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Introduction

Eliciting connected speech is useful for capturing many aspects of an individual's language abilities (Gordon, 2006; Nicholas & Brookshire, 1993; Rochon et al., 2000; Saffran et al., 1989). Common connected speech elicitation methods include description of pictured scenes (e.g., the Western Aphasia Battery's picnic picture; Kertesz, 2007) and storytelling (e.g., the Cinderella Story). In comparison to picture description, storytelling elicits more content and more lexically diverse speech in speakers with chronic aphasia (Alyahya et al., 2020; Stark et al., 2019). However, it is unknown how these two methods compare in measuring structural and syntactic aspects of connected speech. Here, we compared picture description and storytelling in a large group of participants following acute left hemisphere stroke. We tested the degree of agreement and consistency across elicitation methods for structural, syntactic, and lexical measures of connected speech, as well as the degree of concordance in classifying deficits across individuals.

Methods

71 native-English speaking participants (59 ± 13 years; 25 female) completed picnic picture description and Cinderella storytelling within an average 3.9 days from left hemisphere stroke onset. We transcribed speech samples, segmented, and morphologically parsed utterances following published procedures (cf. Fromm et al., 2021). We extracted 12 structural, syntactic, and lexical measures of connected speech (Ding et al., 2020; see Table 1) using a semi-automated quantitative production analysis procedure (C-QPA) via CLAN (Fromm et al., 2021). We conducted paired *t*-tests and correlations to assess method agreement across C-QPA measures and consistency across participants. We conducted χ^2 tests of independence to test if the number of participants classified as impaired (< -2 SDs from controls (n=13)) was significantly different across methods. We corrected for multiple comparisons ($\alpha = 0.004$) and removed outliers.

Results

Regarding agreement, storytelling elicited significantly larger values in comparison to picture description for all C-QPA measures (*t*'s > 3.86; *p*'s < .0002) save one (proportion closed-class words produced; *t*=2.73; *p*=.008). Regarding consistency, only variables related to structural complexity correlated across participants and methods (5/12 variables; *r*'s > 0.37, *p*'s < .0018; non-significant correlations *r*'s < 0.12; *p*'s > 0.18; see Figure 1). However, methods classified the same individuals as impaired on 67% of measures (8/12;

χ^2's < 7.16, p's > .0075; inconsistent classifications χ^2's > 8.60, *p*'s < .0034). See Table 1 for summary.

Summary & Conclusions

Storytelling elicited significantly more structurally complex, syntactically accurate, and increased and more lexically diverse speech output in comparison to picture description. Methods were inconsistent across individuals in measuring lexical selection and syntactic accuracy, but generally consistent classifying individuals as impaired or spared, save for some structural and syntactic measures. We conclude that storytelling is the better measure to elicit connected speech for analyses of individual differences across patients. However, when assessing whether an individual has impaired or spared connected speech, either elicitation method will be generally sufficient, but take care when assessing syntactic accuracy.

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References

Alyahya, R. S. W., Halai, A. D., Conroy, P., & Lambon Ralph, M. A. (2020). A unified model of post-stroke language deficits including discourse production and their neural correlates. *Brain*, *143*(5), 1541–1554. https://doi.org/10.1093/brain/awaa074

Ding, J., Martin, R. C., Hamilton, A. C., & Schnur, T. T. (2020). Dissociation between frontal and temporal-parietal contributions to connected speech in acute stroke. *Brain*, *143*(3), 862–876. https://doi.org/10.1093/brain/awaa027

Fromm, D., Katta, S., Paccione, M., Hecht, S., Greenhouse, J., MacWhinney, B., & Schnur, T. T. (2021). A comparison of manual versus automated quantitative production analysis of connected speech. *Journal of Speech, Language, and Hearing Research*, *64*(4), 1271–1282. https://doi.org/10.1044/2020_JSLHR-20-00561

Gordon, J. K. (2006). A quantitative production analysis of picture description. *Aphasiology*, *20*(2–4), 188–204. https://doi.org/10.1080/02687030500472777

Kertesz, A. (1982). *The Western aphasia battery test manual*. Grune and Stratton, New York.

Nicholas, L. E., & Brookshire, R. H. (1993). A system for quantifying the informativeness and efficiency of the connected speech of adults with aphasia. *Journal of Speech, Language, and Hearing Research*, *36*(2), 338–350. https://doi.org/10.1044/jshr.3602.338

Rochon, E., Saffran, E. M., Berndt, R. S., & Schwartz, M. F. (2000). Quantitative analysis of aphasic sentence production: Further development and new data. *Brain and Language*, *72*(3), 193–218. https://doi.org/10.1006/brln.1999.2285

Saffran, E. M., Berndt, R. S., & Schwartz, M. F. (1989). The quantitative analysis of agrammatic production: Procedure and data. *Brain and Language*, *37*(3), 440–479. https://doi.org/10.1016/0093-934X(89)90030-8

Stark, B. C. (2019). A comparison of three discourse elicitation methods in aphasia and age-matched adults: Implications for Language Assessment and Outcome. *American Journal of Speech-Language Pathology*, *28*(3), 1067–1083. https://doi.org/10.1044/2019_AJSLP-18-0265

Table 1. Connected speech C-QPA variable definitions and results comparing storytelling and picture description elicitation methods. An '*' indicates disagreement at the group level (t's > 3.86; p's < .0002), inconsistency across participants (r's < .12; p's > .18), and inconsistent participant deficit classification (χ^2's > 8.60, p's < .003). Definitions adapted from "Dissociation between frontal and temporal-parietal contributions to connected speech in acute stroke" by J. Ding, R.C. Martin, A.C. Hamilton, & T.T. Schnur, 2020, *Brain*, *143(3)*, 862-876.

Connected Speech C-QPA Variables	Definition	Disagreement	Inconsistency	Inconsistent Deficit Classification
Structural complexity				
Mean utterance length	# words in utterances / # utterances	*		*
Mean sentence length	# words in utterances / # sentences	*		
Sentence elaboration	Subject noun phrase + verb phrase elaboration	*		
Embedding index	# embeddings / # sentences	*		*
Narrative words	# words directly contributing to narrative	*		
Lexical selection				
Proportion pronouns	# pronouns/ (# nouns + pronouns)		*	
Proportion verbs	# verbs / (# nouns + verbs)	*	*	
Proportion closed-class words	# closed-class words / # narrative words	*	*	
Syntactic accuracy				
Proportion well-formed sentences	# syntactically well-formed sentences / # sentences	*	*	
Proportion words in sentences	# words in sentences / # narrative words	*	*	*

Determiner index	# nouns requiring determiners, with determiners / # nouns requiring determiners	*	*	*
Auxiliary complexity	(Auxiliary score / # matrix verbs) − 1	*	*	

Figure 1 Scatterplots demonstrate the relationship between storytelling and picture description participant scores for each of 12 C-QPA variables.