Investigating changes in connected speech in nonfluent/agrammatic primary progressive aphasia following script training

Karinne Berstis,[1] Stephanie M. Grasso,[1] Kristin M. Schaffer,[1] Willa R. Keegan-Rodewald,[1] H. Isabel Hubbard,[3] Maya L. Henry[1,2]

Department of Speech, Language, and Hearing Sciences, University of Texas at Austin[1]; Department of Neurology, Dell Medical School, University of Texas at Austin[2]; Communication Sciences and Disorders, University of Kentucky[3]

Aphasia Research and Treatment Lab

Introduction

- Nonfluent/agrammatic PPA (nfvPPA) is characterized by
  - agrammatism in language production
    and/or
  - effortful, halting speech (apraxia of speech)
    (Gorno-Tempini, et al. 2011)
- Positive treatment effects have been reported following intervention targeting the core clinical features of nfvPPA (Schneider et al., 1996; Machado et al., 2014; Hameister et al., 2017; Henry et al., 2013; Henry et al., 2018)
- Video-Implemented Script Training for Aphasia (VISTA) has been shown to be effective for individuals with nfvPPA (Henry et al., 2018)
  - participants practiced individualized scripted material in sessions with the clinician
    - video-based home practice
  - results indicated significant improvement in accurate script production at post-treatment
    - gains maintained up to one year post-treatment

Aims & Hypotheses

- We aimed to
  - extend findings of Henry et al., 2018 by analyzing connected speech samples of a larger sample of individuals with nfvPPA treated with VISTA
  - investigate the utility of largely automated discourse measures related to
    - speech fluency
    - grammar
    - Informativeness
- We predicted
  - trained scripts would show significant improvement from pre- to post-treatment
    - potential for generalization to untrained scripts at the individual level
  - improvements would differ significantly between trained and untrained topics from pre- to post-treatment with trained topics demonstrating greater improvement

Methods

- 20 individuals (10 from Henry et al., 2018) meeting current consensus criteria for nfvPPA

Demographics and Speech, Language and Cognition Scores at Pre-Treatment

	Mean (SD)
Demographics	
Age	68.45 (5.8)
Sex	12 female, 8 male
Years of Education	16.65 (2.6)
Handedness	19 right, 1 left
Speech, Language and Cognition	
Mini-Mental State Examination (30)	27.3 (2.4)
Western Aphasia Battery AQ (100)	86.42 (9.0)
PPVT-short (16)	14.78 (2.0)
AOS rating[a] (0=none - 7=profound)	3.2 (1.2)
Dysarthria rating[a] (0=none - 7=profound)	1.85 (1.7)
Northwestern Anagram Test (%)	64.39 (21.8)

[a] from Wertz et al. (1984); AQ = Aphasia Quotient, PPVT = Peabody Picture Vocabulary Test, AOS = Apraxia of Speech

VISTA Script Video

In-Session Treatment Hierarchy

Clinician-Guided VISTA Treatment Hierarchy *(Henry et al., 2018)*	
Participant is asked to:	
1.	Choose each correct script sentence from four foil sentences.
2.	Put the script sentences in the correct order.
3.	Read the entire script aloud.
4.	Produce individual scripted sentences in response to questions.
5.	Produce the entire script from memory.
6.	Respond to questions with scripted sentences out of the correct order of the script
	During the second treatment session for a given script, a novel communication partner has an unscripted conversation with the participant to promote conversational usage of scripted material.

*Note. Feedback regarding articulation and grammar occurred during steps 3-6, with targeted practice, as needed.

- Participants were treated using VISTA
  - four scripts entered treatment following a single-subject multiple baseline design; two remained untrained
  - scripts were treated in twice weekly sessions with a clinician
  - homework consisted of unison speech production, or “speech entrainment” (Fridriksson et al., 2012) practice for 30 minutes/day
    - audiovisual model was a healthy speaker slowly producing script with exaggerated articulatory gestures
  - probes eliciting responses to script topics conducted twice pre-treatment and post-treatment

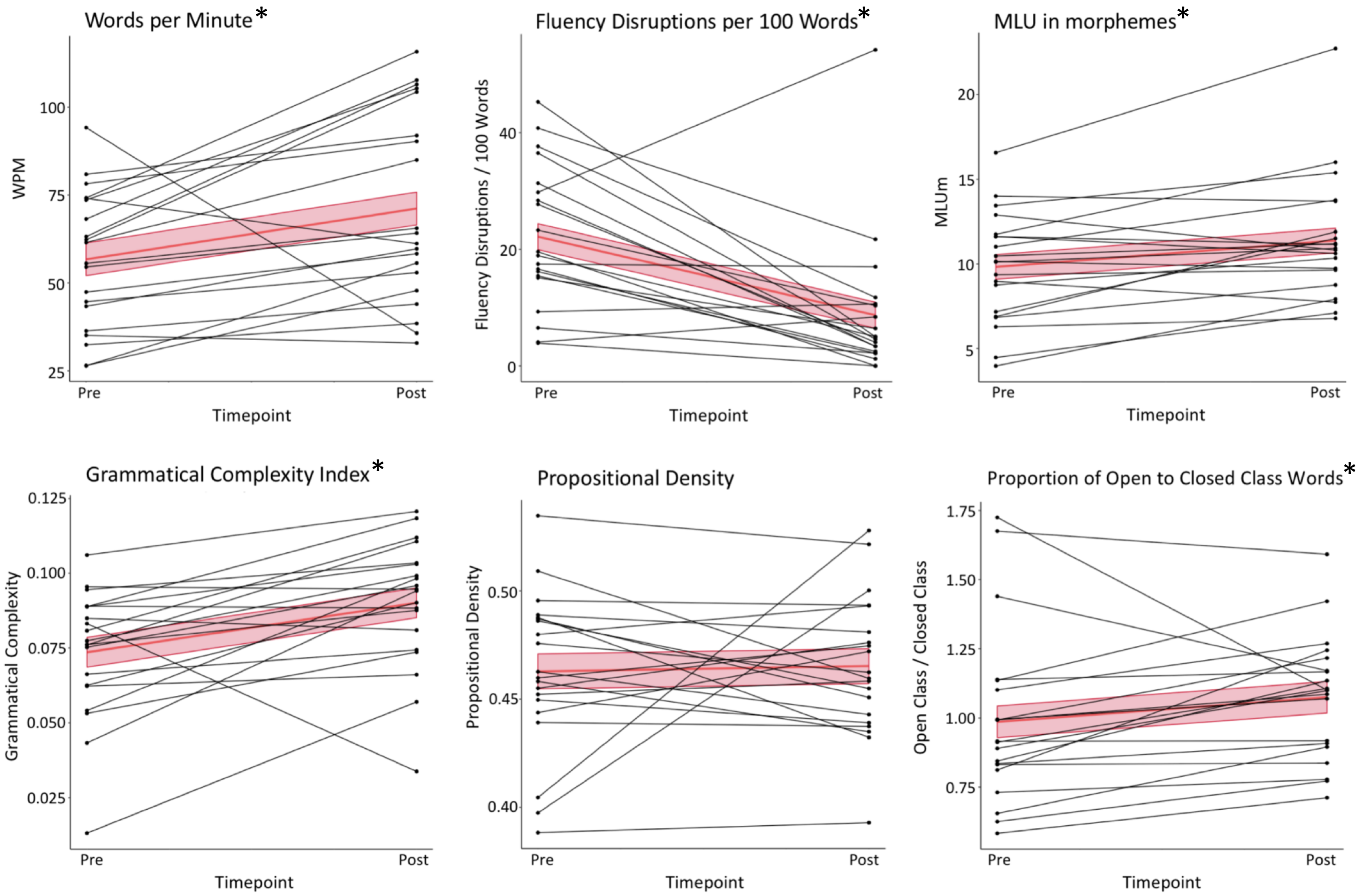
- Responses were transcribed and coded using Computerized Language ANalysis (CLAN) (MacWhinney, 2000)

- Transcriptions were analyzed using CLAN for
  - words per minute (WPM)
  - fluency disruptions per hundred words (i.e., number of fillers, phonological fragments, partial words, retracings, and repetitions)
  - mean length of utterance in morphemes (MLUm)
  - grammatical complexity index
  - proportion of open to closed class words
  - propositional idea density

Results

- Trained script topics showed significant improvement from pre- to post-TX in
  - WPM*
  - Fluency disruptions per 100 words*
  - MLUm*
  - Grammatical complexity*
  - Proportion of open to closed class words*
- Untrained script topics showed significant improvement from pre- to post-TX in
  - Fluency disruptions per 100 words*

Fixed Effect of Time on Discourse Measures for Trained Topics

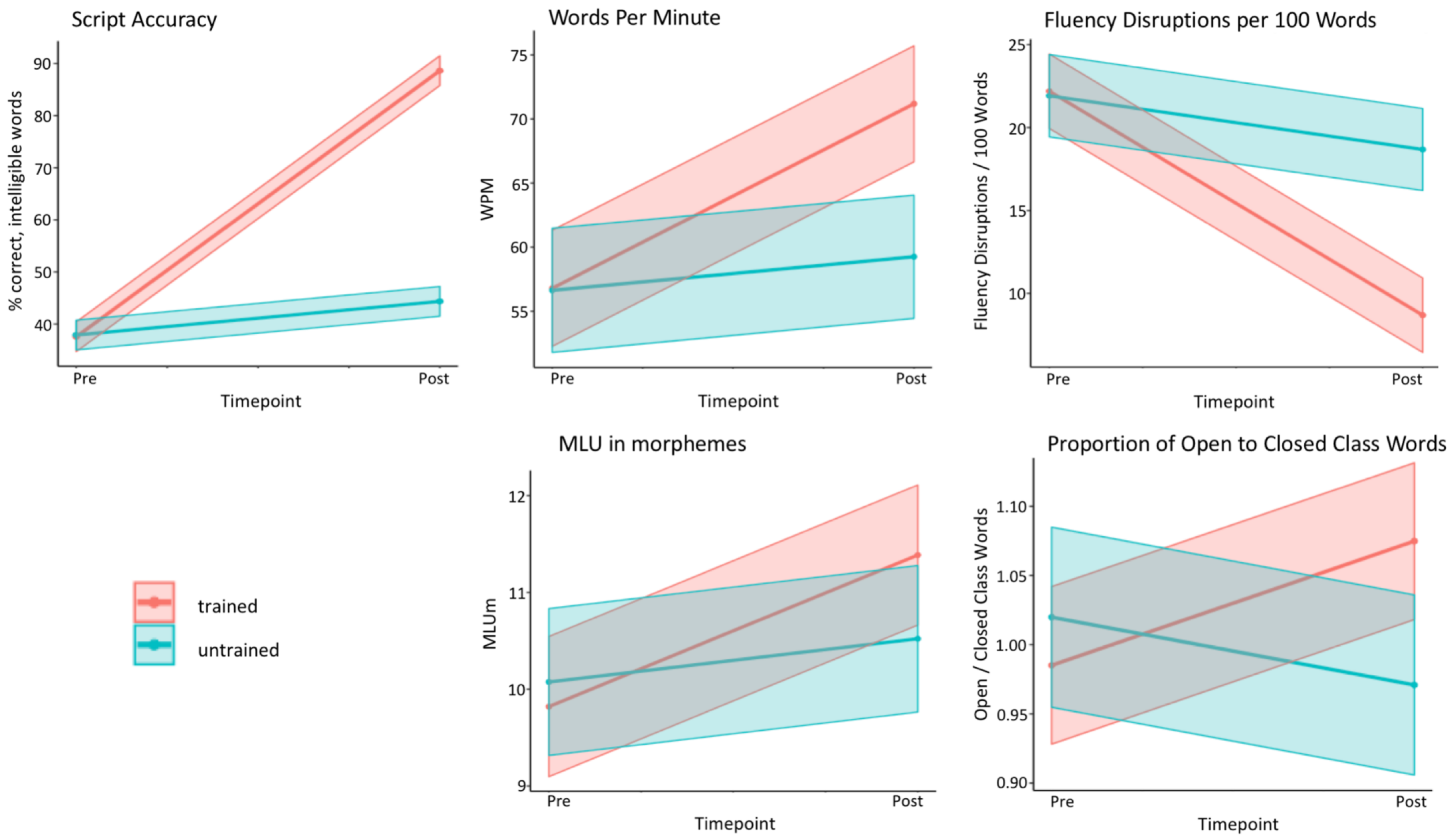


Note. Each model includes a random intercept for participant. The y axis presents fitted values from the linear mixed effects model. The fitted regression line and standard error are shown in color. Each participant's average performance across scripts at pre- and post-treatment are shown in black.

Results

- Significant interaction of time and script type (trained vs. untrained) for
    - Script accuracy (percent intelligible scripted words)
    - WPM
    - Fluency disruptions per 100 words
    - MLUm
    - Proportion of open to closed class words

Significant Interactions of Time and Training Condition



Note. Each model includes a random intercept for participant. The y axis presents fitted values from the linear mixed effects model. Standard error is shown in shaded color along the fitted regression line.

Discussion

- Script training has the potential to yield improvements for individuals who present with deficits in grammar and/or motor speech (i.e., apraxia)

- Largely automated discourse measures hold promise as a means of reducing time demands associated with discourse analysis, promoting real-world clinical utility

- Complementing previous findings (Henry et al., 2018), we found improvements for trained topics on additional measures examining
  - grammar (grammatical complexity, MLUm, proportion of open to closed class words)
  - speech fluency (fluency disruptions)
  - speech rate (WPM)

- Greatest benefit of script training is observed for practiced material
  - untrained topics showed a significant reduction for fluency disruptions per 100 words
    - small, numerical improvements on other variables
  - heterogeneity in generalization effects observed at individual level

- Future Directions
  - examine potential differential effects for individuals with relatively isolated deficits (motor speech vs. agrammatism)
  - examine whether treatment-induced improvements on relevant outcome measures generalize to other connected speech tasks
  - explore additional outcome measures (e.g., acoustic measures) that may aid in characterizing motor speech ability as a complement to linguistically-based discourse measures

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NIDCD National Institute on Deafness and Other Communication Disorders

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