

# Story Grammar Analysis in Persons with Aphasia

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## Background

- Narratives are often the basis of daily conversational interactions. Compromised narrative skills negatively impact functional conversation.
- Narrative impairment is common in persons with aphasia (PWAs), even those with mild word-finding deficits.<sup>1</sup> Consequently, PWAs may experience difficulty in conversation and obstacles to returning to life roles and/or work.
- Story grammar analysis is a well-known and commonly used narrative analysis method that identifies whether or not speakers are able to produce the structured “cognitive skeleton” of a story.<sup>2</sup>
  - Little is known about story grammar in PWAs or its relationship to other discourse measures in this population.
- **Aim 1:** To determine if there are differences between non-brain-injured (NBI) controls and persons with different subtypes of aphasia on production of story grammar components during retelling of the Cinderella story.
- **Aim 2:** To examine the relationship between story grammar and **(a)** Core Lexicon (CoreLex), a measure of the typicality of the vocabulary used to produce a story, and **(b)** Main Concept Analysis (MCA), a measure of how accurately and completely an individual produces the gist or essential elements of a story.
- Story grammar analysis revealed significant differences between NBIs and PWAs, as well as differences between aphasia subtypes.
- Even with conservative significance level cutoffs (because of a large number of comparisons, see *Data Analysis*), it is clear that those who are NABW have a profile more similar to anomic and conduction subtypes than NBI controls.
  - Narrative deficits were not captured by aphasia severity scores in persons with anomic aphasia or those who were NABW, as those populations perform at or near ceiling.
- Most differences in story grammar components were observed on the three most basic components used to define a story episode – “Initiating Event”, “Attempt”, and “Direct Consequence”.
  - Reduced production of episodes or reduced organization within episodes may contribute to reduced coherence or cohesion of overall discourse.
- Very strong relationships existed between the macro-level story grammar analysis and both micro-level typical vocabulary (CoreLex) and a hybrid micro/macro gist (MCA) measures.
  - Implications for treatments incorporating core lexicons, script training, etc.?
  - MCA can be performed without transcription, requires scoring of only a subset of utterances, and captures important information about accuracy and completeness. It may be a more efficient and effective method of predicting macro-level narrative abilities.
- Story grammar and other discourse analyses consistently reveal marked differences between PWAs and controls.
  - Narrative discourse, and not traditional assessment measures, may be a better candidate for decision-making regarding treatment termination.

## References

1. Andreetta, S., Cantagallo, A., & Marini, A. (2012). Narrative discourse in anomic aphasia. *Neuropsychologia*, 50(8), 1787-1793.  
2. Liles, B. (1985). Production and comprehension of narrative discourse in normal and language disordered children. *Journal of Communication Disorders*, 18, 409-427.  
3. MacWhinney, B., Fromm, D., Forbes, M., & Holland, A. (2011). AphasiaBank: Methods for studying discourse. *Aphasiology*, 25(11), 1286-1307.  
4. Nicholas, L.E., Brookshire, R.H. (1995). Presence, completeness, and accuracy of main concepts in the connected speech of non-brain-damaged adults and adults with aphasia. *Journal of Speech, Language, and Hearing Research*, 38, 145-156  
5. Roth, F. & Spekman, N. (1986). Narrative discourse: Spontaneously generated stories of learning-disabled and normally achieving students. *Journal of Speech and Hearing Disorders*, 51, 8-23.  
6. Richardson, J.D. & Dalton, S.G. (2015). Main concepts for three different discourse tasks in a large non-clinical sample. *Aphasiology*.

## Methods

### Database

- 151 Cinderella story transcripts were retrieved from the AphasiaBank<sup>3</sup> database. See Table 1.

Table 1	Age	Gender
Control (NBI)	61.1 years (+/- 15.7)	13 male, 14 female
NABW	61.8 years (+/- 14.2)	10 male, 15 female
Anomic	58.4 years (+/- 14.3)	16 male, 9 female
Conduction	67.0 years (+/- 12.0)	16 male, 11 female
Wernicke	67.3 years (+/- 13.0)	9 male, 5 female
TCM	67.1 years (+/- 10.2)	5 male, 3 female
Broca	62.4 years (+/- 12.4)	18 male, 7 female

Table 2. Story Grammar Components.<sup>5</sup>

Component	Description
1. Setting	Habitual or static states of characters and locations. • Major setting, Minor setting
2. Initiating Events	The immediate cause for a response on the part of the protagonist. • Natural Occurrence, Action, Internal Event, Verbalization
3. Response	The psychological state of the character after the initiating event or a verbal response to the situation. • Affective response, Goal, Cognition
4. Plan	Statements that specify a character’s strategy for obtaining the goal.
5. Attempt	The character’s overt action(s) to obtain the goal.
6. Direct Consequence	The character’s success or failure at attaining the goal(s); any changes in the sequence of events resulting from the character’s actions. • Natural occurrence, Action, End State
7. Reaction	The way the character feels or reports feeling about the outcome; the character’s thoughts regarding success or failure. • Affect, Cognition, Action

### Story Grammar Coding

- Transcripts divided into relevant concepts (RCs) (i.e., utterances [completed or a recognizable attempt] about the story that contained a subject, one main verb, object, subordinate clauses).<sup>4</sup>
- RCs received a story grammar code.<sup>5</sup> See Table 2.
- The following were calculated:
  - **Story Length** = total number of RCs that received a story grammar code
  - **Story Component Usage** = frequency of use of seven different story components

### CoreLex Scoring

- The total number of words spoken in the transcript that have been identified as the core lemmas spoken by 50% (46 of 92) of AphasiaBank control participants.

### Main Concept Coding

- The total number of main concepts spoken in the transcript that have been identified as those produced by 33% of AphasiaBank control participants<sup>6</sup> (34 total MCs) and coded according to Nicholas & Brookshire<sup>4</sup> guidelines.
- Absent (**AB**); Inaccurate/Incomplete (**II**); Inaccurate/Complete (**IC**); Accurate/Incomplete (**AI**); Accurate/Complete (**AC**)
- To create a composite core, a numeric value (0-3) was assigned to each code: AC=3, AI=2, IC=2, II=1, AB=0.

### Data Analysis

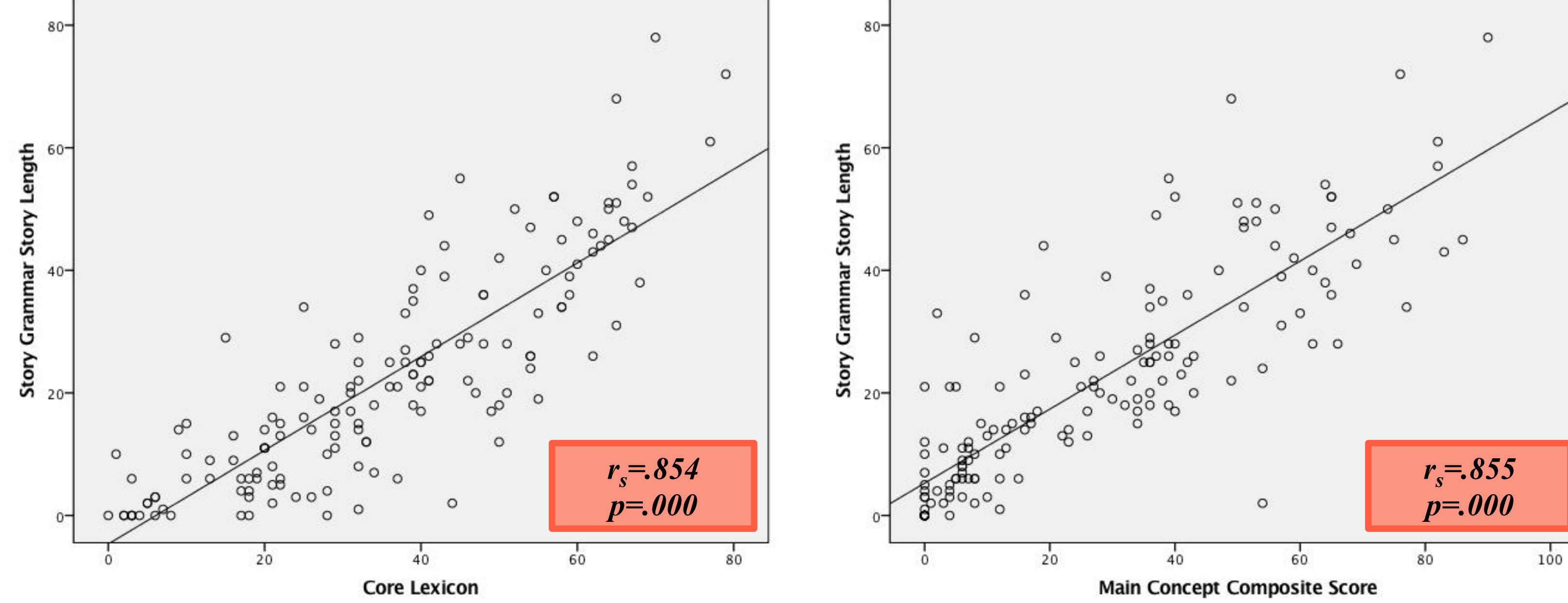
- Aim 1: Omnibus median tests for each story grammar code and for story length. Planned comparisons (median tests, Holm-Bonferroni corrected for 21 comparisons).
- Aim 2: Spearman’s Rank Order Correlation (rho) (one-tailed)

## Results

Figure 1. Differences in Average Story Component Production by Group



Table 3. Median Test Pairwise Results for Story Grammar Components



- Omnibus median tests revealed differences in group medians for Story Length and for all story grammar components except for “Plan” and “Reaction”.
- Pairwise median tests for Story Length revealed significant differences ( $p < .002$ ) between: 1) NBI controls and all aphasia subtypes except for anomic; and 2) Broca and both NABW and anomic.
- Significant results for pairwise median tests for each story grammar component are shown in Figure 1 and Table 3 (but see supplementary materials for uncorrected comparison significance values).
  - Consistent differences between NBIs and most aphasia subtypes. No differences between conduction and Wernicke’s subtypes, or between Broca’s and Wernicke’s subtypes. No observed differences between anomic subtype versus NBIs or NABW subtype.
- “Very strong” correlations (Figures 2 and 3) between Story Length (a sum of all recognizable completed or attempted story grammar components) and both CoreLex (typical vocabulary usage) and MCA (sharing of “gist” accurately and completely).