, me, my brother, my cousin Matt, and her, and my dad, and one of his friends, went into the woods to see the fort, to show her. And we went up there. I stepped on a bee’s nest. And they chased us all the way back. And I got stung and my cousin Matt got stung in one of the private parts. And umm I had a bite right here (points), right here (points), right there (points), and umm one on my cheek. And right here. And when I umm went over, when we got back to my friend Jude’s house, in her bathroom she had this clean kind of stuff. And I put it on me. She put it one me right here (points). But umm, I had to go to the bathroom to put it on, you know. It hurt! And my brother Jason he got stung once. He got stung I think three right here (points). I remember where I got stung, but I don’t remember where Jason got stung. My friend Jude didn’t even get stung. She ran so fast that she didn’t even get stung. The bees chased us and I looked back. And there was one right in front of my face. That’s when I got stung here (points). There was like two hanging around my legs. I was running and trying to get them off me. They both went, “Bzzzz.” It hurt! I was crying my head off.

Female child control, age: 7 years, 1 month

I got stung on the same place twice. One time I was running home because I was playing with my neighbor. Her name is Holly. I was in my bare feet. And I got my foot stung. The next time, I got my toe stung. We had like cement steps that were going up to where we park. There was a bee hive. I was stepping on a step. And it stung me again.

Male with TBI, age 42:

Well, normally on vacation, like we take a long trip. I got a van. I bought a Dodge van. We’re going down the road. I’ll say to my wife, “Uh . . . aren’t we supposed to turn here?” She kinds of looks at the map. “No, I’m not sure. Let’s see.” Couple times we had to pull in, ask a policeman at the rest area. But normally, we don’t get lost. We kind of look it over before we leave. But, that’s about it, just on long trips maybe, but kind of, I doubt it.”

Male adult control, age 40:

Well one time when I was driving to North Carolina. I was supposed to get off at this one exit. And I missed the exit. The real problem was that I didn’t realize that I missed it until about 20 miles from that point. So, I had to go all the way back. And I made sure to pay real good attention to the roads the rest of the way.

Female adult with TBI, age: 41

Well, I’ve gotten lost even coming here. It was probably the second time I came here. I, uh, went down, uh, 27, no 96, I think. And I came up . . . I remember they said 14 mile. I thought ended. Well, anyways, I just went around and around in circles. And uh . . . so I got lost there. And it does seem . . . I do drive myself when I come here but I still get confused. I don’t get lost but I get scared. I see Southfield Road and then I just . . . Southfield and Greenfield. And still, after coming since February, I’m still not sure whether for a few minutes, a few seconds there if I’m supposed to take Green- continued
Table 3. Continued

field or Southfield, you know. And then I don’t know Southfield, you know. And, uh . . .
I did get lost the second time I came here

Female adult control, age: 44

Ok One day I went shopping to Southland. And we have two cares, a black car and
a white car. I’m really terrible when I park in the parking lot. I have a habit of not really
watching where I park. And this was around the holidays. So I parked my car. I run in.
I’m doing all my shopping, running out. Time to leave the shopping center and I’m
getting in the parking lot and it’s like, “Where did I park my car?” I can’t remember
where I parked my car. And I’m thinking, “OK, I always drive the white car, so I have
the white car.” I think I know in what general area . . . and this probably isn’t about being
lost, but I lost my car (laughing). So here I am walking up and down the aisles looking
for a white car. And I have all these people who think I’m going to be jumping in my
car and they will get my spot. Only, I can’t find my car. I was really embarrassed. So,
after 10 minutes of walking up and down, it dawns on me that I don’t have the white
care. I have the black car!

Adult male with TBI, age: 31

(Long pause). About the only really good time I can remember getting lost was in
West Virginia. Me and my brother had been walking into the woods one day and we
found a pig in the woods. A pig. Pig got out of my uncle’s . . . pig, uh . . . So we found
a pig around. And then we found out that we did get lost. So we went walking through
the woods for about two hours, until it got really dark. Then we found a house and went
back home. But during the time that we were lost, we were really scared cause we didn’t
think we were going to make it back. And I got all upset and started crying like a little
wimp. And I didn’t think we were goin make it back. But we did. It was a little traumatic
for me . . . cause I didn’t think we were going to make it.

Adult control male, age: 35

I was coming back from Buffalo and took the road, my sister was driving. She was
supposed to be coming back and got to the exit sign coming I-75 North and she went
past the exit. And we ended up close to Indiana before she wook me up, cause I was
sleeping. So we had to go up and turn around and come back. It took us a little while but
we did it.

present study quantify the impression of repetitious delivery style to which

Redundancy may be another indication of insufficient monitoring by indi-
viduals with TBI. Alternatively, the repetitions made by the participants with
TBI could represent a pseudodevelopment strategy. That is, individuals with
TBI may have used repetitions as a way to elaborate their stories when they
were unable to organize and produce additional information.

In this study, as in others (Hartley & Jensen, 1991, 1992; Marsh & Knight,
1991), the individuals with TBI produced narratives which were less fluent
than their peers. Their dysflueny resulted from using significantly more fillers
and more false starts than the control group. The present study supports Hart-
ley and Jensens' (1991, 1992) findings and documents persistent problems with fluency in the population with TBI beyond an initial phase of recovery.

These dysfluencies have several implications. First, although it appears that the individuals with TBI were using the fillers as a strategy to compensate for possible problems with word retrieval or memory, this strategy disrupted the flow of their narratives and made them difficult to follow. Second, the abundance of false starts used by children and adults with TBI indicated problems with the planning and organization of narrative discourse (Peterson & McCabe, 1983). That is, these individuals were experiencing significant difficulty organizing and executing complex discourse on demand.

The findings of this study are contrary to the conventional wisdom which posits that children fare better than adults following brain injury (See Finger's historical review, 1991). The children in this study did as poorly or worse than the adults with TBI. Specifically, the children used more fillers and omitted more information from their stories than control participants or adults with TBI. Levin et al. (1982) and others (Fletcher, Miner, & Ewing-Cobbs, 1987) have indicated that there is a lack of convincing evidence that children have improved chances for recovery following TBI, when compared with adults. More recently several researchers (Dennis & Barnes, 1990; Mateer & Williams, 1991; Ylvisaker, 1993) have suggested that prior optimism concerning recovery may need to be replaced with the acknowledgment that deficits persist following TBI in children. Furthermore, these deficits may not be apparent until much later in the child's development (Grattan & Eslinger, 1991). The trend documented in this modest sample warrants further examination.

The narrative impairments of the population of adults and children with TBI in this study appeared to be the result of problems with planning, producing, and monitoring discourse. The results of the present study support prior descriptions (Brooks, 1987; Levin et al., 1982) of deficits in cognitive planning and executive control in individuals who have sustained a TBI. It is possible that the disruptions evident in the narratives of the children and adults with TBI were related less to language impairments than to difficulties with the executive processes utilized in discourse production (Ylvisaker, 1986, 1993; Ylvisaker & Szekeres, 1989).

The fact that the communication deficits of this group of individuals with TBI appeared to be related to impairments in executive processes may help to explain why Jordan, Ozanne, and Murdoch (1988) were not able to define the communication deficits of the children with TBI within the parameters of a recognized developmental language impairment. In fact, the results of this study supported other researchers (Glosser & Deser, 1990; McDonald, 1993) who have noted that the language problems of individuals with TBI are different in form from other language disordered populations.

In conclusion, qualitative and quantitative differences in the discourse of individuals following TBI were demonstrated in this study. The measure-
ments supplied by dependency analysis provided the "communication assessment" for which Ylvisaker has called (1986, p. 52). That is, dependency analysis accounted for the dynamic interaction of linguistic and cognitive factors in the narrative performance of individuals with TBI. The results of this study have supported and extended McDonald's (1993) assertion that CHI discourse is disrupted in both... "informational content and its organization" (p. 44).

By assessing the spontaneous personal narrative production of this population, it was possible to identify problems which may not have been discovered through traditional assessment measures. The individuals with TBI in this study did not produce poorly formed sentences, nor did they appear to have lost the basic structure for a narrative. In other words, their deficits appeared less related to basic language skill deficits than to impairments in higher order processes required for the planning and organization of language. Dependency analysis quantified those impairments and has been demonstrated to be a reliable index of narrative ability following TBI.

**Clinical Implications**

The results of this study yielded important information for clinicians and educators working with individuals with TBI. It would appear that speech-language pathologists need to utilize a dynamic approach to language assessment and therapy which accounts for the bidirectional influence of language and cognition on communicative competence. Clients with TBI need assistance in planning and producing discourse. They also need strategies to help them monitor their language and alert them to discrepancies in their speech. The use of conversational partners who could scaffold discourse for the adults with TBI may relieve some of the frustration these individuals experience and may help them to more effectively accomplish their communicative goals.

For children with TBI, discourse deficits may impede their academic as well as their social development. Ylvisaker (1993) in his comprehensive review of children's language outcomes post injury has noted that many children with TBI do not qualify for academic support services, yet they struggle to meet the academic and social demands of school. The results of this study confirm Ylvisaker's (1993) belief that the assessment of children following brain injury must be ongoing. These assessments must include tasks, such as narrative analysis, which measure the children's performance in real world settings, where complex processing demands may elicit the information clinicians need to devise appropriate intervention plans.

**CONCLUSION**

The results of this study support the inclusion of dependency analysis in future investigations of the functional language outcome of children and adults fol-
lowing TBI. Bruner (p. 77, 1990) noted, “... one of the most ubiquitous and powerful discourse forms in human communication is narrative.” Loss of one’s narrative ability will likely have negative real world consequences whether in academic, vocational, or social settings. It is critical to include the evaluation of narrative ability in future explorations of the consequences of TBI for children and adults.

The present study has added to the existing literature concerning communication outcomes post injury in children and adults by demonstrating that narrative deficits persist beyond the initial period of injury recovery. In addition, this study has established dependency analysis as a reliable tool for distinguishing impaired from intact narrative ability. Finally, through dependency analysis, the narrative skills of a group of children and adults with TBI were both quantified and characterized.

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CONTINUING EDUCATION

Narrative Skills Following Traumatic Brain Injury in Children and Adults

QUESTIONS

1. Dependency analysis focuses on:
   a. Informational content
   b. Syntax
   c. Short-term memory for retelling
   d. Cohesion
   e. Pragmatics

2. The personal narrative of children and adults with TBI are ______ than their non-injured peers:
   a. Less fluent
   b. More repetitive
   c. Lacking in critical information
   d. a & b only
   e. a, b, & c
3. An overabundance of false starts in a spontaneous personal narrative may be indicative of problems with:
   a. Memory
   b. Impulsivity
   c. Planning and organization
   d. Word retrieval
   e. Phonological processing

4. Communication deficits in children with TBI ________:
   a. Are less severe than for adults
   b. Are always quantifiable using traditional language measures
   c. Are apparent immediately following injury
   d. May not become apparent until much later in the child’s development
   e. Do not persist beyond the initial recovery period

5. Traumatic brain injury frequently includes injuries to the ________ region of the brain which may result in ______ impairments:
   a. Parietal/spatial
   b. Temporal/aphasia-like
   c. Frontal/executive processing
   d. Frontal/memory
   e. Temporal/retrieval