



**INTRODUCTION**

- Hand gestures and body movements are considered a communicative modality (McNeill, 1992)
- Persons With Aphasia (PWA) produce gestures despite inherent language deficits (Goodwin, 2000)
  - **Anomic:** Issues with Lexical Retrieval
  - **Broca's:** Issues with Syntactic Production
  - **Wernicke's:** Issues with comprehension and semantic processing
- Gesture has been associated with the facilitation of cognition and language, especially in the lexical retrieval in typical and PWA populations (e.g., Kelly et al., 2009; Rose & Douglas, 2001)
- A previous study has shown positive correlations between micro- and macro-linguistic difficulties for Anomic PWAs (Andreetta et al., 2012)
- Beat vs. Non-beat (i.e., representational) gestures, semantic content may be linked to improved content, by recruiting more cortical networks (Goldin-Meadow et al., 2001)
- Current studies don't look at types of gesture and their connection to both micro- and macro-linguistic production in *narrative discourse* tasks

**CURRENT QUESTIONS**

- Can gesture content and frequency predict increased narrative discourse production?
- Is there any difference in narrative productivity between beat and non-beat gestures (i.e., representations)?

**METHODS**

- **Participants:**
  - 45 PWA language data was used to represent 3 different PWA groups, and 15 healthy controls (i.e., 60 total). All groups were age and gender matched (9 male per group), and PWAs were diagnosed via Western Aphasia Battery (WAB; Kertesz, 1982)
    - 15 Anomic (Mean age = 66.0 Years; Range 41.4 – 83.2)
    - 15 Broca's (Mean age = 63.1 Years; Range 39.0 – 80.9)
    - 15 Wernicke's (Mean age = 66.0 Years; Range 42.6 – 91.7)
    - 15 Control (Mean age = 65.8 Years; Range 41.0 – 85.1)
- **Narrative Task:**
  - Retell the Cinderella story after viewing a story book without words
  - Narratives were obtained from *AphasiaBank* (MacWhinney, 2000)



*Narrative Discourse Measures*

**Micro-linguistic Measures**

- (a) Lexical Diversity: Index Measure of the number of novel words used throughout a narrative (i.e., 0 → narratives only using 1 word; 1 → narratives where no single word is repeated)
  - Similar to conventional Type Token Ratio Measurement, but Moving Average Type Token Ratio (MATTR; Covington & McFall, 2010) accounts for differences in varying narrative lengths

(b) Story Length: # of T-Units or Matrix Clauses (Hunt, 1965)

(c) Syntactic Complexity: # of subordinated clauses within all matrix clauses (Lê et al., 2011)

	Episode Component	Definition
1	Initiating Event	A character is motivated to do a goal
	Example	<i>Cinderella wanted to go to the ball.</i>
2	Action	Done in pursuit of that goal
	Example	<i>Cinderella made a dress of rags to attend.</i>
3	Direct Consequence	Marks attainment or non-attainment of the goal
	Example	<i>Her stepmother ripped the dress apart to stop her.</i>

**Macro-linguistic Structures**

(d) Narrative Organization: # of Complete Story Episodes (Lê et al., 2011)

	Episode Component	Definition
1	Initiating Event	A character is motivated to do a goal
	Example	<i>Cinderella wanted to go to the ball.</i>
2	Action	Done in pursuit of that goal
	Example	<i>Cinderella made a dress of rags to attend.</i>
3	Direct Consequence	Marks attainment or non-attainment of the goal
	Example	<i>Her stepmother ripped the dress apart to stop her.</i>

(e) Local Coherence: Averaged measure of the relationship of a single utterance to the previous utterance (i.e., 1-5; 1 not related, 5 very related; Van Leer & Turkstra, 1999)

(f) Global Coherence: Averaged measure of a single utterance to the overall content of the narrative (i.e., 1-5; 1 not related, 5 very related; Van Leer & Turkstra, 1999)

**Gesture Analyses:**

- Classified as having a clear stroke of movement (based on McNeill, 1992)
- Gestures were rated on Beat or Non-beat via the Beat Filter (McNeill, 1992)
- This is a measurement that tracks the number of movements via visual observation (i.e., not computer motion tracking)
  - For example, simple up and down movements vs. more vibrant motions
- The filter provides a score starting from 1 (simple beat) to much higher (e.g., 6, non-beat/representational)

**Statistical Analyses:**

- Discourse measures were analyzed using a linear regression model accounting for (a) group membership (i.e., Anomic vs. Broca's vs. Wernicke's vs. Controls), (b) beat filter, and (c) gesture frequency

$$Y = B_0 (\text{Constant}) + B_1 (\text{Group}) + B_2 (\text{Averaged Beat Filter}) + B_3 (\text{Gesture Frequency}) + \text{error}$$

- These coefficients were used as the basis to predict discourse measures (i.e., *Micro* and *Macro*)

**RESULTS**

**Narrative Language Results Summary**

Group	Gesture Frequency	Microlinguistic Measures			Macro-linguistic Measures			
		MATTR	T-Units	Syntactic Complexity	Narrative Organization	Local Coherence	Global Coherence	
Anomic	Average	27.27	.980	28	7.53	2.73	3.83	3.83
	Range	0 - 117	.933 - .994	3 - 69	0 - 21	0 - 6	2.91 - 4.94	2.91 - 4.94
Broca's	Average	31.67	.978	20.74	1.8	.93	2.91	2.91
	Range	10 - 76	.962 - .990	6 - 50	0 - 11	0 - 4	2.09 - 3.73	2.09 - 3.73
Wernicke's	Average	41.87	.984	37.07	9.27	2.07	2.32	2.35
	Range	6 - 149	.964 - .993	6 - 126	0 - 38	0 - 7	1.40 - 3.69	1.50 - 3.18
Control	Average	10.94	.988	54.27	30.73	6.93	3.87	2.14
	Range	0 - 69	.972 - .993	13 - 123	3 - 90	1 - 12	2.18 - 5.00	0 - 12

**Regression Results**

	Constant	Group	Beat Filter	Gesture Frequency	R <sup>2</sup>	F	Sig
T-Units	8.707 p=.351	5.493 p=.068	2.136 p=.183	0.265 p=.022	0.174	3.928	0.013
Lexical Diversity (MATTR)	.975 p=1.18 x 10 <sup>-87</sup>	.002 p=.127	1.67 x 10 <sup>-4</sup> p=.800	7.25 x 10 <sup>-5</sup> p=.123	0.088	1.799	0.158
Syntactic Complexity	.491 p=.936	3.627 p=.066	2.067 p=.052	-.080 p=.282	0.127	2.714	0.053
Narrative Organization	2.301 p=.050	.409 p=.268	-.018 p=.926	-.004 p=.773	0.023	0.433	0.73
Local Coherence	2.924 p=1.38 x 10 <sup>-11</sup>	.053 p=.633	-.026 p=.658	-.008 p=.068	0.064	1.271	0.293
Global Coherence	4.152 p=3.55 x 10 <sup>-19</sup>	.005 p=.959	-.120 p=.027	-.008 p=.042	0.148	3.245	0.029

- Significant coefficients are in yellow (p<.05); mildly significant coefficients are in gray
- Consistent significance for most constant coefficient prediction
- Lack of *significant* (i.e., p<.05) group prediction
- Significant general gestural prediction for narrative length and macro-linguistic production

**DISCUSSION**

- Gestural predictors do not account for a large amount of the variance (i.e., R<sup>2</sup> < 20% across models)
  - Group interactions effects may play a more integral role
  - Basic model may not be strong enough to account for general language production
- Lack of Group Effects
  - Numbers may be too small to account for differences between groups
- Regression has some connections to some mild Micro-linguistic measures, and more macro-linguistic measures
  - Measurement may need more sophisticated methods rather than general visual observations (i.e., Beat Filter)
  - General observations seem to support connections to other findings (e.g. Andreetta et al., 2012)
- Regression has some significant measures to Macro-linguistic measures
  - Encouraging *may* have an effect on more macro-linguistic measures
  - Future directions may need to look at a more inclusive taxonomy or gesture type

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