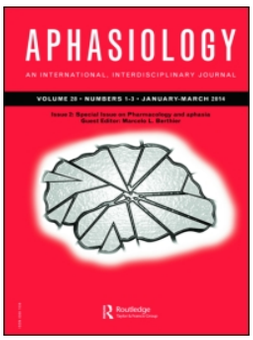

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Narrative and conversational discourse of adults with closed head injuries and non-brain-injured adults: A discriminant analysis

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Background: Although there is general agreement regarding the clinical utility of discourse analyses for detecting the often subtle communicative impairments following closed head injuries (CHI), there is little consensus regarding discourse elicitation or analysis procedures. Consequently it has been difficult to compare findings across studies.

Aims: In an effort to facilitate a movement towards the adoption of a more consistent methodology for the assessment of discourse abilities, the current study examined several commonly used measures of discourse performance and the accuracy with which these measures were able to distinguish individuals with CHI from non-brain-injured (NBI) controls. Previous studies have suggested that conversation is less demanding than narrative discourse because such narratives require greater manipulation of extended units of language while conversational discourse can be maintained with minimal responses (Chapman, 1997; Galski, Tompkins, & Johnston, 1998). On the basis of these reports it was hypothesised that the measures of narrative story performance would more accurately discriminate the participant groups than conversational measures.

Methods & Procedures: Discourse samples were elicited from 32 adults with CHI and 43 NBI adults. Discourse samples included two story narratives, generation and retelling, and 15 minutes of conversation. A variety of discourse analyses were performed including story narrative measures of grammatical complexity, cohesive adequacy, and story grammar. Measures of conversation included appropriateness and topic initiation. Discriminant function analyses (DFA) were then employed to determine the accuracy of the selected measures in classifying the participants into their respective groups.

Outcomes & Results: Results of the DFA with only the story narrative measures indicated that 70% of the cases, 64.5% of the CHI group, and 74.4% of the NBI group were accurately classified. This finding was not significant, suggesting that the story narrative measures did not reliably discriminate the CHI from the NBI participants. The DFA with the conversational measures correctly classified over 77% of the cases, 78.1% of the CHI participants, and 72.1% of the NBI group. This finding was significant, which suggests that the measures

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of conversational discourse were better able to discriminate the participant groups. A third DFA was performed, with all of the story narrative and conversational discourse measures included, which revealed that the conversational measures, comments and adequate plus responses, and the story narrative measure, T-units within episode structure in the generation task, made the greatest contributions to discriminating between the groups. Overall, group membership was correctly classified by the DFA in 81% of the cases, 84.4% of the CHI group, and 77.5% of the NBI participants. This finding was significant, suggesting that these three discourse measures discriminated the two participant groups with the highest degree of reliability.

Conclusions: These findings did not support the hypothesis that the narrative discourse measures would more accurately predict group membership of the CHI and NBI participants than the conversational measures. A variety of factors may account for these findings including the interactive nature of conversation as well as social factors which appear to make this genre more difficult for individuals with CHI and a more sensitive index of their cognitive-communicative impairments.

The clinical utility of including discourse analyses in the assessment procedures for cognitive-communicative deficits secondary to closed head injury (CHI) in adults has been documented by a variety of recent investigations (e.g., Coelho, Liles, & Duffy, 1991, 1995; Hartley & Jensen, 1991; Mentis & Prutting, 1987; Snow, Douglas, & Ponsford, 1995, 1997). Although there is general agreement among these studies regarding the sensitivity of discourse analyses for detecting the often subtle communicative impairments following CHI, there is little consensus regarding discourse elicitation or analysis procedures. Consequently it has been difficult to compare findings across studies. For example, two recent studies compared the discourse performance of CHI and non-brain-injured (NBI) controls. In the first study (Coelho, 2002) narratives were elicited in two story tasks, retelling and generation, from two groups of adults, 55 CHI and 47 NBI. Narratives were analysed at the levels of sentence production, cohesive adequacy, and story grammar. Discourse performance was then compared across groups and tasks. Results indicated that two measures distinguished the groups. The CHI participants produced significantly fewer words per T-unit and fewer T-units within episode structure than the NBI group. In addition significant differences were noted for all five discourse measures (words per T-unit, subordinate clauses per T-unit, cohesive adequacy, number of complete episodes, and proportion of T-units within episode structure) across the story tasks. All participants, CHI and NBI, 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 as compared to the story generation task. In the second study (Coelho, Youse, & Le, 2002) samples of conversation were elicited from 32 individuals with CHI and 43 NBI adults, and analysed for various dimensions of appropriateness and topic initiation. Findings indicated that the CHI group produced significantly fewer comments (i.e., utterances for which no response was explicitly demanded) than the NBI participants. In addition, the CHI participants produced significantly more adequate plus responses (i.e., providing more information than was requested) than the NBI group.

The findings of these studies illustrate some of the difficulties involved in the measurement of narrative ability, namely the pragmatic nature of the task. Narrative performance may be influenced by a variety of contextual parameters such as: listener characteristics, elicitation procedures, presentation medium, complexity of content, structural complexity, social function, and manner of textual coherence (Liles, Duffy,

Merritt, & Purcell, 1995; Togher, 2001). In addition to contextual influences, the measurement of narrative performance is further complicated by the multiplicity of measures that have been applied. For example, narrative ability may be described in terms of the speaker's social role, cognitive organisation, linguistic structure of the text, and sentence-level complexity (Liles et al., 1995; Togher, 2001).

In an effort to facilitate a movement towards the adoption of a more consistent and clinically efficient methodology for the assessment of discourse abilities, the current study examined several commonly used measures of discourse performance in story and conversational narratives. Specifically, we were interested in the accuracy with which these measures were able to distinguish individuals with CHI from NBI controls. The measures applied to story narratives included within-sentence analyses such as grammatical complexity and between-sentence analyses such as cohesive adequacy and story grammar. Conversational measures included dimensions of response appropriateness and topic initiation. Discriminant function analyses were then employed to determine which of the selected measures were most effective at classifying large groups of adults with CHI and NBI adults.

Ylvisaker, Szekeres, and Feeney (2001) have suggested that discourse proficiency involves an interaction of cognitive and linguistic organisational processes. Story narratives were selected for study because they provide the opportunity for the analysis of two separate sources of information related to cognitive and linguistic levels of narrative organisation. The first level, macro-organisation, relates to story grammar. At this level ''information is organised in terms of how intentions and events are logically related in time or through cause–effect relations reflected in general experience'' (Liles et al., 1995, p. 423). Because the interpretation of content is facilitated by the speaker/listeners' access to general cognitive schemata, this level of narrative organisation is hypothesised to go beyond the content of a specific text (Mandler, 1982). The second organisational level, micro-organisation, involves linguistic organisation of the text, both within and across sentence boundaries. At this level the text is processed as a closed unit (Liles et al., 1995).

The complexities of conversational discourse have been well described in a number of studies (Doyle, Goda, & Spencer, 1995; Mackenzie, 2000; Togher, 2001; Togher, Hand, & Code, 1999; Wilkinson, 1999). Effective participation in a conversation is dependent on a variety of factors such as: topic maintenance, turn taking, appropriate referencing, sensitivity to the conversational partner, and general cognitive abilities such as attention, vigilance, and memory. Somewhat contrary to this view, other studies have suggested that conversation is less demanding than narrative discourse, because such narratives require greater manipulation of extended units of language while conversational discourse can be maintained with minimal responses (Chapman, 1997; Galski et al., 1998).

In the present study we hypothesised that the measures of narrative story performance would more accurately discriminate the participant groups than conversational measures. It was predicted that because proficiency in story narrative production is heavily dependent on cognitive and linguistic organisational skills, this discourse genre would be more sensitive to the cognitive-linguistic dysfunction associated with CHI than conversational discourse. It was also hypothesised that entering all of the narrative and conversational discourse measures into a single step-wise discriminant function analysis would increase the accuracy with which the participant groups could be discriminated.

METHOD

Participants

CHI. A total of 32 native speakers of English who had sustained a 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 (see below).

All CHI participants met the following criteria: (a) no reported history of substance abuse or psychiatric illness; (b) visual acuity and visual perceptual abilities adequate to distinguish stimulus materials as determined by screening procedures; (c) hearing acuity adequate to follow directions in each task as determined by screening procedures; (d) an aphasia quotient (AQ) from the *Western Aphasia Battery* (Kertesz, 1982) above 93; (e) no significant motor speech disorder as determined by an experienced speech-language pathologist; (f) Rancho Los Amigos Level of Cognitive Functioning (Hagen, Malkmus, & Durham, 1980) of VII (automatic-appropriate) or above; (g) *Galveston Orientation and Amnesia Test* (Levin, O'Donnel, & Grossman, 1979) score of 75 or above; and (h) a score of 120 or above on the *Dementia Rating Scale* (Mattis, 1976), a general screen of cognitive processing. The CHI group consisted of 8 females and 24 males ranging in age from 16–69 years (mean = 31.7 years). Four members of this group were African-American and the remainder Caucasian. Years of education for the CHI group ranged from 10–21 (mean = 13.2). The CHI participants were also assigned to one of three socioeconomic groups: Professional, Skilled Worker, or Unskilled Worker on the basis of the Hollingshead rating (Hollingshead, 1972) (see Coelho et al., 2002 for a description). The group consisted of 11 professionals, 10 skilled workers, and 11 unskilled workers. All of the CHI participants' injuries were rated as either moderate (duration of coma less than 6 hours) or severe (duration of coma greater than than 6 hours) on the basis of criterion established by Lezak (1995). Time post onset ranged from 1–99 months (mean = 12.8 months).

NBI. A total of 43 hospital employees, working in a variety of capacities, who were native speakers of English made up the NBI group. No individual in this group reported a history of neurologic or psychiatric disease, or substance abuse. NBI participants were also selected on the basis of socioeconomic level. Attempts were also made to match these individuals, as closely as possible, with the CHI participants on the basis of age and gender. There were 30 males and 13 females studied, ages ranged from 16–63 years old (mean = 31.9 years). Two individuals from this group were African-American and 41 Caucasian. Level of education ranged from 11–24 years (mean = 15.3). With regard to socioeconomic status, the NBI group consisted of 15 professionals, 10 skilled workers, and 18 unskilled workers.

Discourse elicitation procedures

Two genres of discourse were elicited from all participants: stories under two conditions, Retelling and Generation, and conversation.

Story retelling task. Subjects were presented 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 soundtrack. After viewing the filmstrip the subjects were given the following instruction: ''Tell me that story.''

Story generation task. Subjects were presented with a copy of the Norman Rockwell painting, The Runaway. The subjects 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 subject until the task was completed.

Conversation. Each of the individuals, CHI and NBI, was individually brought into a quiet room by the examiner. He introduced himself to each participant and stated that he was interested in learning more about conversational behaviour. Each participant was then engaged in a 15-minute conversation. The examiner and co-interactor in each of the conversations was a 42-year-old Caucasian male with approximately 22 years of education working as a speech-language pathologist. The examiner was essentially a stranger to all of the individuals with CHI and NBI participants prior to the conversations. Most conversations were initiated by the examiner with the question ''Why are you here at the hospital today?''. Each conversation was audiotaped and each recording transcribed verbatim with each utterance being assigned to one of the speakers (examiner or participant).

Data collection

Each story and conversation was audiotaped and later transcribed verbatim. Transcriptions of the stories were distributed into T-units (i.e., an independent clause plus any subordinate clauses associated with it) prior to analysis, following the conventions described by Liles (1985). For the conversations each utterance was assigned to one of the speakers, examiner or participant. Any discourse samples that were judged to be inconsistent with the intended elicited genre (e.g., production of a narrative description instead of a story, or an extended monologue instead of conversation) were excluded from analysis.

Analyses of story narratives

The narrative discourse analysis procedures, including reliability measures, employed in the present study have been explained in detail elsewhere (see Coelho, 2002). Therefore the analyses are only briefly described below.

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

(1) Number of Words per T-unit.
(2) Number of Subordinate Clauses per T-unit—the total number of subordinate clauses in each story was obtained and divided by the total number of T-units. The frequency of subordinate clause use may be considered a measure of the complexity of sentence-level grammar.

Between-sentence. Between-sentence measures included:

(1) Cohesive Adequacy—The measure of cohesive adequacy used in this study was Percent Complete Ties out of Total Ties. Cohesive ties pertain to how meaning is conjoined across sentences. A word is considered to be a cohesive tie if the listener must search outside the sentence for the completed meaning. Three categories of adequacy were used: complete, incomplete, and erroneous.

(2) Story Grammar—Two measures of story grammar performance were employed in this study: (a) Number of Total Episodes: number of complete and incomplete episodes, considered to be a measure of content organisation; and (b) Proportion of T-units Contained within Episode Structure (T-units in episode structure/total T-units). An episode consists of (a) an initiating event that prompts a character to formulate a goal, (b) an action, and (c) a direct consequence marking attainment or nonattainment of the goal.

Analyses of conversation

The procedures for the analysis of conversation, as well as reliability measures, have been discussed elsewhere (see Coelho et al., 2002). These analyses are summarised below. The middle 6 minutes of each conversation were analysed. Two categories of analyses were employed with each transcribed conversation: Appropriateness (Blank & Franklin, 1980) and Topic Initiation (Brinton & Fujiki, 1989). Number of conversational turns was also tallied.

Appropriateness. Within the category of Appropriateness, each utterance was categorised either as a Speaker-Initiation or a Speaker-Response.

Speaker-initiations. These were classified as Obliges (utterances containing explicit requirements for a response from the listener) or Comments (utterances not containing an explicit demand for a response). The total numbers of Obliges and Comments produced by a subject or the examiner over the course of each conversation were tallied.

Speaker-responses. These were classified in terms of adequacy. An Adequate response was one that appropriately met the initiator's verbalisation. An Adequate Plus response was relevant and elaborated the theme, providing more information than was requested. The total numbers of Adequate Plus and Adequate responses produced by each participant in each conversation were tallied.

Topic initiation. Either a participant or the examiner could introduce topics. Topics could be changed in one of three ways: (a) at the beginning of the conversation, or by ending discussion of one topic and initiating another, referred to as a Novel Introduction; (b) by means of a Smooth Shift, in which discussion of one topic is subtly switched to another; or (c) by means of a Disruptive Shift, in which discussion of one topic is abruptly or illogically switched to another topic. The total numbers of Novel Introductions and shifts (Smooth, Disruptive) produced by a participant over the course of each conversation were tallied.

Turns. An utterance was defined as an oral statement or response.

Reliability of discourse measures

Inter- and intra-examiner reliability scores for all of the discourse measures described in the present paper have been reported on elsewhere (Coelho, 2002; Coelho et al., 2002) and therefore will only be summarised here. For the measures of story narrative ability, inter- and intra-examiner reliability scores ranged from 90–98%. Reliability scores for the conversation measures ranged from 80–99%.

RESULTS

In the present study data from 32 CHI and 43 NBI participants from the two previous investigations described in the introduction (Coelho, 2002; Coelho et al., 2002) were re-analysed using discriminant function analyses (DFA). The intent of the present study was to investigate the accuracy with which group membership (CHI versus NBI) could be predicted on the basis of discourse performance. The measures selected for inclusion in the DFA included measures of story narrative and conversational discourse. Results from each of these DFAs are discussed below.

Story narrative measures

Five measures that sampled aspects of micro-organisation (i.e., words per T-unit and subordinate clauses per T-unit) and macro-organisation (i.e., percentage of complete cohesive ties to total cohesive ties, total episodes, and proportion of T-units within episode structure) in story retelling and story generation tasks were entered into the DFA for narrative discourse. The DFA accurately classified 70% of the cases, $\chi^2(10) = 14.54$, $p = .15$, 64.5% of the CHI group and 74.4% of the NBI group (see Table 1). This finding was not significant, accounting for approximately 20% of the explained variance, suggesting that the story narrative measures did not reliably discriminate the CHI from the NBI participants. Of the story narrative measures, the *proportion of T-units within episode structure* and *words per T-unit both from the story generation task* had the highest correlations with the discriminant function, .54 and .49 respectively (see Table 2).

Conversation measures

Seven measures of conversational performance (i.e., numbers of obliges, comments, adequate and adequate plus responses, novel topic introductions, smooth topic shifts, and turns) were included in the DFA for conversation. Of the measures of conversational performance studied, *number of comments* and *adequate plus responses*, had the highest correlations to the discriminant function, −.91 and .67 respectively (see Table 3). This DFA correctly classified over 77% of the cases, $\chi^2(7) = 25.04$, $p = .001$, 78.1% of the CHI participants and 72.1% of the NBI group (see Table 4). This finding was significant, accounting for approximately 30% of the explained variance, which suggests that the measures of conversational discourse were better able to discriminate the participant groups.

TABLE 1
Classification results from discriminant function analysis of story narrative measures

	Predicted group membership		
Actual group	*CHI*	*NBI*	*Total*
CHI	20 (64.5%)	11 (35.5%)	31 (100.0%)
NBI	10 (25.6%)	29 (74.4%)	39 (100.0%)

70.0% of original grouped cases correctly classified.

TABLE 2
Correlations between the story narrative measures and the discriminant function

Measure	*Correlation*
GENER-TUEPTR	.54
GENER-WDSTU	.49
RETELL-TUEPTR	.42
RETELL-SUBT	.39
GENER-COMTPC	.29
RETELL-COMTPC	.26
RETELL-WDSTU	.23
GENER-SUBT	.22
GENER-EPTOT	−.15
RETELL-EPTOT	−.03

The measures with the highest correlation contribute the most to discriminating between the groups.

GENER = story generation task, RETELL = story retelling, task, WDSTU = words per T-unit, SUBT = subordinate clauses per T-unit, COMTPC = percent complete ties out of total ties, EPTOT = number of total episodes, TUEPTR = proportion of T-units within episode structure.

Story narrative and conversation measures

In an effort to determine if group classification could be improved by including all 17 measures of both the story narrative and conversational discourse, a step-wise DFA was performed. In this procedure the measure providing the best discrimination is entered first, then from the remaining 16 measures, the measure that adds the most to discriminating between the groups is added to the first selected measure. This procedure continues until there are no measures that, when added, significantly increase the capacity to discriminate above the measures entered in previous steps. Results from the step-wise DFA revealed that the conversational measures *comments* and *adequate plus responses* and the story narrative measure *T-units within episode structure in the generation task* made the greatest contributions to discriminating between the groups (see Table 5). The combination of just these three measures discriminated the groups as well as any other

TABLE 3
Correlations between the conversation measures and the discriminant function

Measure	*Correlation*
COMMENTS	−.91
ADEQUATE PLUS RESPONSES	.67
OBLIGES	−.28
ADEQUATE RESPONSES	.23
NOVEL TOPIC INTRODUCTIONS	−.19
TURNS	−.09
SMOOTH TOPIC SHIFTS	−.04

The measures with the highest correlation contribute the most to discriminating between the groups.

TABLE 4
Classification results from discriminant function analysis with conversation measures

	Predicted group membership		
Actual group	*CHI*	*NBI*	*Total*
CHI	28 (87.5%)	4 (12.5%)	32 (100.0%)
NBI	13 (30.2%)	30 (69.8%)	43 (100.0%)

77.3% of original grouped cases correctly classified.

combination of the 17 story narrative and conversational measures. Overall, group membership was correctly classified by the DFA in 81% of the cases, $\chi^2(3) = 32.23$, $p < .001$, 84.4% of the CHI group and 77.5% of the NBI participants (see Table 6). This finding was significant and accounted for over 37% of the explained variance suggesting that these three discourse measures discriminate the participant groups with the highest degree of reliability. However it was the conversational measures (i.e., *comments* and *adequate plus responses*) that had the largest correlations with the discriminant function, .79 and .55, versus the story narrative measure (i.e., *T-units within episode structure in the generation task*) with a correlation of .40.

DISCUSSION

Prior to discussing the findings of this study it is important to acknowledge a limitation in the procedures employed for data analysis. If one estimates the discriminant functions that may best predict group membership from a given data set, one should not then use the same data set, as was done in this study, to judge the accuracy of the prediction. Validation of a predicted discriminant function requires testing of the function with another data sample, thereby reducing the effect of chance on the predictive process. Replication of the present study is needed. With that qualification in mind, the results of the present study should be interpreted cautiously.

Results of the DFAs run with the discourse data from the CHI and NBI participants indicate that the conversational measures were more accurate in discriminating the groups. These findings did not support the hypothesis which predicted that the narrative discourse measures would more accurately predict group membership of the CHI and NBI participants than the conversational measures. A variety of explanations may account for these findings.

TABLE 5
Correlations between selected story narrative and conversation measures and the discriminant function

Measure	*Correlation*
COMMENTS	.79
ADEQUATE PLUS RESPONSES	−.55
GENER-TUEPTR	.40

GENER = story generation task, TUEPTR = proportion of T-units within episode structure

TABLE 6
Classification results from discriminant function analysis with selected story narrative and conversation measures

	Predicted group membership		
Group	*CHI*	*NBI*	*Total*
CHI	27 (84.4%)	5 (15.6%)	32 (100.0%)
NBI	7 (22.5%)	31 (77.5%)	40 (100.0%)

80.6% of original grouped cases correctly classified.

Galski and colleagues (1998) have commented that the success of an individual's social, vocational, familial, and academic integration rests on the recovery of effective communication. Although previous research has demonstrated that individuals with CHI have difficulty with many narrative discourse tasks (see Coelho, 1995), it may be that because of the interactive nature of conversation it is a more difficult discourse genre for this population. Consistent with this explanation, it has been reported that individuals with CHI produced more discourse errors in conversation than in a structured referential communication task. This may be attributed to social aspects, such as the relationship between conversational partners—that is, familiarity, status, and role—as well as the face-saving strategies used for politeness when communication breakdowns occur (Prince, Haynes, & Haak, 2002). Such factors are extremely difficult to simulate in other types of noninteractive discourse.

A second explanation pertains to the stylistic variation that can exist among speakers within a specific genre. In other words speakers may achieve the same text macrostructure through many different patterns of microstructure (Armstrong, 2002). Consequently such variation in NBI speakers is important to note when making judgements regarding what is ''normal'' or what is ''disordered'' in the discourse of individuals with CHI. For example, in the present study over 25% of the NBI participants were classified as CHI on the story narrative tasks and that rose to over 30% in conversation.

An additional explanation pertains to the potential cognitive factors that have been suggested to be important for meaningful participation in conversation. For example, topic maintenance and appropriate referencing require both selective and sustained attention. Further, functional memory is required to recall what the speaker has said as well as the listener (Mackenzie, 2000). Similarly, comprehension of sarcasm and implicit language may also influence the effectiveness of a conversational participant. Individuals with CHI would be at risk for demonstrating difficulty with any or all of these factors.

Finally, it is important to emphasise that although all of the CHI participants studied had suffered moderate to severe injuries, they were selected on the basis of having recovered fluent conversational speech. Therefore the present findings may not be applicable to all individuals with CHI, particularly those with limited discourse production capabilities. Although the DFAs reported in the present study involved a variety of discourse measures, discriminant functions derived from different measures of narrative and conversational discourse may have yielded different results. A related issue pertains to the potential effects of the measures and interactions with the targeted discourse genres. For example, the conversational measures are considered to be pragmatic in nature, while the story narrative measures involve various aspects of cognitive-linguistic organisation. A reasonable explanation for the present findings would be that

pragmatic measures are more sensitive to the communicative dysfunction displayed by individuals with CHI than the more structurally focused narrative measures.

The findings from the present study did support the second hypothesis which stated that if all of the discourse measures were entered into a DFA, the CHI and NBI participants would be discriminated with a higher degree of accuracy than with the conversational or story narrative measures alone. Previous investigations of the discourse of individuals with CHI have documented an array of impairments across discourse genres analysed at varied levels. The likelihood of delineating the nature of discourse impairment secondary to CHI with a single measure is poor given the broad array of cognitive, linguistic, and psychosocial sequelae that characterise CHI. Therefore it is not surprising that, as noted in the present study, a variety of discourse measures more accurately discriminated the CHI and NBI participant groups. The study of discourse following brain injury requires the use of multiple and varied elicitation tasks and measures.

Regarding implications of these findings, it has been observed that discourse represents a critical point of intersection between cognition and language, and therefore is an important component in the management of individuals with CHI (Ylvisaker et al., 2001). The present findings suggest that conversation may be more sensitive than story narratives to the discourse impairments that characterise individuals with CHI. None the less, ongoing research is needed to develop discourse procedures that will not only be sensitive to subtle impairments but clinically efficient as well.

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