Influence of Stimulus- and Patient-Level Factors on Naming Treatment Outcomes in Individuals with Aphasia

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Introduction
Limited studies have evaluated the influence of psycholinguistic properties of stimuli on treatment response in individuals with aphasia (e.g., Hendricks et al., 2014; Riley & Thompson, 2015). Furthermore, whether individual baseline semantic and phonological skills predict treatment response has not been systematically examined in aphasia. Further investigation would aid in determining which variables to consider in stimuli selection and which impairment profiles respond to particular treatments. This retrospective study aims to predict binary item-level treatment response from stimulus characteristics and individual deficit profiles. Specifically, we examined if treatment-related changes in naming accuracy were predicted by (1) stimulus-level psycholinguistic properties, and (2) patient-level semantic and phonological skills.

Methods
Participants: Participants were 30 individuals with chronic post-stroke aphasia.
Assessment and Treatment: Prior to treatment, aphasia severity was assessed using the Western Aphasia Battery – Revised Aphasia Quotient (WAB-R AQ) (Kertesz, 2007) and semantic and phonological skills were assessed via three lexical-semantic and three phonological processing tasks (see Meier et al., 2016). The scores in each domain were averaged to create one semantic and one phonological score per participant. Participants completed a 180-item picture naming probe at baseline, every two treatment sessions, and post-treatment. Trained and monitored (not trained) items were assessed at each probe session. Intervention consisted of up to 24 two-hour sessions of typicality-based semantic feature treatment (Gilmore et al., 2018).
Statistical Analysis: Psycholinguistic variables were selected based on prior literature. A principal component analysis (PCA) was completed with the probe stimuli reducing these highly correlated variables into lexical-semantic, phonological, and phonotactic domains (Table 1). All models used mixed effects logistic regression with binary naming accuracy as the predicted variable, WAB-R AQ as a covariate, and random intercepts for item and participant. For Question 1, three models were built, each including a different PCA component score. Predictors were the three-way interaction between training (trained vs. monitored item), session, and principal component score (one for each model) and lower order terms of these interactions. For Question 2, two models were built, each including individual linguistic processing scores (semantic or phonological). Predictors were the three-way interaction between training, session, and linguistic score and lower order terms of these interactions.

Results

Question 1 showed a significant three-way interaction among session, training, and the lexical-semantic component ($p<.05$) (Model 1a). In this model, the predicted probability of a correct response for trained (but not monitored) items increased over time more for semantically difficult vs. easy items (Figure 1). Question 2 showed significant three-way interactions among session, training, and semantic skills ($p<.05$) (Model 2a) and session, training, and phonological skills ($p<.05$) (Model 2b). Specifically, the predicted probability of a correct response increased more over time for a.) individuals with stronger vs. weaker semantic skills for trained items only b.) individuals with stronger vs. weaker phonological skills for trained and monitored items.

Conclusions

This work provides preliminary evidence that a.) lexical-semantic properties of stimuli influence treatment response and b.) semantic and phonological processing skills, independent from aphasia severity, have predictive power for outcomes to semantically-based naming treatment.

References

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Table 1. Loadings for Principal Component Analysis

Psycholinguistic Variable	Component Loadings		
	Lexical-Semantic	**Phonological**	**Phonotactic**
Typicality (log)*	**0.70**	-0.20	-0.08
Semantic Neighborhood Density	**0.67**	0.46	0.14
Frequency (log)	**0.74**	0.51	0.14
Age of Acquisition (log)*	**0.77**	0.18	0.08
Number of Syllables*	0.06	**0.89**	-0.03
Number of Phonemes*	0.18	**0.90**	-0.11
Phonological Neighborhood Density	0.12	**0.84**	0.02
Phonotactic Probability (phonemes)	0.05	0.11	**0.91**
Phonotactic Probability (biphones)	0.06	-0.19	**0.91**

*Reverse coded

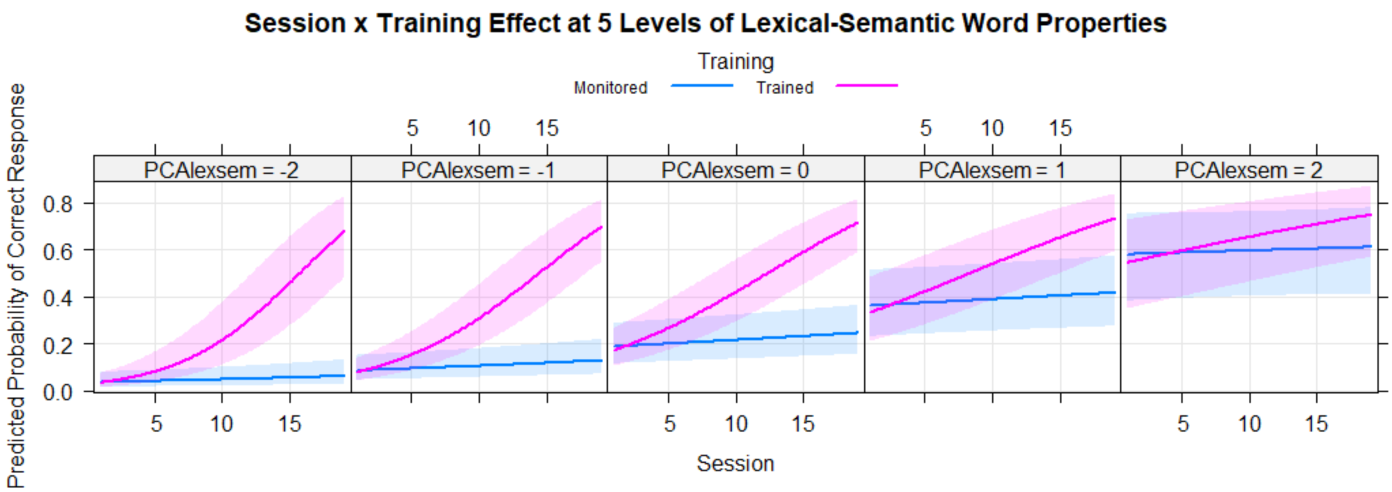

Figure 1. Question 1 - Session by training effect (trained vs. monitored items) for five levels of the lexical-semantic PCA component (PCAlexsem)