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Story Narratives of Adults With Closed Head Injury and Non-Brain-Injured Adults: Influence of Socioeconomic Status, Elicitation Task, and Executive Functioning

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Storrs

Narratives were elicited in two story tasks, retelling and generation, from two groups of adults, 55 with closed head injury (CHI) and 47 non-brain-injured (NBI), recruited from rehabilitation facilities in three northeastern states. Participants were classified, on the basis of their socioeconomic status (SES), as professional, skilled worker, or unskilled worker. Narratives were analyzed using five discourse measures at the levels of sentence production, intersentential cohesion, and story grammar. Discourse performance was then compared across groups, tasks, and SES levels. Discourse performance of the CHI group was also compared with their scores from the Wisconsin Card Sorting Test, a measure of executive functioning. Results indicated that two discourse measures distinguished the groups. The CHI participants produced significantly fewer words per T-unit and fewer T-units within episode structure than did the NBI group, which was attributed to difficulties with content organization. Performance on all five discourse measures differed for the story retelling versus the story generation tasks for both CHI and NBI groups. All participants produced longer and more grammatically complex T-units in the story generation task than in story retelling. However, cohesive adequacy and story grammar were better in the story retelling task than in the story generation task. It was therefore concluded that story generation was a more challenging task than story retelling for both groups. The only significant difference noted for SES involved the measure of intersentential cohesion. The unskilled workers demonstrated poorer cohesive adequacy than either the skilled workers or professionals, regardless of group or story task. Finally, modest correlations were noted between the discourse performance of the CHI group and scores from the Wisconsin Card Sorting Test in both story tasks.

KEY WORDS: discourse, TBI, pragmatics, stories, adults

Numerous studies have demonstrated the clinical utility of examining the language of individuals with closed head injuries (CHI) beyond the levels of lexicon and grammar, specifically at the level of discourse (e.g., Hartley & Jensen, 1991; Liles, Coelho, Duffy, & Zalagens, 1989; McDonald, 1993; Mentis & Prutting, 1987; Snow, Douglas, & Ponsford, 1997). The findings of these investigations have been consistent in documenting a variety of subtle communication impairments (see Coelho, 1995, for a review). Of the various discourse genres

that have been examined, story narratives provide an opportunity to study how language is organized and used to express complex ideas in brain-injured individuals. Story narratives offer the possibility of multiple within- and between-sentence levels of analysis, including story grammar knowledge. Story grammar knowledge refers to the internal structure of stories that guide an individual's comprehension and production of the logical relationships, both temporal and causal, between people and events. The episode is considered to be the central element in most models of story grammar. Episode components are defined as statements bearing information about stated goals, attempts at solutions, and the consequences of these attempts (Liles et al., 1989). Because the relationships among the components of episodes are considered to be logical and not bound by specific content, organization of an episode is thought to involve processes that are not exclusively linguistic.

Story narratives have been examined in a number of recent investigations of discourse performance following CHI (Coelho, Liles, & Duffy, 1991; Hartley & Jensen, 1991; Liles et al., 1989; Stout, Yorkston, & Pimentel, 2000; Tucker & Hanlon, 1998). However, it has been difficult to compare the findings of these studies because of differences in the numbers and characteristics of studied individuals with and without brain injuries, as well as the diversity of the analyses applied. In an effort to establish a larger database of discourse performance by individuals with and without CHI, the present investigation examined the production of story narratives in two large groups of adults, those with CHI and those non-brain-injured (NBI). Four specific questions were addressed. Each of the questions is discussed below.

This review discussion begins with a point of clarification. The term CHI denotes a specific subset of traumatic brain injuries (TBI) and is used here only when the participants in a study are specifically described as such. In those instances when CHI was not specified, the generic term TBI is used.

Question 1: Which measures of discourse performance distinguish the CHI and NBI groups?

A brief review of five studies of story narratives in individuals with TBI (Coelho et al., 1991; Hartley & Jensen, 1991; Liles et al., 1989; Stout et al., 2000; Tucker & Hanlon, 1998) illustrates some of the weaknesses of the existing literature. First of all, there have been vast differences in the numbers of the participants studied. These have ranged from 2 (Coelho et al.) to 94 (Stout et al.) individuals with TBI and from 5 (Tucker & Hanlon) to 38 (Stout et al.) NBI adults. Of the five studies, three used story retelling (Hartley & Jensen; Liles et al.; Stout et al.) and four used story generation (Coelho et al.; Hartley & Jensen; Liles et al.; Stout et al.) as narrative elicitation tasks. Although multiple analyses were applied in each study, there was little consistency in terms of what was analyzed. For example, two studies examined syntactic complexity (Coelho et al.; Liles et al.), three studied cohesion (Coelho et al.; Hartley & Jensen; Liles et al.), two examined story grammar (Coelho et al.; Liles et al.), and three measured some aspect of productivity, efficiency, or content (Hartley & Jensen; Stout et al.; Tucker & Hanlon). Only two of the studies used the same story elicitation materials and analysis procedures (Coelho et al.; Liles et al.). Unfortunately, these two investigations studied the smallest groups of CHI individuals. With regard to the findings of these studies, syntactic complexity of the individuals with CHI was noted to be comparable to that of NBI (Coelho et al.; Liles et al.). Intersentential cohesion was judged as being problematic in two studies (Coelho et al.; Hartley & Jensen), whereas a third study indicated that cohesion was dependent on the story elicitation task. The individuals with CHI demonstrated cohesion comparable to NBI adults in story retelling, but demonstrated a different, less adequate cohesive pattern in story generation (Liles et al.). Story grammar was analyzed in two studies and noted to be a problem in both for the adults with CHI, particularly in story generation (Coelho et al.; Liles et al.). Amount, efficiency, or accuracy of content in the story narratives of adults with TBI was noted to be poorer than that of NBI adults (Hartley & Jensen; Stout et al.; Tucker & Hanlon), and the individuals with TBI produced fewer implied meanings (Tucker & Hanlon). On the basis of this review, it is clear that there is need for a more comprehensive, systematic study of story narratives in larger groups of adults with CHI and those without brain injury. The present study examined story retelling and generation in 55 adults with CHI and 47 NBI adults, analyzed with measures of within- and between-sentence-level performance. It was hypothesized that the individuals with CHI would demonstrate lower scores on measures of story grammar ability but would have comparable scores to the NBI adults on measures of sentence production and cohesion.

Question 2: Is discourse performance influenced by the socioeconomic status of CHI and NBI participants?

The potential influence of socioeconomic status (SES) on discourse performance has been addressed in recent studies of discourse; but none of them have involved story narratives (Snow, Douglas, & Ponsford, 1995, 1997; Yorkston, Zeches, Farrier, & Uomoto, 1993). Snow et al. (1997) examined informational content, productivity, and pragmatic measures of procedural discourse in three

groups of participants: TBI, orthopedic patients of comparable "at risk" socioeconomic backgrounds to those in the TBI group who had also been involved in motor vehicle accidents but had not suffered brain injuries, and college students. They found that content and productivity of the individuals with TBI were not different from those of the individuals in the orthopedic group, but were different from those of the college students. The pragmatic errors of the individuals with TBI were different from both of the other groups. The authors observe that had only the college students been used as the control group, inappropriate conclusions about the extent of the discourse deficits of the individuals with TBI would have been made. Similarly, Yorkston et al. examined the lexical pitch of narrative samples from 43 adults with TBI and 45 NBI adults grouped by socioeconomic level. Lexical pitch refers to how appropriately a speaker reads an audience so as not to "talk down to" or "talk over the heads of" the listeners and is dependent on the speaker's lexical choice and use of audience feedback. Results indicated that lexical pitch varied as a function of socioeconomic level. The authors noted that because of the over-representation of poorly educated young males in the TBI population as a whole, use of inappropriate control groups, such as college students or graduates, may overestimate the cognitive-linguistic deficits associated with TBI. In the present study, participants were grouped by socioeconomic level to investigate differences in discourse performance across these levels. It was hypothesized that individuals of higher SES, with CHI or without brain injury, would have higher scores on measures of sentence production, cohesion, and story grammar.

Question 3: Is the discourse performance of CHI and NBI participants similarly influenced by story elicitation task?

With regard to discourse analysis procedures, Stout et al. (2000) noted differences in the discourse performance of their TBI group across narrative tasks and attributed that finding to varying cognitive demands of the tasks. The individuals with TBI spoke more slowly, communicated content at a slower rate, and produced longer mazes than the NBI group in a picture description task. In story retelling, the TBI group produced shorter stories that contained less meaningful content. Similarly, differences in the quantity of output and complexity of sentence formulation across story retelling and generation tasks have been reported (Liles et al., 1989). These differences were presented as indicating that story generation was more complex than retelling. However, because this conclusion was based on the analysis of discourse samples from only 4 individuals with CHI and 23 NBI adults, there is need for replication with larger groups. In the present study, the discourse performance of the CHI and NBI participants was compared across story retelling and generation tasks. It was hypothesized that all participants, CHI and NBI, would demonstrate lower scores on measures of sentence production, cohesion, and story grammar in the story generation task than in the story retelling task.

Question 4: Does the discourse performance of the individuals with CHI correlate with scores on a measure of executive functioning?

The term *executive control* or *executive functioning* refers to three important components: (a) formation of goals; (b) planning of actions, including temporal organization of behavior necessary for achieving such goals; and (c) implementation of plans, which includes the mental flexibility to modify or amend plans (Hart, Schwartz, & Mayer, 1999). It has been suggested that discourse impairments following TBI are a reflection of a dysfunction of executive control over cognitive and linguistic organizational processes (Ylvisaker, Szekeres, & Feeney, 2001). Consistent with this notion, Lezak (1995) observed that by studying the flow of verbal behavior in discourse, inferences can be made about an individual's ability to organize and maintain coherent and goal-directed ideas. Findings of significant correlations in adults with TBI between measures of discourse performance and scores from the Wisconsin Card Sorting Test (WCST, Grant & Berg, 1948), a measure of executive functioning (Coelho, Liles, & Duffy, 1995; Tucker & Hanlon, 1998), support these contentions. The present study compared the discourse performance of the participants with CHI with their scores from the WCST. It was hypothesized that significant correlations would be noted between the WCST scores and measures of cohesion and story grammar, but not sentence production.

Method

Participants

CHI

Fifty-five native speakers of English who had sustained a closed head injury (CHI) were studied. Participants were selected because they had recovered a high level of functional language—that is, they had achieved fluent conversation and did not demonstrate any significant deficits on traditional clinical language tests. In addition, participants were recruited to represent a range of socioeconomic backgrounds. Contact with these individuals was secured through three rehabilitation hospitals in Connecticut, New York, and Rhode Island.

The CHI group consisted of 16 females and 39 males

ranging in age from 16 to 69 years old (mean = 28.6 years). Time postonset ranged from 1 to 99 months (mean = 10.5 months). On the basis of SES, participants were categorized into one of three groups: professional, skilled worker, or unskilled worker. SES was determined using the Hollingshead Four Factor Index of Social Status (Hollingshead, 1972). Briefly, this index considers such factors as occupation and years of education to determine a person's position within a community. Initially, Hollingshead delineated five distinct class groups on the basis of ranges of scores determined by factors of employment and education weighted by a standard regression equation. Group V indicates the lowest SES and I the highest. In the present study, three groups were formed from five possible Hollingshead ratings. Group 1, professionals, included individuals with Hollingshead ratings of I and II; Group 2, skilled workers, included individuals with Hollingshead ratings of III; and Group 3, unskilled workers, included individuals with ratings of IV and V. The five ratings were collapsed into three groups because many of the distinctions between Hollingshead ratings I and II and IV and V were subtle, and it would have been extremely difficult to find adequate numbers of participants at each rating level. For the younger individuals who were not yet in an occupation, the Hollingshead rating was based on the household they were living in at the time of their injury, that is, the rating reflected the SES of their parents.

All individuals with CHI met the following criteria: (a) no reported history of substance abuse or psychiatric illness; (b) passing scores on screens for hearing acuity, visual acuity, and visual perceptual deficits; (c) an aphasia quotient (AQ) above 93 based on the Western Aphasia Battery (Kertesz, 1982); (d) no significant motor speech disorder as determined by an experienced speech-language pathologist; (e) Rancho Los Amigos Level of Cognitive Functioning (Hagen, Malkmus, & Durham, 1980) of VII (automatic-appropriate) or above; (f) Galveston Orientation and Amnesia Test (Levin, O'Donnell, & Grossman, 1979) score of 75 or above; and (g) a score of 120 or above on the Dementia Rating Scale (Mattis, 1976), a general screen of cognitive processing. See Table 1 for specific characteristics for the group of CHI participants.

NBI

Forty-seven hospital employees, working in a variety of capacities, who were native speakers of English served as the control group. No individual in this group reported a history of neurologic or psychiatric disease or substance abuse; these individuals passed screens for hearing and visual acuity. Non-brain-injured participants were selected on the basis of SES (Hollingshead rating). Attempts were also made to match these individuals as closely as possible with the individuals with CHI on the basis of age and gender. There were 32 males and 15 females studied; ages ranged from 16 to 63 years old (mean = 30.9 years). See Table 2 for characteristics of the NBI participants.

To test for potential differences in the mean ages of each group, a two-way analysis of variance (ANOVA) was performed for group and SES. No significant main effects for group, $F(1, 96) = 1.34$, $p = .25$, or SES, $F(1, 96) = 2.27$, $p = .11$, were noted, and there was no interaction, $F(2, 96) = 0.17$, $p = .84$ (see Tables 1 and 2).

Story Elicitation Procedures

Stories were elicited from all participants under two conditions: Retelling and Generation.

Retelling Task

Participants were shown the picture story, *The Bear and the Fly* (Winter, 1976), by filmstrip projector on a 23 cm × 30.5 cm screen. The picture story has 19 frames with no sound track and shows how a Father Bear inadvertently wrecks his house and abuses his family—Mother Bear, Daughter Bear, and a dog—during his attempts at killing a bothersome fly. After viewing the filmstrip, the participants were given the following instruction: "Tell me that story." When a participant stopped retelling the story, the examiner would wait 10 seconds then ask, "Is that the end of the story?" If the participant answered affirmatively, the task was ended.

Generation Task

Participants were presented with a copy of the Norman Rockwell painting, *The Runaway.* The picture depicts a small boy and a rather large, friendly policeman seated at a diner counter. The boy has a knapsack attached to a stick lying on the floor beside his stool. A counterman is facing both the boy and the policeman and seems to be amused by the situation. The participants were given the following instruction: "Tell me a story about what you think is happening in this picture." The picture remained in view of the examiner and participant until the task was completed. When a participant stopped telling a story, the examiner would wait 10 seconds and then ask, "Is that the end of the story?" If the participant answered affirmatively, the task was ended.

Data Collection

Each story was audiotaped and later transcribed verbatim. The transcriptions were distributed into T-units before analysis. A T-unit is defined as an independent clause plus any subordinate clauses associated with it

Table 1. (p. 1 of 2) Characteristics of the closed head injured (CHI) participant group.

Participant	Age	Sex	MPO	ED	LOC	Injury (cause—CT/MRI findings)
					SES Level—Professionals (Hollingshead Group 1)	
1	21	M	4	14	19 days	MVA—hemorrhage of left frontal lobe with bony fragments adjacent to right superior orbital fissure & right optic nerve compression
2	22	M	1	16	NA	MVA—multiple areas of high density in brain parenchyma, subdural & subarachnoid hemorrhage in region of interhemispheric fissures
3	27	F	1	14	<5 minutes	MVA—right frontotemporal contusion with intracerebral hemorrhage, displacement of left ventricle, small subarachnoid hemorrhage
4	17	M	3	11	NA	MVA—high midbrain contusion, soft tissue swelling in right fronto-temporal region
5	22	F	2	16	14 days	MVA—multiple parenchymal hemorrhages
6	18	M	3	12	17 days	MVA—bilateral hemorrhagic contusions left > right, left frontal epidural hematoma
7	49	M	2	21	<24 hours	MVA—subarachnoid hemorrhage left occipital area
8	47	M	2	18	10 days	Fall—right frontal contusion with subdural hematoma, right frontal lobectomy performed
9	22	M	2	16	4 days	MVA—intraventricular subarachnoid hemorrhage, bilateral frontal & right parietal contusions, left ventricular bleed, diffuse edema
10	20	F	33	12	42 days	MVA—subarachnoid air secondary to basilar skull fracture, multiple contusions in both hemispheres, small amount ventricular blood
11	54	M	8	16	none	Struck by car—multiple bilateral lacerations
12	16	F	1	11	<2 hours	MVA—blood in left occipital horn with probable small hemorrhage, right frontal lobe contusion
13	42	M	7	16	NA	MVA—NA
14	33	F	12	15	NA	MVA—NA
15	47	M	12	18	<24 hours	Fall—edema left hemisphere
16	40	F	26	16	none	MVA—NA
17	18	M	2	12	2 days	MVA—NA
18	55	M	1	18	<24 hours	MVA—NA
Range	16–55		1–33	11–21		
Mean	32.4		6.9	15.1		
					SES Level—Skilled Workers (Hollingshead Group 2)	
1	21	F	8	12	NA	MVA—cerebral contusion
2	24	M	6	14	63 days	MVA—small right frontal subdural hematoma & left hemorrhagic contusion
3	17	M	2	13	3 days	MVA—bilateral contusions, left hemorrhagic contusion
4	20	M	21	13	6 days	MVA—subarachnoid hemorrhage & generalized edema
5	30	M	2	12	7 days	MVA—contusion deep in right hemisphere, blood in subarachnoid space in region of frontal intrahemispheric fissure
6	33	M	1	14	4 days	MVA—multiple petechial hemorrhages & diffuse edema
7	19	F	2	12	3 days	MVA—mild lateral ventricular enlargement
8	26	M	2	13	17 days	MVA—cerebral contusion, intracerebral hematoma & subarachnoid blood
9	27	M	2	12	none	Struck by car—negative
10	24	F	9	13	24 days	MVA—right frontal & parietal hematomas, right parietal craniotomy
11	19	M	2	12	NA	MVA—frontal skull fracture
12	17	M	4	11	NA	MVA—NA
13	60	M	28	12	21 days	Fall—NA
14	18	F	8	12	35 days	MVA—NA
15	69	F	75	13	30 days	MVA—NA
16	34	M	99	13	45 days	MVA—NA
17	27	M	1	12	10 days	MVA—NA
18	45	F	10	15	42 days	MVA—left frontal subdural hematoma
Range	17–69		1–99	12–15		
Mean	29.4		15.7	12.7		

Table 1. (p. 2 of 2) Characteristics of the closed head injured (CHI) participant group.

Participant	Age	Sex	MPO	ED	LOC	Injury (cause—CT/MRI findings)
SES Level—Unskilled Workers (Hollingshead Group 3)						
1	21	M	8	10	4 days	MVA—multiple contusions: left frontal & right posterior temporal lobes
2	39	M	2	10	13 days	MVA—edema left temporo-parietal & right parietal regions
3	28	M	1	12	3 days	MVA—negative
4	23	M	3	12	<24 hours	MVA—intraventricular blood
5	21	M	9	12	<24 hours	MVA—small lesion left basal ganglia, left frontal contusion
6	19	M	2	12	4 days	MVA—left parietal epidural hematoma & small right subdural hematoma
7	33	F	17	14	21 days	MVA—subarachnoid blood on upper temporo-parietal region
8	20	M	43	9	99 days	MVA—diffuse encephalopathy & focal structural lesion right frontal-parietal area
9	20	F	3	12	21 days	MVA—bilateral cerebral edema
10	21	M	6	12	21 days	MVA—posterior fossa hemorrhage including left cerebellar contusion, intraventricular hemorrhage, & CNS edema with compression of brainstem
11	16	M	1	10	3 days	MVA—left frontal contusion & left posterior internal capsule contusion
12	29	M	2	12	14 days	Struck with bat—diffuse edema with punctate contusions & scattered hemorrhages, right posterior temporo-parietal contusion with mass effect
13	28	M	1	12	7 days	Fall—right fronto-temporal contusion with subdural hematoma & edema
14	28	F	2	12	<20 minutes	MVA—edema right parietal lobe
15	21	F	1	11	7 days	MVA—NA
16	31	M	29	12	30 days	Fall—multiple skull fractures, left cerebral aneurysm clipped
17	29	M	7	10	none	MVA—NA
18	19	M	18	10	90 days	MVA—NA
19	25	M	8	12	21 days	Fall—right temporal contusion with scattered subarachnoid hemorrhages
Range	16–39		1–43	9–14		
Mean	24.8		5.9	11.4		
Totals for all CHI participants						
Range	16–69		1–99	9–21		
Mean	28.6		10.5	13.0		
Females		16				
Males		39				

Note. SES = socioeconomic status; MPO = months post-onset; ED = years of education; LOC = loss of consciousness; MVA = motor vehicle accident; NA = information not available.

(Hunt, 1970). A T-unit is similar to a sentence but is more reliably identified. Segmenting narratives into sentences is often problematic because of the tendency of some speakers to link sentences of a narrative with conjunctions such as *and*, *or*, and *then*, making it difficult to delineate sentence boundaries. Use of T-units, which are clearly defined, solves the problem of continuous conjoining of clauses (Hughes, McGillivray, Schmidek, 1997; Liles, 1985). Measurement of story narrative performance was made at three levels: sentence production, intersentential cohesion, and story grammar. Each of the measures are described below and summarized with examples in Table 3.

Measures

Sentence Production

Two measures of sentence production were examined and compared across tasks and groups:

1. *Number of Words per T-unit*—the total words divided by the number of T-units. Words per T-unit was considered a measure of sentence length.

2. *Number of Subordinate Clauses per T-unit*—the total number of subordinate clauses in each story divided by the total number of T-units. This ratio was obtained in order to permit comparisons across stories that varied in length. The frequency of subordinate clause use was considered a measure of the complexity of sentence-level grammar.

Cohesive Adequacy

Procedures for identifying cohesive markers and categories of cohesive markers have been described in previous investigations (Liles, 1985; Liles et al., 1989; Mentis & Prutting, 1987). Each occurrence of a cohesive marker or tie was judged as to its adequacy using Liles's procedure. Three categories of adequacy were

Table 2. Characteristics of non-brain-injured (NBI) group by SES level.

Professional (HH Group 1)				Skilled worker (HH Group 2)				Unskilled workers (HH Group 3)			
Participant	Age	Sex	ED	Participant	Age	Sex	ED	Participant	Age	Sex	ED
1	46	F	18	1	63	M	12	1	18	M	12
2	22	F	17	2	22	F	16	2	22	F	12
3	30	F	18	3	56	F	13	3	23	F	12
4	23	F	18	4	26	F	16	4	28	M	11
5	59	M	18	5	46	F	14	5	32	M	12
6	39	M	22	6	48	M	14	6	26	M	12
7	52	M	22	7	28	M	17	7	31	M	14
8	51	M	17	8	24	M	16	8	26	M	12
9	30	M	17	9	30	M	16	9	26	M	12
10	25	F	18	10	26	F	17	10	26	F	12
11	26	F	18	11	36	M	12	11	28	M	11
12	38	M	17	12	16	M	11	12	33	M	12
13	18	M	12	13	17	M	11	13	19	F	12
14	16	M	11	14	17	M	11	14	25	M	14
15	16	M	11	15	17	M	11	15	18	M	12
16	56	M	13								
17	54	M	12								
Range	16–59		11–22		16–63		11–17		18–33		11–14
Mean	32.7		16.9		34.2		13.6		25.4		12.1

Totals for all normal participants

Range	16–63		11–22
Mean	32.2		14.2
Females		15	
Males		32	

Note. SES = socioeconomic; HH = Hollingshead; ED = years of education.

used: (a) complete—a tie was judged to be "complete" if the information referred to by the cohesive marker was easily found and defined with no ambiguity, (b) incomplete—a tie was judged to be "incomplete" if the information referred to by the cohesive marker was not provided in the text, and (c) error—a tie was judged to be an "error" if the listener was guided to ambiguous information elsewhere in the text. The primary measure of cohesive adequacy used in this study was the percentage of complete ties out of total ties (see Table 3).

Story Grammar

The number of episodes was used as a measure of story grammar. According to Stein and Glenn (1979), an episode consists of (a) an initiating event that prompts a character to formulate a goal-directed behavior, (b) an action, and (c) a direct consequence marking attainment or nonattainment of the goal. An episode was considered complete only if it contained all three components. An incomplete episode contained two of the three components. Two measures of story grammar performance were employed in this study:

1. *Number of Total Episodes*—the number of complete and incomplete episodes. This was considered to be a measure of content organization. Incomplete episodes were included in the tally of total episodes because it was felt that the presence of even two episode components represented a degree of content organization that should be noted. Further, in some story narratives incomplete episodes followed complete episodes, and the missing component of the incomplete episode was often an initiating event. Table 3 illustrates such an example. It appears as though the missing initiating event may be implied and be the same as the initiating event from the preceding complete episode.

2. *Proportion of T-units Contained Within Episode Structure*—this measure was considered to be an indication of participants' ability to use story grammar as an organizational plan for language. For example, certain participants often inserted comments during the retelling or generation of a story that may have been related to the story but did not contribute to the actual story. Although such stories were longer in terms of the total number of T-units produced, the proportion of

Table 3. Discourse measures from present study.

Discourse measures	Description	Example
Sentence production		
Words per T-unit	Total words in story divided by number of T-units	118 words/6 T-units = 19.7
Subordinate clauses per T-unit	Number of subordinate clauses in story divided by number of T-units	3 subordinate clauses/6 T-units = .5
Cohesion		
Cohesive adequacy—Percent complete ties of total ties	Each occurrence of a cohesive tie judged as to its adequacy. Number of complete ties in story divided by total number of cohesive ties.	***Complete tie***—The girl was hungry. *She* ate her lunch. ***Incomplete tie***—The boys walked home from the mall. They stopped at *his* house for a snack. ***Erroneous tie***—Dave and Joe drove to the game. *He* forgot the tickets.
Story grammar		
Number of total episodes	Total number of complete and incomplete episodes in a story.	***Complete episode***—*[Initiating event]* and this fly comes in. and the Father's bothered by this. *[Attempt]* so he decides to swat or hit the fly. and he hits his wife. *[Direct consequence]* and she goes down. ***Incomplete episode***—*[Attempt]* and he hits his daughter *[Direct consequence]* and the daughter goes down to the floor.
Proportion of T-units within episode structure	Number of T-units in episode structure divided by total number of T-units in story.	10 T-units in episodes/16 total T-units = .62

T-units that contributed to the episodic structure was often quite small.

Reliability

One examiner analyzed all story narratives. Ten percent of the narratives were re-analyzed by a second examiner to assess inter-examiner reliability. An additional 10% of the story narratives were re-analyzed by the first examiner approximately 6 months after the initial analyses were completed to assess intra-examiner reliability. Reliability measures were based on point-to-point scoring. Inter-examiner reliability scores ranged from 90% to 96%, and scores for intra-examiner reliability ranged from 92% to 98%. Reliability scores appear in Table 4.

Measure of Executive Function

To investigate the potential relationship between the discourse measures employed in the present study and executive functioning, the WCST was administered to the CHI group. According to Spreen and Strauss (1998), the WCST is considered a measure of executive function "in that it requires strategic planning, organized searching, the ability to use environmental feedback to shift cognitive sets, goal-oriented behavior, and the ability to modulate impulsive responding" (p. 219). Previous studies have indicated that the WCST is a valid measure of executive functioning (Levin et al., 1991, 1996). The WCST was scored using the revised guidelines (Heaton, Chelune, Talley, Kay, & Curtiss, 1993). Four scores derived from the WCST were included in the analysis: (1) total number of cards, (2) total number of categories, (3) total number of perseverative responses, and (4) total number of perseverative responses that were errors.

Results

In order to compare the discourse performance of the participant groups across SES levels and story tasks, a three-way ANOVA for repeated measures was applied for each of the discourse measures. An alpha level of .01 was adopted for all ANOVAs to control for type I errors. Results revealed no evidence of a three-way interaction between group (CHI and NBI), SES (professional, skilled worker, unskilled worker), and story task (retelling, generation) for any of the five discourse measures [words per T-unit, $F(2, 96) = 1.45$, $p = .24$; subordinate clauses per T-unit, $F(2, 96) = 2.83$, $p = .06$; percent complete ties of total ties, $F(2, 96) = 0.75$, $p = .47$; total episodes, $F(2, 96) = 2.26$,

Table 4. Reliability scores for the discourse measures.

Analyses	Inter-examiner	Intra-examiner
Sentence Production		
Identification of T-units	96%	98%
Identification of subordinate clauses	93%	96%
Cohesion		
Cohesive adequacy	90%	92%
Story Grammar		
Identification of episodes	94%	96%

p = .11; T-units within episode structure, $F(2, 96) = 0.93$, p = .40]. Three-way ANOVAs for repeated measures were also used to analyze the two-way interactions and main effects for the group by task, SES by group, and SES by task comparisons. Means and standard deviations for the three comparisons appear in Tables 5, 6, and 7. It is important to note that because the cohesion score was reported as a percentage (percent complete ties of total ties), it was transformed before parametric statistical analyses. The cohesion data appear in Tables 5, 6, and 7 as percentages because it was felt that the percentages would be more visually meaningful than the transformed scores. Results of the group by task comparison indicated no two-way interactions for any of the discourse measures [words per T-unit, $F(1, 96) = 1.75$, p = .19; subordinate clauses per T-unit, $F(1, 96) = 0.13$, p = .72; percent complete ties of total ties, $F(1, 96) = 0.001$, p = .97; total episodes, $F(1, 96) = 0.02$, p = .87; T-units within episode structure, $F(1, 96) = 3.15$, p = .08] (see Table 5).

The results of the analyses for the SES by group and SES by task comparisons are summarized separately by discourse measure below. In the presentation of the results, measures of effect size (eta-squared, or η^2) accompany all significant findings and may be interpreted as an index of the size or importance of the difference between means. In the interpretation of the η^2 values, the convention proposed by Cohen (1977) is followed that characterizes η^2 values of .01 to .07 as "small," .08 to .14 as "moderate," and .15 and above as "large."

Comparison of Discourse Performance for SES by Group

Sentence Production

Words per T-unit

For the measure *words per T-unit*, ANOVA indicated there was no interaction, $F(2, 96) = 0.58$, p = .56, or main effect for SES, $F(2, 96) = 2.76$, p = .07. A significant main effect for group, $F(1, 96) = 10.27$, p = .002, was noted, with the NBI participants producing more words per T-unit than the adults with CHI (see Table 6). The η^2 value (.10) indicated a moderate effect size for the difference.

Number of Subordinate Clauses per T-unit

Results of the ANOVA revealed no main effects for group, $F(1, 96) = 2.86$, p = .09, or SES, $F(2, 96) = 0.96$, p = .38, and no interaction, $F(2, 96) = 3.89$, p = .02, for number of subordinate clauses per T-unit.

Cohesion

Percentage of Complete Ties out of Total Ties

No main effect for group, $F(1, 96) = 1.13$, p = .29, was noted, nor was there an interaction, $F(2, 96) = 2.27$, p = .11, revealed by the ANOVA. A significant main effect for SES, $F(2, 96) = 7.12$, p = .001, was apparent (see Table 6). The η^2 value (.13) indicated a moderate effect size. Post hoc Scheffé testing indicated that the cohesive adequacy scores of the unskilled workers were significantly lower than those of both the skilled workers (p = .04) and the professionals (p = .02), regardless of group. Differences between the scores of the skilled workers and the professionals were not significant (p = .92).

Story Grammar

Number of Total Episodes

For the number of total episodes, results of the ANOVA indicated no main effects for group, $F(1, 96) = 0.15$, p = .70, or SES, $F(2, 96) = 1.60$, p = .22, and there was no interaction, $F(2, 96) = 1.83$, p = .17.

Proportion of T-units Within Episode Structure

Results of the ANOVA demonstrated no main effect for SES, $F(2, 96) = 2.60$, p = .08, or interaction, $F(2, 96) = 1.75$, p = .18. However a significant main effect was noted for group, $F(1, 96) = 11.93$, p = .001, in which the NBI participants produced a larger proportion of T-units within episode structure than did the CHI participants (see Table 6). The eta-squared value (.11) demonstrated a moderate effect size for this difference.

Comparison of Discourse Performance for SES by Task

Sentence Production

Words per T-unit

The ANOVA revealed a significant main effect for task, $F(1, 96) = 31.86$, $p < .001$, with all participants producing

Table 5. Means and standard deviations of discourse measures for group by task comparisons.

	Discourse measures				
	Sentence production		Cohesion	Story grammar	
Task	Words/ T-unit	Subordinate clauses/ T-unit	Percentage of complete ties/total ties	Total episodes	T-units within episode structure
			CHI (*N* = 55)		
Story retelling					
M	9.46	.11	90.53	3.40	.64
SD	1.88	.13	10.20	1.60	.20
Story generation					
M	12.12	.45	67.70	.92	.37
SD	4.10	.37	17.30	.70	.29
			NBI (*N* = 47)		
Story retelling					
M	10.64	.18	93.61	3.49	.71
SD	3.83	.18	9.32	1.38	.18
Story generation					
M	14.93	.54	70.04	.97	.55
SD	6.04	.43	14.68	.40	.34

Note. CHI = closed head injury, NBI = non-brain-injured.

more words per T-unit in the story generation task than in story retelling (see Table 7). Effect size for this difference was large (η^2 = .25). There was no main effect for SES, $F(2, 96) = 2.76$, $p = .07$, or interaction, $F(2, 96) = 2.90$, $p = .06$.

Number of Subordinate Clauses per T-unit

Results of the ANOVA indicated no main effect for SES, $F(2, 96) = 0.96$, $p = .38$, and no interaction, $F(2, 96) = 3.81$, $p = .03$. A main effect was apparent for task, $F(1, 96) = 69.04$, $p < .001$, in which all participants produced a larger number of subordinate clauses per T-unit in the story generation task than in story retelling (see Table 7). The eta-squared value (.42) indicated this difference had a large effect size.

Cohesion

Percentage of Complete Ties out of Total Ties

The ANOVA indicated no interaction, $F(2, 96) = 1.02$, $p = .36$. A main effect was noted for task, $F(1, 96) = 196.90$, $p < .001$, with participants demonstrating a higher degree of cohesive adequacy in the story retelling task than in story generation (see Table 7). The effect size for this difference was noted to be large (η^2 = .68). A main effect was also revealed for SES, $F(2, 96) = 7.12$, $p = .001$. The eta-squared value (.13) indicated a moderate effect size. To determine which levels of SES accounted for this difference, Scheffé post hoc testing was performed. Results indicated that the cohesive adequacy of the unskilled workers was significantly poorer than that of either the professionals ($p = .003$) or the skilled workers ($p = .007$), regardless of task. There were no significant differences in the cohesive adequacy of the professionals and the skilled workers ($p = .94$) (see Table 7).

Story Grammar

Number of Total Episodes

No interaction, $F(2, 96) = 2.76$, $p = .07$, was revealed by the ANOVA, nor was there a main effect for SES, $F(2, 96) = 1.60$, $p = .22$, on the measure *number of total episodes*. A significant main effect was demonstrated for task, $F(1, 96) = 289.30$, $p < .001$, with participants producing more episodes in the story retelling task than in story generation (see Table 7). A large effect size was noted for this difference (η^2 = .75).

Proportion of T-units Within Episode Structure

The ANOVA indicated a main effect for task, $F(1, 96) = 38.20$, $p < .001$, on this measure of story grammar. Participants from both groups produced a higher

Table 6. Means and standard deviations of discourse measures for SES by group comparisons.

SES	Discourse measures				
	Sentence production		Cohesion	Story grammar	
	Words/ T-unit	Subordinate clauses/ T-unit	Percentage of complete ties/total ties	Total episodes	T-units within episode structure
CHI (*N* = 55)					
Professional (*N* = 18)					
M	11.78	.36	79.48[c]	2.33	.47
SD	4.33	.44	18.06	1.90	.27
Skilled (*N* = 18)					
M	11.28	.30	83.08[d]	2.03	.53
SD	4.10	.37	15.47	1.56	.27
Unskilled (*N* = 19)					
M	9.29	.18	74.98[c d]	2.13	.49
SD	2.15	.17	20.94	1.74	.31
Group					
M	10.78[a]	.28	79.18	2.16	.50[b]
SD	3.53	.33	18.16	1.73	.28
NBI (*N* = 47)					
Professional (*N* = 15)					
M	13.23	.37	88.36[e]	2.33	.54
SD	6.21	.36	12.84	1.79	.31
Skilled (*N* = 17)					
M	12.89	.27	82.28[f]	2.53	.62
SD	6.75	.26	19.38	1.89	.29
Unskilled (*N* = 15)					
M	12.25	.44	75.29[e, f]	1.83	.73
SD	4.08	.53	19.78	1.26	.23
Group					
M	12.79[a]	.36	81.97	2.23	.63[b]
SD	5.68	.38	17.33	1.65	.28

Note. CHI = closed head injury; NBI = non-brain-injured; SES = socioeconomic status as determined by the Hollingshead ratings. Group means with the same superscripts are significantly different at the $p \leq .01$ level. Means across the SES levels with the same superscripts are significantly different at the $p \leq .05$ level.

proportion of T-units within episode structure in the story retelling task than in story generation (see Table 7). The eta-squared value (.28) indicated a large effect size. No main effect for SES, $F(2, 96) = 2.60$, $p = .08$, or interaction, $F(2, 96) = 0.35$, $p = .70$, was noted.

Discourse Measures and Executive Functioning

To assess the potential relationship between discourse performance and executive functioning for the adults with CHI, Pearson product-moment correlations were calculated for the WCST scores and the five discourse measures in the story retelling (see Table 8) and generation tasks. It should be noted that better performance on the WCST was demonstrated by lower scores for number of cards (CARDS), number of perseverative responses (PERSEV), and number of perseverative responses that were errors (ERR), and a higher score for number of categories (CATS). Results are summarized below by discourse task.

Story Retelling

For the measure *words per T-unit*, significant correlations ranging from .33 to .39 were noted for all four scores from the WCST: CARDS ($p \leq .01$), CATS ($p \leq .01$), PERSEV ($p \leq .05$), and ERR ($p \leq .05$). Three of the four

Table 7. Means and standard deviations of discourse measures for SES by task comparisons.

SES	Discourse measures				
	Sentence production		Cohesion	Story grammar	
	Words/ T-unit	Subordinate clauses/ T-unit	Percentage of complete ties/total ties	Total episodes	T-units within episode structure
Story retelling					
Professional (*N* = 33)					
M	9.82	.11	94.23[f]	3.79	.63
SD	1.79	.10	7.92	1.47	.18
Skilled (*N* = 35)					
M	10.37	.16	93.18[g]	3.51	.66
SD	5.27	.23	10.65	1.56	.19
Unskilled (*N* = 34)					
M	9.86	.16	88.46[fg]	3.06	.71
SD	2.19	.15	12.68	1.48	.19
Total (*N* = 102)					
M	10.06[a]	.14[b]	92.10[c]	3.45[d]	.67[e]
SD	3.25	.15	10.42	1.55	.19
Story generation					
Professional (*N* = 33)					
M	15.06	.62	72.81[h]	.88	.37
SD	6.26	.43	15.72	.55	.33
Skilled (*N* = 35)					
M	13.76	.41	71.88[i]	1.03	.48
SD	5.40	.36	16.39	.71	.33
Unskilled (*N* = 34)					
M	11.34	.43	61.37[hi]	.94	.48
SD	4.28	.50	17.31	.60	.34
Total (*N* = 102)					
M	13.39[a]	.49[b]	68.69[c]	.95[d]	.44[e]
SD	5.31	.43	16.47	.62	.33

Note. SES = socioeconomic status as determined by the Hollingshead ratings. Means with the same superscripts are significantly different at the $p \leq .01$ level.

scores from the WCST (CARDS, PERSEV, ERR) were significantly correlated ($p \leq .05$) with the measure *number of subordinate clauses per T-unit* (.33–.34). No significant correlations were noted for the measure of *cohesive adequacy* and the WCST scores. For number of total episodes, significant correlations ($p \leq .05$) were noted for three of four WCST scores (CARDS, PERSEV, and ERR; .28–.30). For the measure *proportion of T-units within episode structure*, no significant correlations were noted.

Story Generation

Only one significant correlation ($p \leq .05$) was noted between the WCST scores and the discourse measures in the story generation task. This correlation was for the measure *words per T-unit* and the WCST score CARDS (.27).

Discussion

Which Measures of Discourse Performance Distinguish the CHI and NBI Groups?

It was hypothesized that the CHI group would demonstrate lower scores on measures of story grammar ability but have comparable scores to the NBI group on the measures of cohesive adequacy and sentence production. Results of this study only partially supported this hypothesis. Two of the five discourse measures distinguished the groups—*words per T-unit* and *T-units*

Table 8. Pearson product-moment correlations for the CHI groups' discourse performance in the story retelling task and scores from the Wisconsin Card Sorting Test (WCST).

Discourse measures	WCST scores			
	CARDS	CATS	PERSEV	ERR
Sentence Production				
Words/T-unit	.39**	−.37**	.33*	.33*
Subordinate clauses/T-unit	−.33*	.20	−.34*	−.33*
Cohesive Adequacy				
Percentage of complete ties/Total ties	.18	.02	.02	.02
Story Grammar				
Number of total episodes	−.30*	.23	−.28*	−.29*
T-units within episode structure	.05	−.10	.24	.23

Note. CARDS = number of cards, CATS = number of categories, PERSEV = number of perseverative responses, ERR = number of perseverative responses that were errors.

*$p \leq .05$; **$p \leq .01$.

within episode structure. The first measure, words per T-unit, was an index of sentence length. As a group, the NBI participants produced longer T-units in their stories than did the CHI group. This finding was in accord with previous investigations, which have noted decreased narrative productivity among individuals with TBI (Hartley & Jensen, 1991; Stout et al., 2000; Tucker & Hanlon, 1998). In spite of the longer T-units produced by the NBI group, complexity of sentence-level grammar was comparable for both groups, as noted in previous studies (Coelho et al., 1991; Liles et al., 1989), and thus was consistent with the hypothesis. The grammatical structure of the T-units may have been limited by the nature of the story elicitation tasks. This would have been most apparent in the story retelling task, in which the story was presented sequentially via a filmstrip in a frame-by-frame fashion. Consequently, the content was pre-organized, which may have inhibited elaboration. The NBI group, however,appeared able to integrate additional information (i.e., more words) into their T-units. This ability to add information to grammatically restricted T-units was felt to be a reflection of their superior linguistic organizational skills as compared to the CHI group.

Another measure in which the CHI group's performance was comparable to that of the NBI participants was cohesive adequacy, as hypothesized. Previous studies of the discourse abilities of individuals with CHI, using stories for narrative elicitation, have reported cohesion as being problematic (Coelho et al., 1991; Hartley & Jensen, 1991; Liles et al., 1989). In the present study, cohesive adequacy, as measured by the percentage of total ties that were complete, was examined. Although the NBI group's cohesive adequacy scores were higher than those of the CHI group, the differences were not significant. Cohesion is typically considered to be an index of discourse organization. In light of the fact that the CHI participants appeared to demonstrate difficulties with organization on other measures, such as words per T-unit and T-units within episode structure, this finding appeared inconsistent. However, the notion that cohesion is purely a measure of organization has been questioned. For example, it has been suggested that cohesion may be more accurately described as an index of lexical retrieval than of intersentential organization (Glosser & Deser, 1990). As such, cohesion would be a reflection of linguistic processes, as opposed to strictly higher-order conceptual processes, and perhaps more susceptible to disruption following focal insults to the left hemisphere, instead of the diffuse damage characteristic of CHI.

The second measure, which distinguished the CHI and NBI groups, was an indicator of story grammar ability: T-units within episode structure. Although the CHI and NBI participants were not different in terms of the number of total episodes produced, which had also been noted in previous studies (Coelho et al., 1991; Liles et al., 1989), the NBI participants produced more T-units within the structure of episodes. In other words, the NBI group produced fewer extraneous T-units—that is, T-units that did not contribute to episodic structure. As stated previously, this measure was considered to be a reflection of an individual's ability to use story grammar to organize language. This finding was also in agreement with the hypothesis.

Is Discourse Performance Influenced by the Socioeconomic Status of CHI and NBI Participants?

For this question, it was hypothesized that higher SES would be associated with higher scores on the measures

of sentence production, cohesion, and story grammar for both participant groups. Once again, results only partially supported the hypothesis. Data analyses revealed no differences for the two sentence production measures, words per T-unit and subordinate clauses per T-unit, or the two story grammar measures, total episodes and T-units within episode structure. The two significant differences that were detected involving SES and group and SES with task occurred on the measure of cohesive adequacy. The professional and skilled worker groups had better cohesive adequacy than the unskilled workers, regardless of group membership or story task. These findings are in agreement with previous studies of discourse production that have found that SES is an important consideration for certain dimensions of discourse proficiency (Snow et al., 1995, 1997; Yorkston et al., 1993). SES, which in large measure is attributed to years of education, had a greater influence on cohesive adequacy than the specific aspects of sentence production and story grammar examined in the present study. Why this occurred was not entirely clear. However, if cohesive adequacy is attributed to lexical selection processes as discussed previously, then it would be logical that increased education could result in greater lexical proficiency. This proficiency could in turn be associated with greater cohesive adequacy.

Is the Discourse Performance of CHI and NBI Participants Similarly Influenced by Story Elicitation Task?

It was hypothesized that all CHI and NBI participants would demonstrate lower scores on the sentence production, cohesion, and story grammar measures in the story generation task than in the story retelling task. Findings from the present study indicated that the participants performed differently on the story retelling and generation tasks across all five discourse measures. However, the differences were not consistently as predicted. At the level of sentence production, CHI and NBI participants produced more words and subordinate clauses per T-unit in story generation than in story retelling. This was in agreement with previous comparisons of the same story tasks (Liles et al., 1989). The restrictive nature of story retelling—that is, the frame-by-frame presentation of the story via the filmstrip—may have led participants to summarize the story sequentially and discouraged elaboration and the production of longer more complex T-units. Although this potential strategy may have restricted embellishment of the story, it did yield complete episodes with relatively adequate cohesion. By contrast, participants in the story generation task were asked to create a story from a single picture. Most participants produced fewer episodes and fewer cohesive ties, and thus the opportunity for breakdowns in cohesion was limited. These results supported the hypothesis.

Similar findings were noted for the story grammar measures, in which participants produced a greater number of episodes and more T-units within episode structure in the story retelling task than in story generation. In the retelling task, participants appeared to have an easier time producing episodes, perhaps because of the frame-by-frame presentation of the story. In the story generation task, on the other hand, the content of the story had to be spontaneously developed. Based on the numbers of total episodes and T-units within episode structure, story generation appeared to be the more difficult task, as hypothesized. Although in terms of cohesive adequacy the story retelling task appeared to be more difficult, this was felt to be a function of the number of episodes produced. That is, because the participants produced fewer episodes in the story generation task, there were fewer cohesive ties required, and thus the cohesive adequacy score was higher. Finally, with regard to whether the story generation task was more difficult than the retelling task, results indicated that although the participants produced longer and more complex sentences in the story generation task, cohesive adequacy and story grammar were better in the story retelling task. Inasmuch as episodic organization and adequate cohesion are critical to the creation of a meaningful story, it is concluded that story generation was more challenging than story retelling for both the NBI and CHI groups.

Does the Discourse Performance of the Individuals with CHI Correlate with Scores on a Measure of Executive Functioning?

The relationship between executive functioning and discourse would appear to be quite logical. Ylvisaker et al. (2001) have suggested that discourse proficiency involves an interaction of cognitive and linguistic organizational processes, which requires executive control. In the present study, it was hypothesized that only the cohesion and story grammar measures would be correlated with the WCST scores. Results revealed several significant, but modest, correlations between scores from the WCST and the discourse measures, which supported the hypothesis in part. In the story retelling task, seven of the ten significant correlations were noted for the sentence production measures, words per T-unit and subordinate clauses per T-unit. Not only were these findings unexpected, but the direction of the correlations for the discourse measure, words per T-unit, was puzzling. Those CHI participants with the longest sentences or more words per T-unit appeared to have poorer scores on the WCST than those CHI participants with the shorter sentences. This would suggest that production of longer sentences did not compensate for lack of content or poorly organized content. The relationship

between the measure subordinate clauses per T-unit and the WCST scores appeared more straightforward. As sentence complexity increased (i.e., more subordinate clauses per T-unit), WCST scores improved. No significant correlations were noted for the cohesive adequacy measure in either story task, which was also not predicted by the hypothesis. For the story grammar measures, three significant correlations for number of episodes in the story retelling task were also noted and were in agreement with the hypothesis. This finding was consistent with previous findings (Coelho et al., 1995) in which higher performance on the WCST was associated with the production of more episodes in story tasks. Results for the story generation task did not support the hypothesis. Only one significant correlation that involved the sentence production measure *words per T-unit* was noted, and as was the case with the story retelling task, a greater number of words per T-unit was associated with poorer performance on the WCST.

The results of the present study corroborate the findings of previous investigations of the relationship between executive functioning and discourse production of adults with CHI (Coelho et al., 1995; Tucker & Hanlon, 1998); however, these results are far from definitive. Although executive functioning appears to be a promising avenue for investigating the cognitive-linguistic nature of discourse, numerous issues must be addressed in future studies of this topic to delineate this relationship. First of all, there is no clear consensus on how best to measure executive functions (Miyake, Emerson, & Friedman, 2000), nor is it clear which dimension of executive functioning some of the more widely used assessment tools are measuring. For example, the WCST has been variously described as a measure of shifting ability (Miyake et al.), organizational skills (Murray & Ramage, 2000), or planning abilities (Body, Perkins, & McDonald, 1999). In addition, memory processes, particularly working memory, have been implicated as playing a critical role in discourse (Baddeley, 1987; Connor, MacKay, & White, 2000; Tompkins, 1995; van Dijk & Kintsch, 1983) and should be included in future investigations of the underlying nature of discourse production.

Clinical Implications

On the basis of the present findings, the following recommendations for the clinical application of discourse analyses are offered:

1. When assessing individuals with CHI who present with subtle cognitive-communication impairments, carefully selected discourse analysis procedures can serve as a highly useful adjunct to traditional diagnostic procedures. Results from the present study indicated that the discourse performance of the CHI and NBI participant groups was distinguishable on the basis of two measures, a sentence production measure (words per T-unit) and a story grammar measure (proportion of T-units within episode structure). The sentence production measure indicated that the NBI group produced longer sentences in their stories than did the CHI group. The story grammar measure specified that the NBI group's stories were also more efficient than those of the CHI group, in that more of the sentences they produced contributed to episode structure. In other words the NBI group produced longer, more efficient, and better-organized stories than the CHI participants. Therefore, it is recommended that discourse analysis procedures to be used with the CHI population include, at a minimum, measures of narrative length and content organization.

2. With regard to the influence of SES on discourse performance, results indicated that cohesive adequacy was the only measure of the five studied in this investigation to be influenced by SES. The cohesive adequacy of the unskilled workers was poorer than that of the skilled workers and professionals, regardless of story elicitation task. It is suspected that education is the primary factor in SES that influences cohesion. However, whether the influence of education on cohesion occurs through lexical selection or organization is unclear. Regardless, it is recommended that when examining the discourse, particularly cohesion, of individuals with CHI, SES—or at the very least, level of education—be carefully considered when selecting control groups for comparison purposes.

3. The discourse procedure employed in the present study involved the use of two discourse elicitation tasks (story retelling and story generation). The value of this approach was demonstrated by the differential performance of the participant groups across the tasks. Results indicated that the CHI and NBI groups produced longer and more grammatically complex stories in the story generation task than in story retelling. However, both groups had better cohesive adequacy and story grammar in the story retelling task than in story generation. It is recommended that the decision regarding which narrative elicitation tasks to include in a discourse analysis procedure should be based on what the researcher is examining. For example, as indicated in the current study, the story generation task appeared more useful for examining narrative productivity and sentential complexity issues, whereas the story retelling task appeared better suited for sampling cohesive adequacy and story grammar abilities.

4. Finally, a better understanding of the nature of discourse impairments will lead to more effective interventions. At the present time, the primary issue appears to be whether treatment should focus on the potential

underlying cognitive components (e.g., executive functions, working memory, and organization), on various dimensions of discourse processes (e.g., sentential complexity, cohesive adequacy, episode structure), or both. A recent treatment study targeted story grammar ability of an individual with TBI. The intervention emphasized comprehension of story grammar structure and identification and generation of episode components within stories. Over the course of treatment a marked increase in the number of complete episodes produced by the individual with CHI was noted. Follow-up sessions at 1 and 3 months posttreatment, however, demonstrated limited maintenance and poor generalization of the treatment effects. The authors speculated that the single most important factor in the lack of functional change in this individual was that there were no real-world consequences for discourse failure within the treatment procedures (Cannizzaro & Coelho, in press). It is recommended that regardless of whether such interventions focus on discourse or cognitive components, treatment should be linked to an environment in which the individual will be functioning and to meaningful, efficient social interactions.

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