



Development of Clinician-Friendly Discourse Analysis Tools: Main Concept Analysis

Sarah Grace Hudspeth, Sarah Campbell, Nicole Williams, Emily Dillow, Jessica D. Richardson
Neuroscience of Rehabilitation Laboratory, Department of Communication Sciences and Disorders
University of South Carolina, USA



Background

- Discourse is a highly individualized and complex speech act essential for effective communication in daily life.
- Individuals with language disorders demonstrate impaired narrative ability and a resultant decline in functional communication.¹
- While current discourse measures have standardized instructions, norm-referenced discourse measures are lacking, making it difficult for clinicians to quantify how differently a client is performing compared to his/her peers.
- Main Concept Analysis has been established as a reliable and valid method of assessing narrative adequacy.²
- In previous main concept research, investigators determined which main concepts they considered to be central to successful retell of a story or picture sequence. No studies to date have generated lists based on narratives of control speakers.
- The authors' experience while completing the study, as well as peer-reviewed research, has suggested potential age-related differences in narrative quality,³ warranting further investigation. In addition to age-related differences, we also examined differences in sex and years of education.
- Standardized main concept lists for three narrative tasks involving different types of discourse may allow clinicians to quickly gain insight into patients' functional communication.
 - The *Cinderella* story was selected as an example of story retell.
 - Breaking Window* was selected as an example of sequential picture description.
 - PB&J* was selected as an example of procedural discourse.

Methods

- Database:**
- Transcripts of control participants were retrieved from the **AphasiaBank** database, which is available to researchers working with PWAs.
 - Individuals were divided into four age bins: 20-40 (Young); 41-60 (Middle); 61-80 (Old); and 81 and older (Oldest).
 - Demographics for the three tasks are reported below.
 - Breaking Window: N = 153 (Young = 21; Middle = 24; Old = 74; Oldest = 27)
 - PB&J: N = 152 (Young=19; Middle=27; Old=72; Oldest=27)
 - Cinderella: N = 158 (Young=21; Middle=30; Old=75; Oldest=27)
- Relevant Concepts (RCs):**
- Relevant concepts are defined as correct utterances about the story that contained a subject, one main verb, and object (if appropriate).
 - May contain subordinate clauses, but must contain ONLY ONE MAIN verb.²
 - A master list of all relevant concepts was developed for each age group for the three stories.
 - All concepts were simplified to S-V-O form for ease of comparison across participants.
 - Each participant's transcript was analyzed. Every RC identified resulted in an additional point for the participant and for the concept. As new concepts were identified, they were added to the list.
 - To examine age-related differences, a median test was conducted by age group for each story on the number of RCs spoken by participants
- Main Concepts (MC):**
- Relevant concepts spoken by 50% or more of individuals in an age group qualified as a Main Concept.
 - After identifying Main Concepts, all normal language transcripts were scored according to the guidelines published by Nicholas and Brookshire.² The possible scores are:
 - Absent (AB): The participant did not produce any portion of the MC
 - Inaccurate/Incomplete (II): The participant attempted to produce a portion of the MC, but it was missing at least one essential element and another essential element was incorrect.
 - Inaccurate/Complete (IC): The participant produced a complete MC, but at least one essential element was inaccurate.
 - Accurate/Incomplete (AI): The participant produced an accurate MC, but at least one essential element was missing.
 - Accurate/Complete (AC): The participant produced all essential elements, and all essential elements were correct.
 - After scoring was completed, scores were converted to a numeric composite score with AB = 0, II = 1, IC = 2, AI = 2, AC = 3
 - To examine potential differences by sex and years of education, proportion scores were calculated using the composite scores for each age group.

Results

- Relevant Concepts:**
- The total number of RCs spoken for each age group for each story are below:
 - Cinderella: 309, 387, 585, and 237, from Young to Oldest.
 - Breaking Window: 32, 33, 45, and 32, from Young to Oldest
 - PB&J: 35, 58, 199, and 59, from Young to Oldest
 - A median test was completed to investigate differences in age groups.
 - Results revealed a significant difference between the Middle and Oldest and Oldest and Oldest age groups for Cinderella story only ($\chi^2=10.884, p=.001$ and $\chi^2=8.414, p=.004$, respectively)(See Fig. 1).
- Main Concepts:**
- Cinderella and PB&J stories had different MC lists across all ages.
 - Breaking Window story had a different MC list for the Oldest group only.
 - A median test was completed using the proportion scores for sex and education.
 - Significant differences by sex were found only for Cinderella ($\chi^2=4.802, p=.028$).
 - No differences were found for any story based on years of education. ($p=.764, .259$, and .953).

Table 1. List of Main Concepts for each story. *Superscript letters after each Main Concept indicate the age groups in which at least 50% of individuals produced the concept. (Y: 20-40; M: 41-60; O: 61-80; O+: 81+). Color-coded italicized text is essential information, while words in black are frequently spoken but non-essential elements.

Main Concepts for Cinderella

- Dad remarried a woman with two daughters.*^(Y, M, O, O+)
- Cinderella lives with stepmother and/or stepsisters.*^(Y)
- Stepmother and/or stepsisters were mean to Cinderella.*^(Y, M)
- Cinderella was a servant to the stepmother and stepsisters.*^(Y, M)
- Cinderella has to do all the housework.*^(Y, M, O, O+)
- The king thinks the prince should get married.*^(Y)
- King announces there is going to be a ball in honor of son who needs to find wife.*^(Y, M, O, O+)
- They got an invitation to the ball.*^(Y, M)
- They are excited about the ball.*^(Y)
- Cinderella is told by the stepmother she cannot go to the ball unless/because/ until (insert reason).*^(Y, M, O)
- The animals help her make a dress.*^(Y)
- The stepsisters tore her dress.*^(Y, M)
- Stepmother and/or stepsisters went to the ball.*^(Y)
- Cinderella was upset.*^(Y, M)
- A fairy godmother appeared to Cinderella.*^(Y, M, O, O+)
- The fairy godmother makes [item(s)] turn in to [item(s)].*^(Y, M, O)
- The fairy godmother makes Cinderella a beautiful princess.*^(Y, M, O, O+)
- Cinderella went to the ball in the coach.*^(Y, M, O, O+)
- She knew she had to be home by midnight because everything will turn back at midnight.*^(Y, M, O, O+)
- Prince falls in love with Cinderella.*^(M, O)
- The prince and Cinderella danced around the room.*^(Y, M, O)
- Cinderella realized it is midnight.*^(Y, M, O)
- She ran down the stairs.*^(Y, M, O, O+)
- As she is running down the stairs she lost one of the glass slippers.*^(Y, M, O, O+)
- Everything turns back to its original form.*^(Y, M)
- Prince finds Cinderella's shoe.*^(O+)
- She returned home in time.*^(Y, O)
- The prince searched door to door for Cinderella.*^(Y, M, O, O+)
- Prince comes to Cinderella's house.*^(Y, M, O)
- The stepsisters try on the glass slipper.*^(M, O)
- The slipper didn't fit the stepsisters.*^(M, O)
- He put the slipper on Cinderella's foot.*^(M, O)
- The slipper fits Cinderella perfectly.*^(Y, M, O, O+)
- Cinderella and the prince were married.*^(Y, M)
- Cinderella and the prince lived happily ever after.*^(Y, M, O, O+)

Main Concepts for Breaking Window

- The boy was outside.*^(Y, M, O, O+)
He was playing soccer.^(Y, M, O, O+)
The ball breaks the neighbor's window.^(Y, M, O, O+)
The man is sitting in a chair (and/or inside the house).^(Y, M, O, O+)
The ball hits the man.^(O+)
The ball broke a lamp.^(Y, M, O)
The man picked up the ball.^(Y, M, O, O+)
The man looked out of the window.^(Y, M, O, O+)

Main Concepts for PB&J

- Get bread from (location)*^(M)
- Get two slices of bread.*^(Y, M, O, O+)
- Get the peanut butter.*^(Y, M, O, O+)
- Get the jelly.*^(Y, M, O)
- Get a knife.*^(Y, M)
- Put peanut butter on bread.*^(Y, M, O, O+)
- Put jelly on bread.*^(Y, M, O, O+)
- Put the two pieces together.*^(Y, M, O, O+)

Figure 1. A) Total Relevant Concepts, B) Median Relevant Concepts, and C) Total Main Concepts for each story by Age Group.

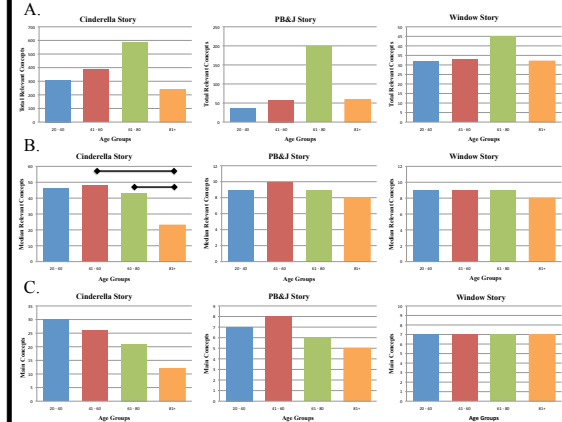


Table 2. Proportion of each Nicholas and Brookshire score by age for all stories

	CINDERELLA				PB&J				BREAKING WINDOW			
	20-40	41-60	61-80	81+	20-40	41-60	61-80	81+	20-40	41-60	61-80	81+
AB	.3	.269	.333	.333	.143	.375	.333	.2	.143	.143	.286	.286
II	0	0	0	0	0	0	0	0	0	0	0	0
AI/IC	.033	.019	0	0	0	0	0	0	0	0	0	0
AC	.633	.692	.667	.667	.857	.625	.667	.8	.857	.857	.714	.714

Results (Cont.)

The data in Table 2 show a general trend for proportionally more scores of AC received by the younger age groups, which steadily decreases as age increases. The reverse trend is also true, with proportionally more scores of AB received by the older age groups, and steadily decreasing as age decreases.

Discussion

- Although there were only two significant differences in the median number of relevant concepts spoken across age groups, our analysis showed that there are important age-related differences in the content produced for each task.
- The difference found between males and females in retelling the Cinderella story indicates there may be an inherent gender bias, with females having greater knowledge and familiarity with the Cinderella story.
 - Future studies should explore the use of a gender neutral story to eliminate bias.
- The discourse of older individuals may be less coherent and cohesive as demonstrated by a trend of more AB scores for older age groups (although it has not been determined if there is a statistically significant difference).
- We have established a set of standardized and normed results for three discourse tasks that clinicians can use to quickly evaluate a client's speech and compare to same age peers.
- The generated MC lists could serve as a clinically useful non-transcription-based checklist for narrative assessment when Cinderella, Breaking Window, or PB&J stories are elicited according to AphasiaBank protocols.

Future Directions

- Analyze narratives of speakers with aphasia and TBI using generated MC lists.
- Correlate number of MCs produced to listener ratings of narrative adequacy to establish functional relevance.
- Develop an automatized MC analysis tool within Computerized Language Analysis (CLAN).
- The potential for even more efficient discourse measurements, such as core lexicon production, will also be investigated.

References:
1. Webster, J., Franklin, S., & Howard, D. (2007). An analysis of thematic and phrasal structure in people with aphasia: What more can we learn from the story of Cinderella? *Journal of Neurolinguistics*, 23(5), 363-394.
2. 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.
3. Caplan, G., Wright, J.H., Vagovich, S.A. (2005). CUE and main event analyses of the structured discourse of older and younger adults. *Journal of Communication Disorders*, 38 (6), 431-444.