Cognitive Correlates of Storytelling in Severe TBI

Serena Jaskolka
University of New Hampshire, Department of Communication Sciences & Disorders
Correspondence email: Serena.Jaskolka@unh.edu
Mentor: Kathryn J. Greenslade, PhD, CCC-SLP, Director of the Social Communication Intervention & Assessment Lab (SoCIALab)

Introduction

- Narrative discourse, or storytelling, is an essential part of communicating socially. Impaired narration impacts the ability to share information, in turn affecting quality of life.
- Difficulty with narrative discourse is common in people with traumatic brain injury (TBI).[4,8,11]
- Story Grammar[13] (SG) is a framework used to organize Western narratives, consisting of:
  - **Setting**: introduction of character, place, time
  - One or more **Episodes**, each having:
    - **Initiating event (IE):** an event that drives the main character to take action
    - **Attempt (A):** the main character's plan or actions in response to the initiating event
    - **Direct Consequence (DC):** the result of the main character's attempt
    - **Mental States (MS)**: characters' thoughts/ feelings
  - **Conclusion**: events that end the story
- Previous TBI research on narrative analyses has:
  - addressed narrative length[5,11], completeness of content[11], & local/global coherence[8]
  - demonstrated relationships between these measures & deficits in executive functions (EF) & declarative memory[8,10]
- Minimal TBI research addresses:
  - Cognitive correlates of SG measures, which likely rely heavily on EF & declarative memory
  - Predictive relationships between deficits in narrative discourse, EF, & declarative memory.
- A better understanding of these relationships & their persistence would allow for more effective evaluation & treatment in adults with TBI.

Research Questions

- Do SG measures related to story length, elaboration, & completeness at 6- & 12-months post-TBI correlate with EF, declarative memory, & pragmatic function at 6- & 12-months post-TBI?
- Are correlations concurrent and/or predictive between timepoints?

Participants

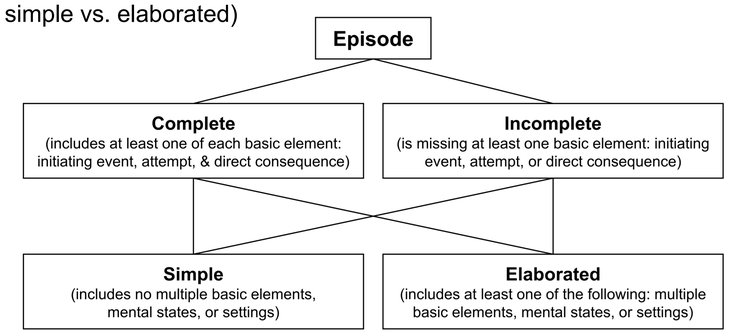
De-identified 6- and 12-month data from the Togher Corpus was obtained through TBIBank, an online, password-protected database.[1]

	Sex	Age (years)	Years of Education	GCS Score	Length of PTA	Primary Language
6-months post-TBI (*n* = 48)	41 Male, 7 Female	34.92	14.46	6.83	49.83	42 English 6 Other
12-months post-TBI (*n* = 44)	35 Male, 9 Female	36.16	14.43	6.66	55.66	40 English 4 Other

Note: GCS: Glascow Coma Scale, PTA: post-traumatic amnesia

Methods

Step 1: Divide narratives into propositions (verb phrase/predicator or relational word + related arguments)[12]
Step 2: Assign story grammar codes (setting, IE, A, DC, MS, conclusion)
Step 3: Assign episode number and type (complete vs. incomplete, simple vs. elaborated)



Example A

40she meets the prince .	IE
41they dance all night	A
and have a lovely night .	DC

Example B

101 and &-um they're all getting excited	MS/A
because they're going to the ball .	MS/IE
103 and &-um she is not allowed to go to the ball by the stepmother .	DC

Inter-rater reliability > 80% for story grammar coding.

Example C

144 they don't seem to recognize her as their sister .	MS/S
145 because she's done up now .	S
146 she's got a lovely white dress .	S
147 she's got glass slippers on .	S
148 <she's a> [/] she's a very fine lady .	S
149 she's introduced as royalty from another jurisdiction .	S

Example D

33and on the way she met &-uh (.) a lady	IE
that (.) changed her dress 34 and outfit .	A

Results

		6-months				12-months			
		Number of SG elements	Number of episodes	Number of EC episodes	Number of SG elements per episode	Number of SG elements	Number of episodes	Number of EC episodes	Number of SG elements per episode
6-months	EF	Task 2 Accuracy*; Task 4 Accuracy**; Total Rationale**	Total Reasoning Sub-Skills*	Task 4 Accuracy*	Task 4 Accuracy*; Total Rationale**; Total Reasoning Sub-Skills**	Task 4 Accuracy**; Total Rationale*	Task 2 Accuracy**; Total Accuracy*	N/A	Task 4 Accuracy*; Total Rationale*
	Declarative memory	HVLT-R**; BVMT-R**	HVLT-R**; BVMT-R*	HVLT-R*; BVMT-R**	N/A	HVLT-R*; BVMT-R*	HVLT-R**; BVMT-R**	HVLT-R; BVMT-R*	N/A
	Pragmatic function	LCQ Other**	LCQ Other**	N/A	N/A	N/A	LCQ Other**	LCQ Other*	N/A
12-months	EF	Task 2 Accuracy**; Task 4 Accuracy*; Task 4 Rationale*; Total Rationale**;	Task 2 Accuracy**; Task 4 Accuracy**; Total Accuracy*	Task 2 Accuracy; Task 4 Accuracy*; Task 2 Rationale**	Task 2 Accuracy*	Task 2 accuracy**; Task 4 Accuracy**; Task 4 Rationale*, Total Rationale*	Task 2 Accuracy*; Task 4 Accuracy**; Total Reasoning Sub-Skills*	Task 2 Accuracy*; Task 4 Accuracy*; Total Reasoning Sub-Skills*	Task 2 Accuracy*; Task 4 Accuracy*
	Declarative memory	HVLT-R**; BVMT-R**	HVLT-R**; BVMT-R*	HVLT-R**; BVMT-R*	N/A	HVLT-R**; BVMT-R**	HVLT-R**; BVMT-R**	HVLT-R**; BVMT-R*	N/A
	Pragmatic function	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

* $p < .05$ (2-tailed), ** $p \leq 0.01$ (2-tailed)

Discussion

- Concurrent and predictive relationships were found between the FAVRES[7] Task 2 and 4 Accuracy scores and narrative impairments post-TBI, suggesting performance across tasks relies on similar planning and organizational abilities.
- Declarative memory as measured by the HVLT-R[1] and BVMT-R[2] was significantly correlated with and predictive of an individual's ability to produce a longer and more elaborated narrative.
- Relationships between pragmatic function and narrative impairments post-TBI were less informative in explaining narrative deficits than EF or declarative memory, potentially due to the broad range of abilities assessed by the LCQ.[3]
- These results support and extend existing findings[8,10] by documenting the impact of persisting deficits in EF and declarative memory post-TBI on discourse level language.

Future Directions

- Analyze these relationships at different timepoints to see if they are consistent (e.g., 3-, 9-, & 24-months post-TBI).
- Compare macrolinguistic narrative performance to other measures of pragmatic function, such as a subset of items from the LCQ, or The Awareness of Social Inference Test.[8]

Conclusion

Current findings support the use of macrolinguistic narrative (story grammar) measures to capture the functional impact of persisting EF & declarative memory impairments in clients with severe TBI. This may increase the efficiency & effectiveness of assessment & treatment, thus, improving communicative participation & quality of life in this population.

Acknowledgements

We would like to thank Melanie Pond for her work in creating the traditional story grammar analysis approach used for this research, & Melissa Higginson for her expert coding & assistance in creating the database used for this research. We also wish to thank the creators of TalkBank, the Togher lab, and the participants in the Togher corpus, without whom this work would not have been possible.

References

1. Brant, J., & Benedict, R. H. B. (197). *Hopkins Verbal Learning Test – Revised*. Psychological Assessment Resources, Inc.
2. Benedict, R. H. B. (1997). *Brief Visuospatial Memory Test – Revised*. Psychological Assessment Resources, Inc.
3. Douglas, J. M., Flaherty, C. A., & Snow, P. C. (2000). Measuring perception of communicative ability: the development and evaluation of the La Trobe Communication Questionnaire. *Aphasiology*, *14*(3), 251-268
4. Elbourn, E., Kenny, B., Power, E., Honan, C., McDonald, S., Tate, R., Holland, A., MacWhinney, B., & Togher, L. (2019). Discourse recovery after severe traumatic brain Injury: exploring the first year. *Brain Injury, 33*(2), 143-159.
5. Hartley, L. L., & Jensen, P. J. (1991). Narrative and procedural discourse after closed head injury. *Brain Injury*, *5*(3), 267-285.
6. Lê, K., Coelho, C., Mozeiko, J., Krueger, F., & Grafman, J. (2014). Does brain volume loss predict cognitive and narrative discourse performance following traumatic brain injury? *American Journal of Speech-Language Pathology*, *23*(2), S271-S284.
7. Macdonald, S. (2005). *Functional Assessment of Verbal Reasoning and Executive Strategies* (*FAVRES*). CCD Publishing.
8. Marini, A., Zettin, M., & Galetto, V. (2014) Cognitive correlates of narrative impairment in moderate traumatic brain injury. *Neuropsychologia*, *64*, 282-288.
9. McDonald, S., Flanagan, S., Rollins, J., & Kinch, J. (2003). A new clinical tool for assessing social perception after traumatic brain injury. *Journal of Head Trauma Rehabilitation, 18*(3), 219-238.
10. Mozeiko, J., Le, K., Coelho, C., Krueger, F., & Grafman, J. (2011). The relationship of story grammar and executive function following TBI. *Aphasiology, 25*(6-7), 826-835.
11. Norman, R. S., Mueller, K. D., Huerta, P., Shah, M. N., Turkstra, L. S., & Power, E. (2022). Discourse performance in adults with mild traumatic brain injury, orthopedic injuries, and moderate to severe traumatic brain injury, and healthy controls. *American Journal of Speech-Language Pathology*, *31*(1), 67-83.
12. Roth, F. P., & Spekman, N. J. (1976). Narrative discourse: Spontaneously generated stories of learning-disabled and normally achieving students. *Journal of Speech and Hearing Disorders, 51*(1), 8-23.
13. Stein, N. L., & Glenn, C. G. (1979). An analysis of story comprehension in elementary school children. In R. O. Freedle (Ed.), *New directions in discourse processing* (pp. 53-120). Ablex.