Introduction

Difficulty with organizing story narratives is a deficit that emerges consistently following traumatic brain injury (TBI) (Body & Perkins, 2004; Brookshire, Chapman, Song, & Levin, 2000; Coelho, 2002). Story grammar measures that tap the organizational structure of stories (e.g., episodes) have been shown to be sensitive to TBI. However, organizational measures may not fully describe discourse ability. For example, a storyteller may relate an organized narrative that is missing key story components. Hence, the inclusion of content measures with organizational measures may render a more global picture of an individual's narrative discourse performance.

A previous pilot study introduced a measure of story goodness that combined content and organizational measures (story completeness and story grammar) (Lê, Coelho, Mozeiko, & Grafman, 2008). Initial findings, based on 46 non-brain-injured individuals and 24 individuals with TBI, indicated that the story goodness measure was sensitive in 1) discriminating discourse ability between groups and 2) identifying subsets of storyteller profiles.

The present study examined story goodness of 171 individuals with TBI. It is hypothesized that use of a larger sample will bear out the findings from the pilot study. Specifically, it is hypothesized that 1) the distribution across quadrant on the story goodness measure will be different between groups and 2) the measure will differentiate among storytellers with TBI regardless of a 1 or 2 SD cut-off.

Methods

Participants

All participants were native English-speaking male Vietnam War veterans.

TBI group. 171 individuals, 52-70 years of age, who sustained severe penetrating head wounds received during the Vietnam War participated. Education ranged from 8-22 years. Scores ranged from 1-99 on the Armed Forces Qualification Test (AFQT), 25-60 on the Boston Naming Test (BNT), and 87-100 on the Token Test (TT).

Comparison group. 46 individuals, 55-76 years of age with no history of neurologic disease or injury also were studied. Years of education ranged from 12-20. Scores ranged from 14-95 on the AFQT, 46-60 on the BNT, and 94-100 on the TT.

Discourse Analysis Procedure

Task. Participants were shown a multi-frame picture story with no soundtrack on a computer screen. Upon completion each participant was instructed to "tell me that story you just watched." Each retelling was digitally video-recorded. Recordings were transcribed verbatim and segmented into T-units.

Analyses. Story narratives were analyzed along two dimensions—organization and completeness. Story grammar analysis was used as the measure of organization. Story grammar guides comprehension and expression of logical relationships (temporal & causal) between people and events. The analysis yielded the proportion of T-units within episode structure (T-

units within episodes/total T-units in retelling). This score reflects the percentage of utterances framed within episodes.

Story completeness was indexed by tallying the number of critical story components (events and characters) mentioned by the storyteller out of five. In a previous study, these components were mentioned by 80% or more of the comparison group members and, therefore, considered to critical to the story.

Each narrative from both comparison and TBI groups was then reviewed for the presence of the five components. This analysis generated the completeness score, which was the total number of critical components produced in each participant's story retelling.

Intra-rater and inter-rater reliability for the proportion of T-units within episode structure was 90% and 84%, respectively. Intra-rater reliability and inter-rater reliability for the completeness measure were both 100%.

Data Analysis

Pearson correlation coefficients were calculated for the measures of story organization (proportion of T-units in episode structure) and story completeness (number of critical components).

Results

Story Grammar (Organization)

The TBI group had a mean proportion of T-units in episode structure of .61 while the comparison group had that of .70 (see Table 1).

Story Completeness

The TBI group referenced an average of 3.58 of the five critical components (see Table 1). Forty-one percent (N=70) mentioned all five components, 19 percent (N=33) mentioned four components, and 15 percent (N=26) mentioned three components. Eleven percent (N=19) included 2 components, 8 percent (N=14) had only one component, and 5 percent (N=9) had none (see Table 2).

Comparison group members referenced an average of 4.41 critical components (see Table 1). Sixty-five percent of participants (N = 30) mentioned five components, 24 percent (N = 11) included four, and four percent (N = 2) mentioned three. The remaining individuals (N=3) included only one component in their story retelling (see Table 2).

Story Goodness

Story goodness was quantified by pairing the participants' organization and completeness scores. A Pearson correlation coefficient was calculated for the story organization (grammar) and story completeness scores. A moderate correlation between the two measures was noted in both TBI and comparison groups (.531, $p=.01$ and .571, $p < .001$, respectively), suggesting that the indices were not entirely measuring the same things.

Participants' performance across the two measures is depicted within various quadrants (Figures 1 and 2). To compare sensitivity of the measure, cut-off scores were set at 1 SD and 2 SD below the mean based on comparison group performance on each measure. For story grammar, 1 SD below the mean was .49, and 2 SD was .28. For story completeness, 1 SD was

equal to 3.34 critical components, and 2 SD was 2.27. Using these cut-off scores, the "goodness" of the narratives was quantified and performance plotted within quadrants.

A story grammar and completeness score defined each quadrant. Using 1 SD cut-off points, Quadrant 1 (story grammar > .49; critical components ≤ 3.34) contained only one comparison group member, having retold a relatively organized but incomplete story. In contrast, Quadrant 1 encompassed 21% of the TBI group. Eighty-three percent of the comparison group (N=38) clustered in Quadrant 2 (story grammar > .49; critical components > 3.34) as did 54% of the TBI group. Quadrant 2 comprised the best storytellers, producing organized and complete stories. Quadrant 3 (story grammar ≤ .49; critical components ≤ 3.34) contained 9% and 19% of the comparison and TBI groups, respectively. These individuals were the poorest storytellers, producing disorganized and incomplete stories. Participants clustering in Quadrant 4 produced relatively complete (critical components > 3.34) but poorly organized (story grammar ≤ .49) stories. With 6% and 7% of the TBI and comparison groups, respectively, Quadrant 4 had little representation from either cohort.

A 2 SD cut-off point resulted in 2% of the comparison group and 15% of the TBI group falling in Quadrant 1 (story grammar > .28; critical components ≤ 2.27). Quadrant 2 (story grammar >.28; critical components > 2.27) contained 91% of the comparison group and 73% of the TBI group. Quadrant 3 (story grammar ≤ .28; critical components ≤ 2.27) had 9% while Quadrant 4 (story grammar ≤ .28; critical components > 2.27) had 3% of the TBI group in comparison to 4% and 2% of the comparison group, respectively.

Discussion

Results will be discussed with regard to the following:

1) Sensitivity of the story goodness measure in discriminating discourse ability between groups.
2) Utility of multi-pronged approaches to narrative discourse analysis.
3) Potential application for treatment of narrative discourse impairments (e.g., some individuals may require more focus on distilling story content while others may benefit more from approaches that focus on organizing and structuring narratives).
4) Application of the measure to other clinical populations, such dementia and aphasia, to further determine its clinical usefulness.

References

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Table 1: Descriptive statistic on measures of story grammar (organization) and story completeness

	TBI Group		Comparison Group	
Measure	Mean	Standard Deviation	Mean	Standard Deviation
Story grammar (proportion of T-units in episodic structure)	.61	.25	.70	.21
Story completeness (# of critical components)	3.58	1.56	4.41	1.07

Table 2: Frequency distribution for story completeness

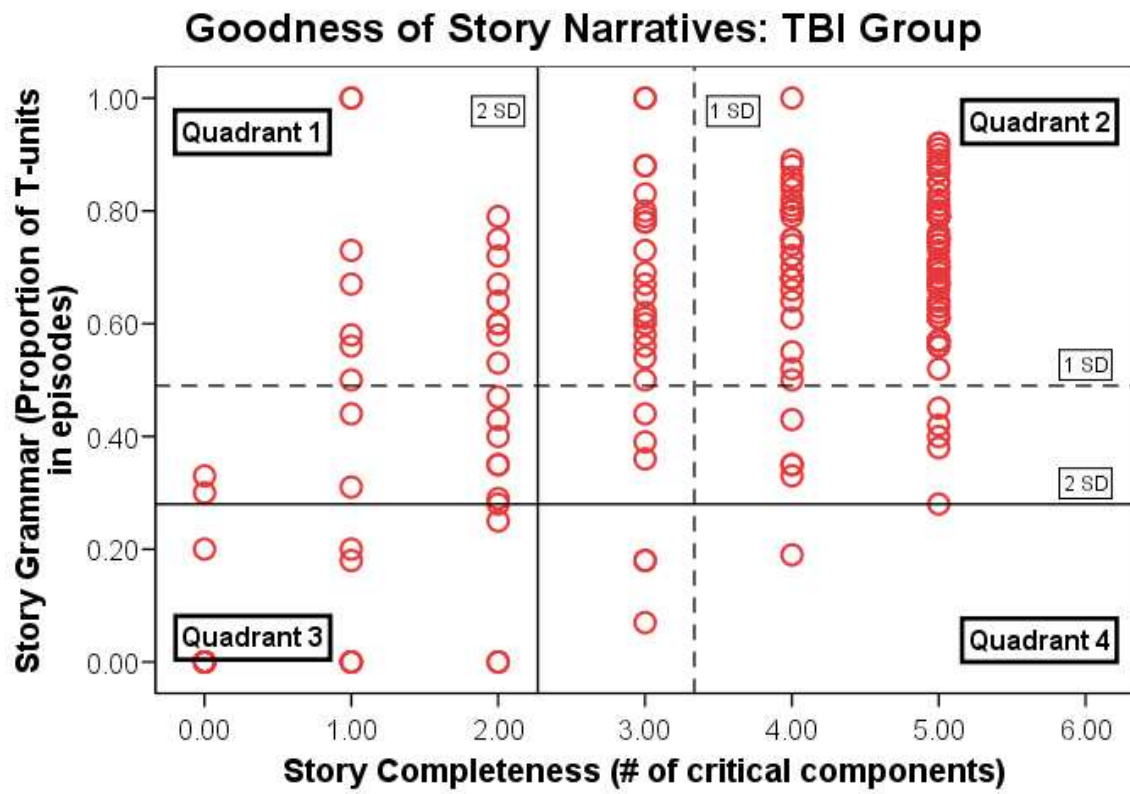| *# of Critical Components*	*% of TBI Group (N)*	*% of Comparison Group (N)*
0	5% (9)	0% (0)
1	8% (14)	7% (3)
2	11% (19)	0% (0)
3	15% (26)	4% (2)
4	19% (33)	24% (11)
5	41% (70)	65% (30)

Figure 1. Goodness of story narratives for the TBI group

Figure 2. Goodness of story narratives for the comparison group