Formulaic Language in Spontaneous Speech as a Marker of Fluency in Post-Stroke Aphasia

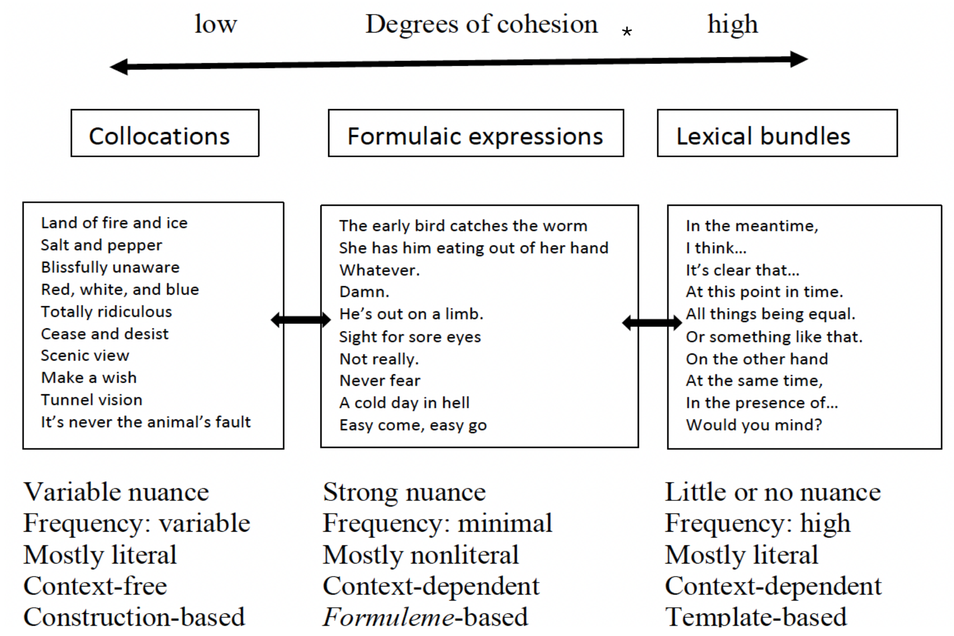
Cathy Torrington Eaton and Sarah Thomas Papermaster
University of Texas Health San Antonio, Texas, USA

INTRODUCTION

- Formulaic – or non-propositional – language (FL) is under-explored area of research with potential for clinical translation in assessment and rehabilitation
  - Quantitative and qualitative results suggest significant differences in FL usage across clinical post-stroke aphasia subtypes[1].
  - Studies have shown mixed effectiveness in using FL therapeutically.
- To date, studies in FL lack a theoretical framework, which is needed to advance systematic research efforts.

Purpose: To test the utility of a proposed theoretic model (**Figure 1**) using spontaneous language of individuals with post-stroke aphasia.

Figure 1. Formulaic Language Model, Van Lancker Sidtis[2]



METHODS

- Retrospective analysis of FL items extracted from language samples of 144 individuals with post-stroke aphasia from AphasiaBank[3-5].
  - n = 77 Broca's, 77 anomic, 43 conduction, 22 Wernicke's aphasia
- Each FL item was coded according to 6 variables from the FL model (**Table 1**; *cohesion excluded).
- Independent variables: Psycholinguistic variables, pt demographic variables (i.e., age, gender, education), motor speech ability (+/- dysarthria, +/- AOS).
- Dependent variables: WAB-R AQ[6], WAB fluency score (1-10), and WAB fluency (fluent aphasia ≥5 on WAB-R fluency score, non-fluent <5).

Table 1. Coding rubric for FL psycholinguistic variables

	Syntactic completeness	Context boundedness	Nuance	Literality	Frequency ($COCA^X$ value)	Length (# of words)
1	Incomplete utterance, spans phrasal boundaries	independent of context	None; purely grammatical constructions, such as items that convey time or location	literal	-	-
2	Complete noun, verb or prepositional phrase, but dependent	specific to listener OR setting OR situation	Minimal to moderate nuance (between 1 - 3)	nonliteral	-	-
3	complete utterance and/or able to stand alone	-	Strong nuance, swear words or utterances that convey emotion or attitude	-	-	-

RESULTS & DISCUSSION

Figure 2. Differences in psycholinguistic characteristics across WAB-R subtypes

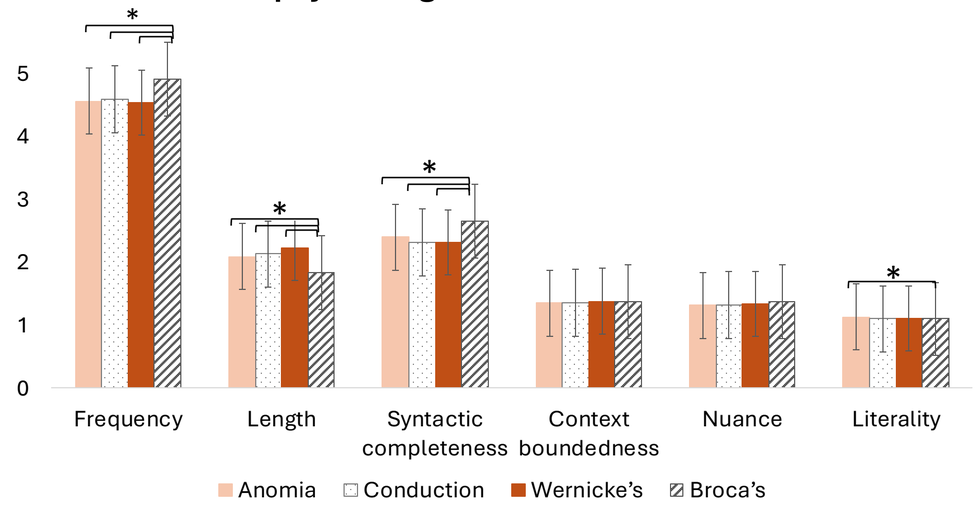


Table 2. Best-fitting regression model predicting fluent vs. nonfluent aphasia

					95% Confidence intervals	
	B	SE	Sig	Exp(B)	Lower	Upper
Constant	16.609	3.539	<.001	16335968.9		
AOS	.997	.368	.007	2.711	1.319	5.574
Frequency	-2.483	.692	<.001	0.84	.022	.324
Syntactic completeness	-2.584	.725	<.001	.075	.018	.313

Results

- Findings demonstrated statistically significant between-group differences in specific psycholinguistic characteristics of FL (frequency, number of words, syntactic completeness, literality) produced in spontaneous speech samples according to WAB-R subtype (**Figure 2**).
- The logistic regression model demonstrated that fluency was predicted by 3 variables – frequency and syntactic completeness of FL items, and presence of AOS (**Table 2**).
  - Classification accuracy: fluent = 85.6%; non-fluent = 69.2%

Discussion

- This project validates the utility of the proposed FL model for individuals with post-stroke aphasia.
- Characterizing FL in spontaneous speech can be used as a marker of fluency status.
- With further research, FL analyses can potentially be added in language analyses for patients with post-stroke aphasia to increase the efficiency of assessment practices[7].

SELECTED REFERENCES

[1]Zimmerer, V.C., Newman, L., Thomson, R. Coleman, M., & Varley, R.A. (2018). Automated analysis of language production in aphasia and right-hemisphere damage: Frequency and collocation strength. *Aphasiology, 32*(11), 1267-1283. https://doi.org/10.1080/02687038.2018.1497138

[2]Van Lancker Sidtis, D. (2018). Familiar phrases in language competence: Linguistics, psychological, and neurological observations that support a dual process model of language. In A. Haselow, K. Gunther (Eds.), *Grammar and cognition: Dualistic models of language structure and language processing* (pp. 29-57). John Benjamins Publishing Company.

[3]Torrington Eaton, C., & Burrowes, L. (2021). Comparing patterns of familiar language use across spontaneous speech contexts in individuals with nonfluent aphasia and healthy controls. *Aphasiology*, *36*(12), 1399-1418.

[4]Torrington Eaton, C., & Thomas, S. (2023). To make a long story short: A descriptive study of formulaic language use in post-stroke fluent aphasia. *Aphasiology*. https://doi.org/10.1080/02687038.2023.2265101

[5]MacWhinney, B., Fromm, D., Forbes, M., & Holland, A. (2011). AphasiaBank: Methods for studying discourse. *Aphasiology, 25*(11), 1286-1307. https://doi.org/10.1080/02687038.2011.589893

[6]Kertesz, A. (2006). *Western Aphasia Battery--Revised (WAB-R)* [Database record]. APA PsycTests. https://doi.org/10.1037/t15168-000

[7]Dalton, S.G., Hubbarb, H.I., & Richardson, J.D. (2020). Moving toward non-transcription based discourse analysis in stable and progressive aphasia. Davies, Mark (n.d.). *The Corpus of Contemporary American English (COCA).* https://www.english.corpora.org/coca/