Speech Deficits in Patients with Stroke Related Aphasia

Alexis Morrison[θ], Leah Rice MA[+], Sara Mohr BA[*], Aneta Kielar Ph.D.[*+^]

*Speech, Language, and Hearing Sciences, GIDP Cognitive Sciences^, University of Arizona
[+]Department of Linguistics, University of Arizona
[θ]Department of Neuroscience, University of Arizona

Introduction

What can stroke induced aphasia tell us about how language is localized in the brain?
Aphasia is the condition in which language production or comprehension is impaired, usually due to stroke in the left hemisphere perisylvian regions.

In this study we measured the language and cognitive ability of 10 stroke patients with aphasia compared to 18 healthy, aged matched controls.
- Identified stroke lesion locations and extent with MRI
- Measured language and cognitive skills
- Focused on the stroke patients ability to produce main concepts for the Cinderella story and how these correlated to scores on different cognitive tasks and the presence of various morphosyntactic features.

Methods

Participants

|	Total N	Males	Age: Mean (range)	Post Onset Time: Mean (range in yrs)	Years Educ: Mean (range)	WAB-R Bedside Aphasia %
Stroke Patients	10	8	58.7 (27-80)	6.31 (3.2-11.6)	15.8 (12-19)	71.8 (47.5-89.2)
Controls	18	6	65.3 (48-80)	N/A	16.9 (12-20)	N/A

Cognitive and Language Tests
- Participants completed a neuropsychological battery

Semantic Skills:
Camel and Cactus
PALPA 48 (Word-Picture match)
PALPA 49 (Auditory Synonym Judgment)
Verb Synonym Judgment

Past tense Inflection Task
Susan walks daily. Yesterday she ____.
John often sings. Yesterday he ____.
*Mary likes to trink. Yesterday they ____.*

JUMP
WALK   HOP
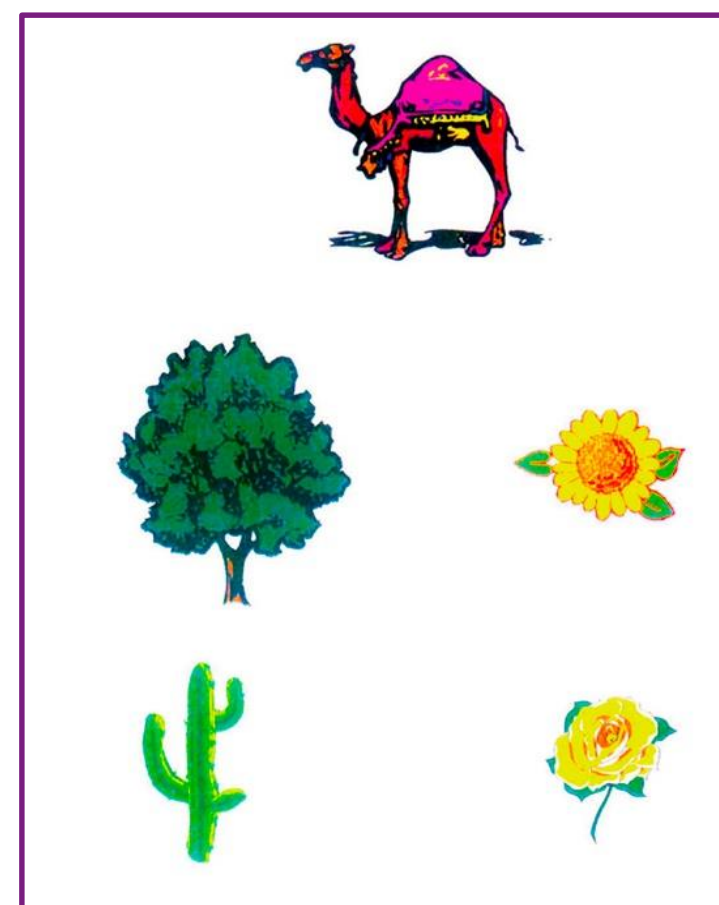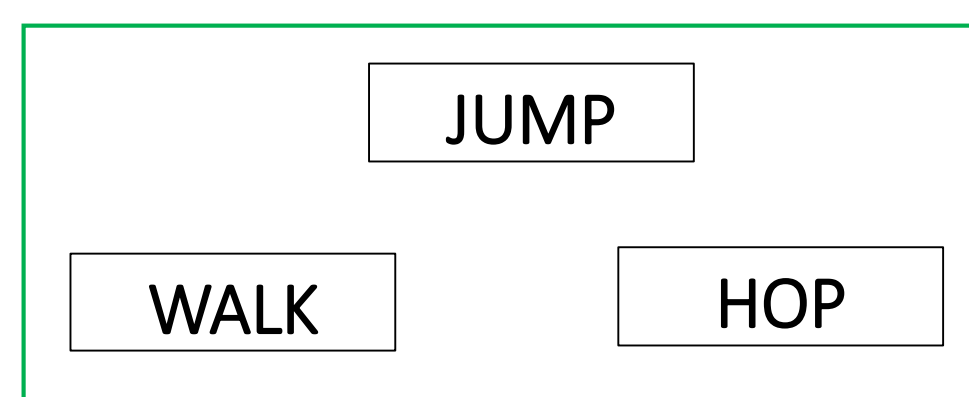
Narrative Story Collection and Analysis
- Participants told the story of Cinderella as best they could remember in as much detail as desired (*using Aphasia Bank Protocol, https://aphasia.talkbank.org/*)
- The stories were digitally recorded, transcribed, and coded for *morphology, syntax, pause length, sentence grammaticality, and errors present*
- The transcripts were analyzed for the presence, accuracy, and completeness of the **main concepts of the Cinderella Story** (Richardson and Dalton, 2015)

- [1]Cinderella [2]lives with her [3]stepmother/stepsisters.
- [1]A fairy godmother [2]appeared to Cinderella.

S (Um and then) :04 (and then the w* the uh) the (uh) fairy came (and um) :02 > [ST:WF] [SI-1] [IC]

<I> [s]	(sentence or fragment)
<II> [ss][as][e0]	(complexity)
<III> [dets][n][v]	(parts of speech)
<IV> [ired]	(tense markers)
<V> [ob1x][xs][vmi1]	(verb argument structure)

Structural MRIs were obtained to determine lesion location and extent
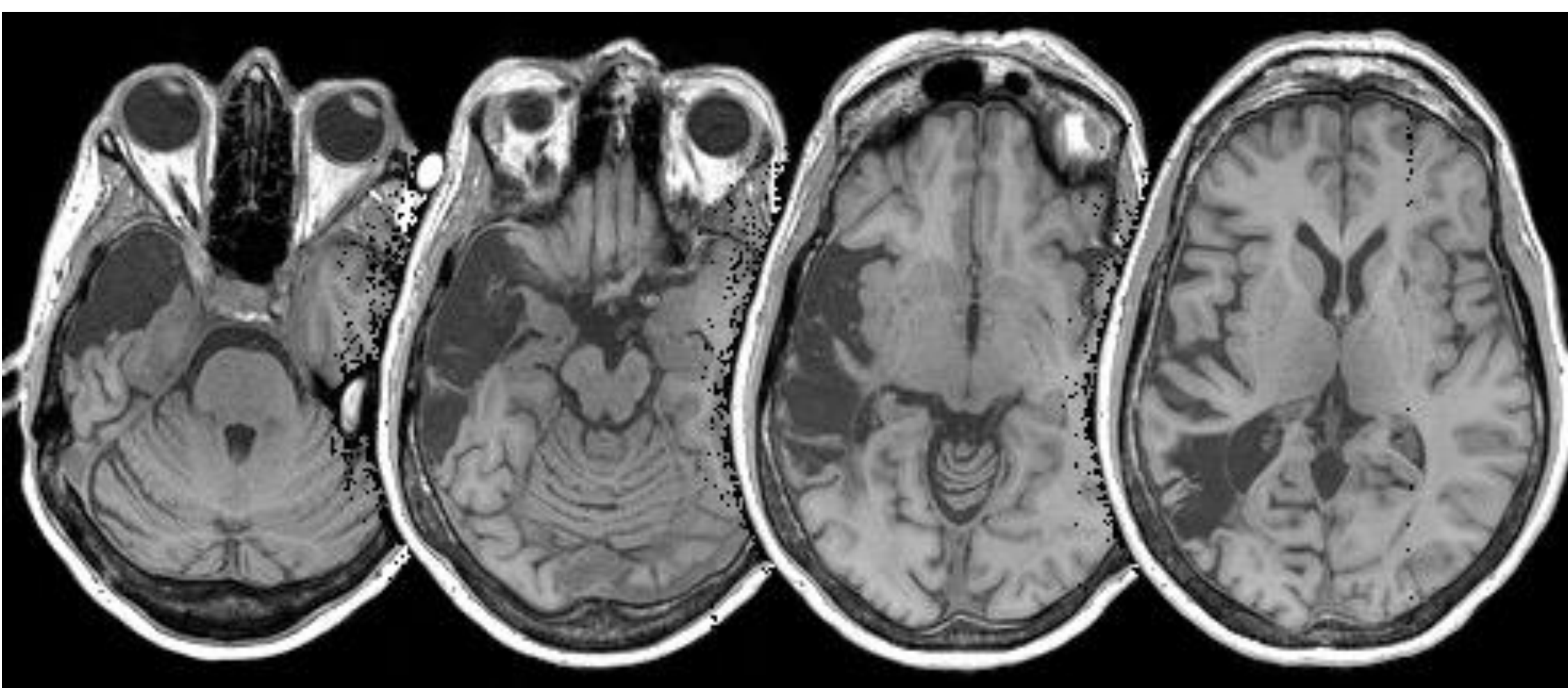
Stroke lesion along the length of the sylvian fissure extending from left IFG, anterior temporal gyrus to the posterior LSTG. Resulted in semantic deficit

Stroke lesion in the territory of the left MCA. Included IFG and anterior portion of the temporal lobe. Resulted in nonfluent aphasia
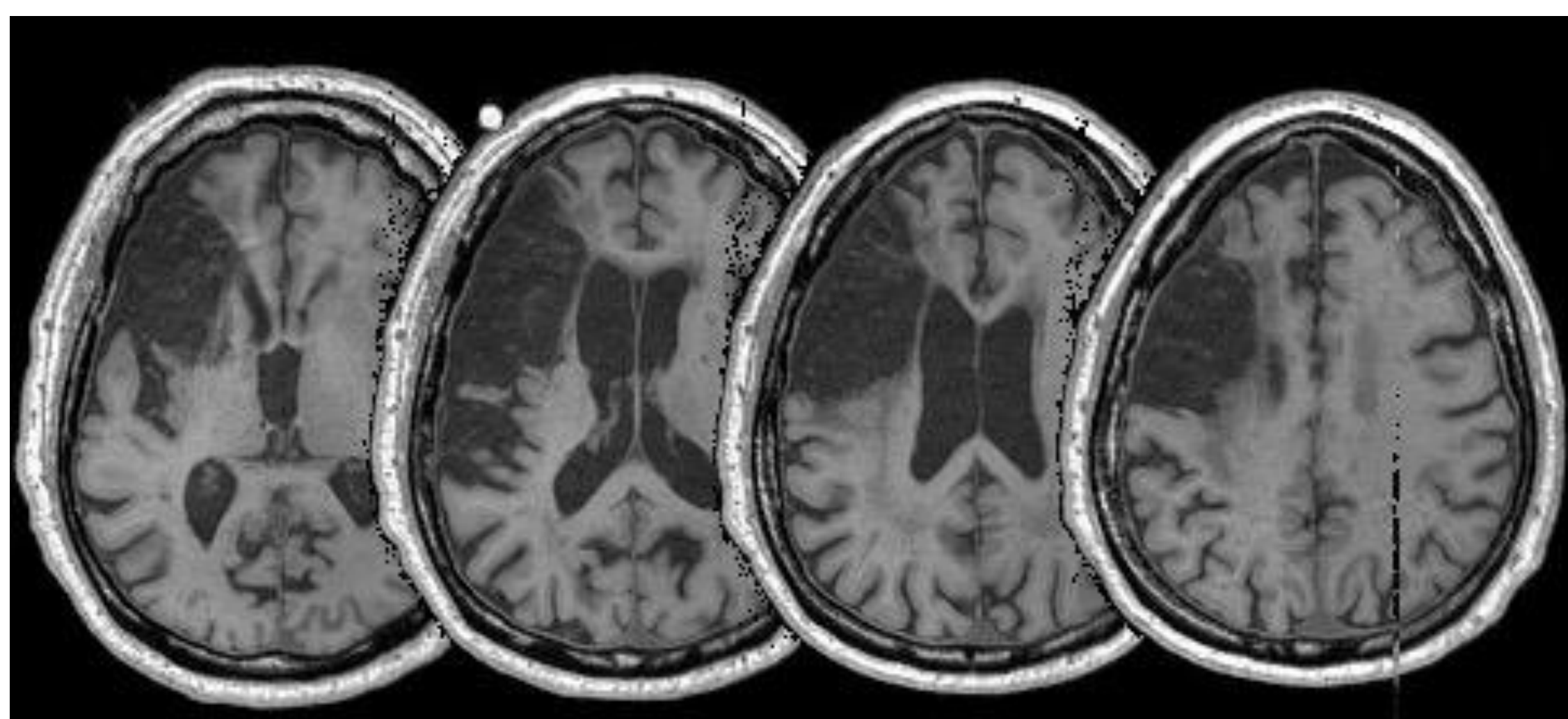
Results

Between Group Differences: Patients vs Controls

|	Noun-Verb Ratio **	Mean Length Utterance **	# of Well Formed Sentences *	Open Class Words *	Closed Class Words *	Sentences without clauses	Sentences with 1 clause **
Stroke Patients	0.69	10.10	17.90	87.60	52.70	24.60	3.10
Controls	1.03	14.23	40.89	198.06	124.61	30.39	10.94

	APB Phonological Composite **	Camel and Cactus **	Sentence Production Priming Test **	PT Composite **	Semantic Composite **	PT PSW Composite Total **	Main Concept Scores **
Stroke Patients	67.65	73.05	56.67	69.00	77.32	57.50	22.12
Controls	96.19	91.84	99.44	98.03	96.65	94.10	64.59

**. F value is significant at the 0.05 level.   **. Is significant at the 0.01 level.*

Correlation Between Main Concept Scores and Semantic Composite Scores for Patients with Stroke Related Aphasia

r(10) = 0.704
p-value = 0.023
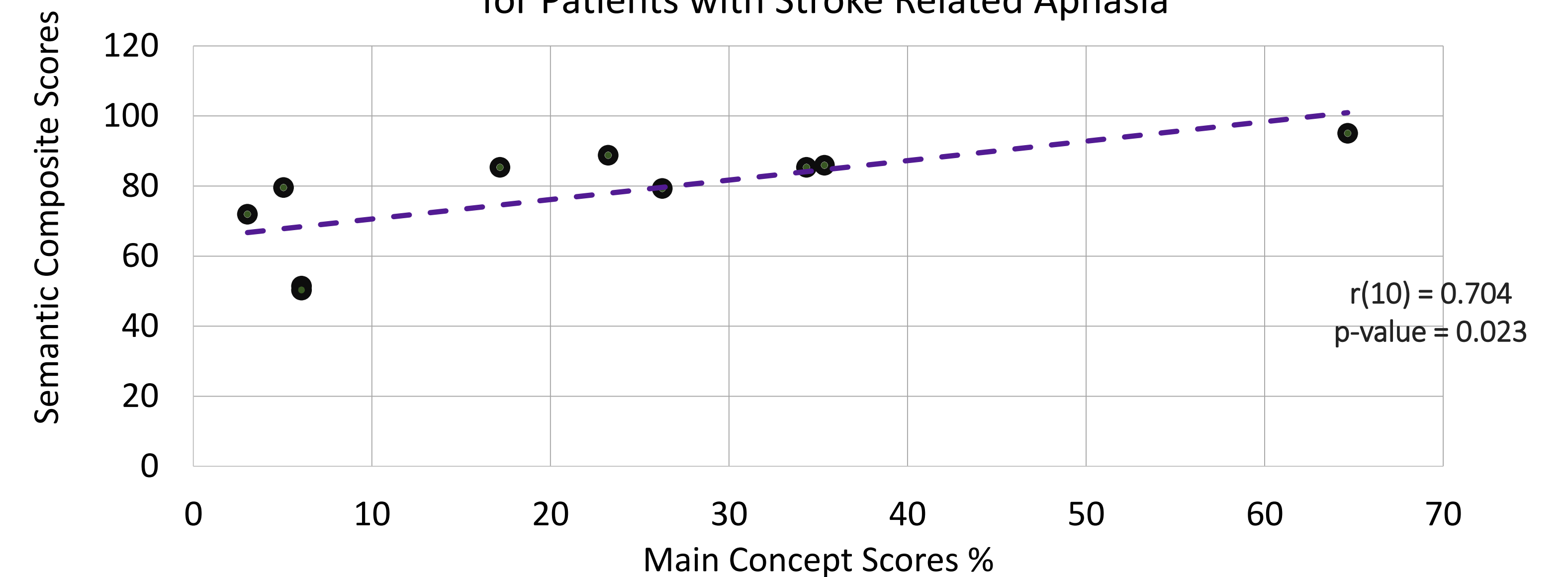
Correlation Between Main Concept Scores and Past Tense Psuedo Words Composite Scores for Patients with Stroke Related Aphasia

r(10) = 0.728
p-value = 0.017
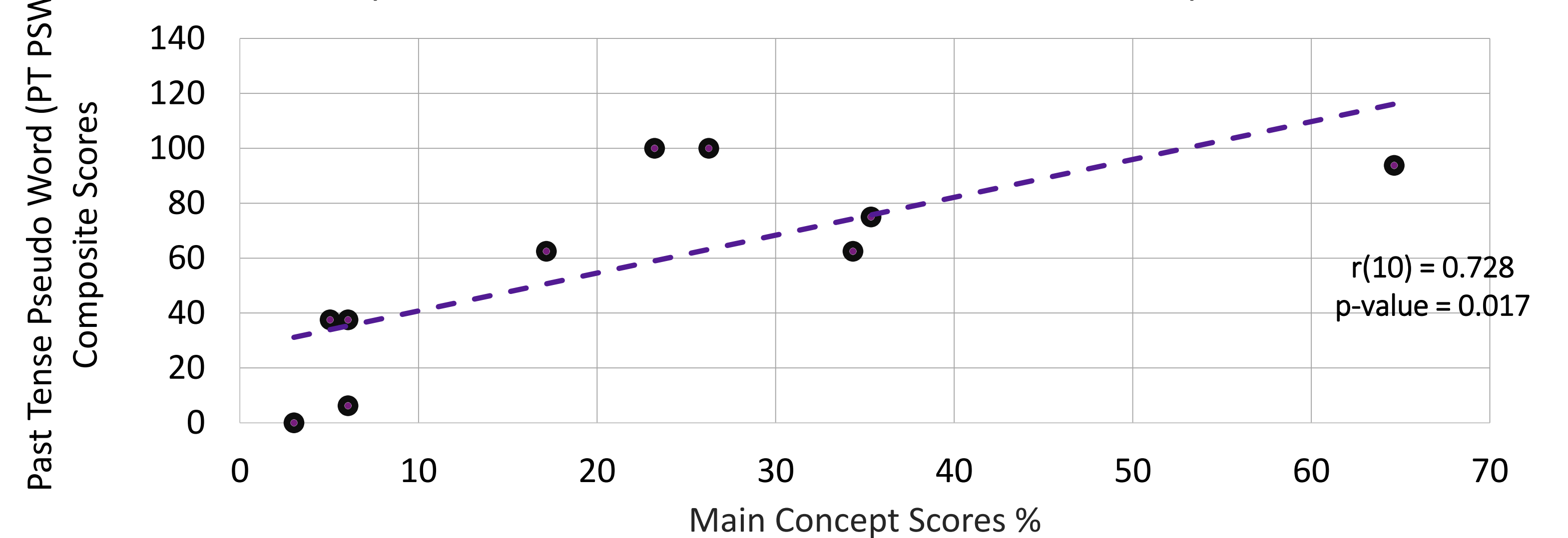
Correlations between Main Concept Scores and Past Tense Composite Scores for Patients with Stroke Related Aphasia

r(10) = 0.644
p-value = 0.044
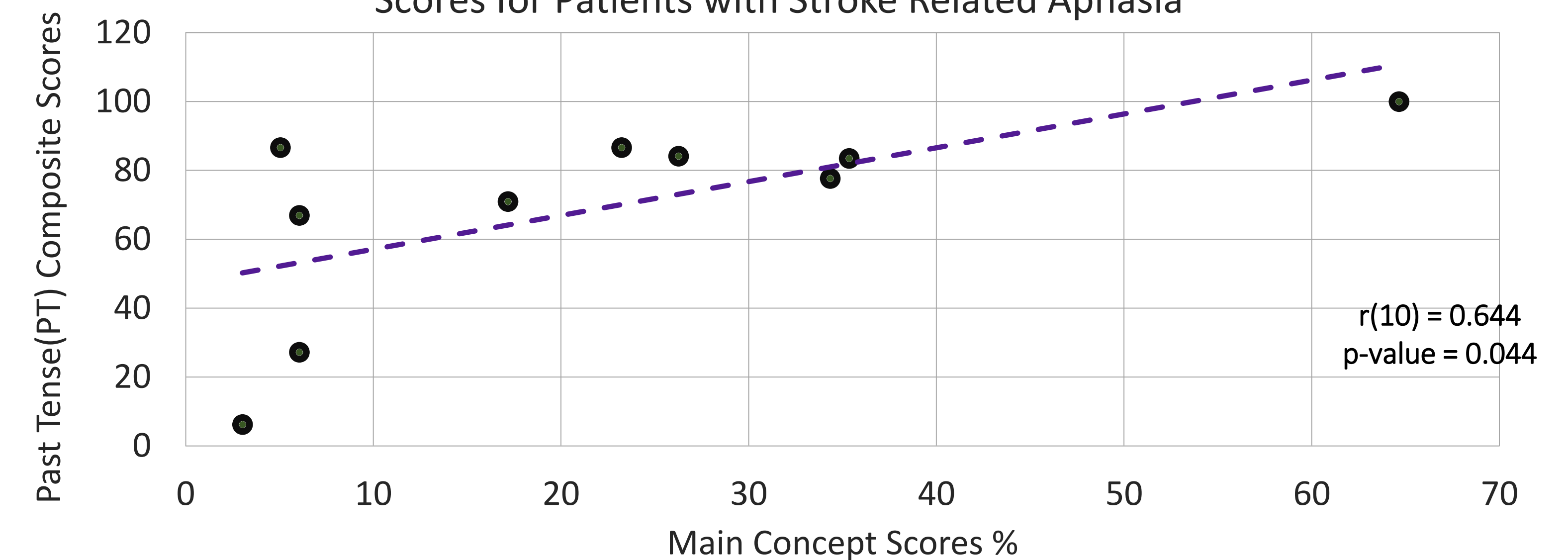
Discussion

- Narrative production for patients with aphasia contained more nouns than verbs.
- Compared to controls, patients produce shorter utterances, with fewer well formed sentences, which lacked embedded clauses .
- Patient's speech was characterized by reduced proportion of closed class words (e.g., inflectional morphemes, determiners, and complementizers)
- There was a positive relationship between the number of *Cinderella Story* main concepts produced and semantic skills, as well as past tense inflection ability.
- The results suggest that the multidimensional analysis of narrative production can give insight into the types of language deficits in aphasia.

Acknowledgements