The influence of multilevel factors on semantic-feature based naming outcomes in bilingual aphasia

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Introduction

Recent work has investigated the effects of person- and treatment-related variables on word-retrieval outcomes following semantic-feature treatment (SFT) in monolingual aphasia (Quique et al., 2019). Yet, similar research has not been undertaken for bilingual aphasia. The current study examined 1) training outcomes from an SFT protocol for Spanish-English bilinguals with aphasia (BWA); 2) patterns of response generalization to untrained items and languages; and 3) the influence of treatment, participant, and item-level factors on treatment effects.

Methods

Twenty-two Spanish-English BWA in the chronic phase of recovery received 10 weeks of SFT for word-retrieval impairment in Spanish or English. Adapted from Kiran et al. (2013), the intervention included 20 treatment sessions (2 hours per session twice per week) and was delivered via videoconference (Peñaloza et al., 2021). Treatment progress and response generalization to untrained items were assessed via 1) 3 pre-treatment naming probes, 2) 10 naming probes completed during treatment, and 3) 3 post-treatment probes. Naming probes consisted of 90 items: 15 each of trained items, semantically-related items, and unrelated control items as well as their corresponding translations in the untreated language (e.g. apple-orange-horse and *manzana-naranja-caballo*). Item-level psycholinguistic variables of interest included lexical frequency, phonological length (in phonemes), and phonological neighborhood density collected from the *CLEARPOND* (Marian et al., 2012) database. Additionally, naming severity scores were extracted from pre-treatment administration of the Boston Naming Test (BNT; Kaplan et al., 2001; Kohnert et al., 1998).

Logistic mixed-effects-modeling using lme4 (Bates et al., 2015) in R examined group-level outcomes. Item-level naming accuracy was estimated in both the treated and untreated languages longitudinally; secondary analyses explored the effect of baseline naming severity and psycholinguistic factors on trained item response accuracy.

Results

In the treated language, there was a significant interaction effect between *session* and *word set* ($b=.27$, $SE=.01$, $z=18.78$, $p<.001$), indicating higher likelihood of a correct response for trained items relative to control items over the course of treatment. A similar, yet less robust, pattern of improvement emerged in the untreated language over time ($b=.08$, $SE=.02$, $z=4.36$, $p<.001$), suggesting some degree of cross-language generalization to the trained item translations. However, there was no significant improvement over time for semantically related items relative to controls in either the treated or untreated language.

A second series of analyses assessing the treatment effect for trained items found a significant interaction effect for *session* and *baseline naming severity* ($b=.18$, $SE=.06$, $z=2.88$, $p<.01$), demonstrating that BWA with milder naming deficits improved more quickly in treatment. After accounting for baseline naming severity, separate psycholinguistic models for phonological length, phonological neighborhood density, and lexical frequency revealed that the effect of treatment on trained item accuracy was *attenuated* for longer words ($b=-.04$, $SE=.01$, $z=-5.60$, $p<.001$), *strengthened* for words with dense phonological neighborhoods ($b=.12$, $SE=.03$, $z=4.05$, $p<.001$), and *unchanged* by differences in word frequency ($b=.03$, $SE=.02$, $z=1.20$, $p=.23$).

Conclusion

These preliminary findings support previous work documenting the efficacy of semantic-feature based treatment for word-retrieval impairment in BWA and suggest that psycholinguistic and severity-related factors modulate treatment response at the group level.

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Tables and Figures

Table 1. Patient demographic information and profile of language performance

Participants	Sex	Age	Education (years)	MPO	Name Sev. (English)	Name Sev. (Spanish)	WAB AQ (English)	WAB AQ (Spanish)
n=22	F=8 M=14	53.36 (17.53)	14.32 (2.80)	85.57 (117.41)	.39 (.29)	.36 (.30)	67.75 (23.85)	55.49 (27.60)

Note. Mean and (SD) are provided. Age= age in years at time of consent; MPO= months post onset at time of consent; Name Sev.= baseline naming severity reported as proportion of items correct on the BNT (max. score 60); WAB AQ= baseline aphasia quotient from the Western Aphasia Battery (Kertesz, 2006)

Figure 1. Accuracy on naming probes across treatment by word set in the treated and untreated languages
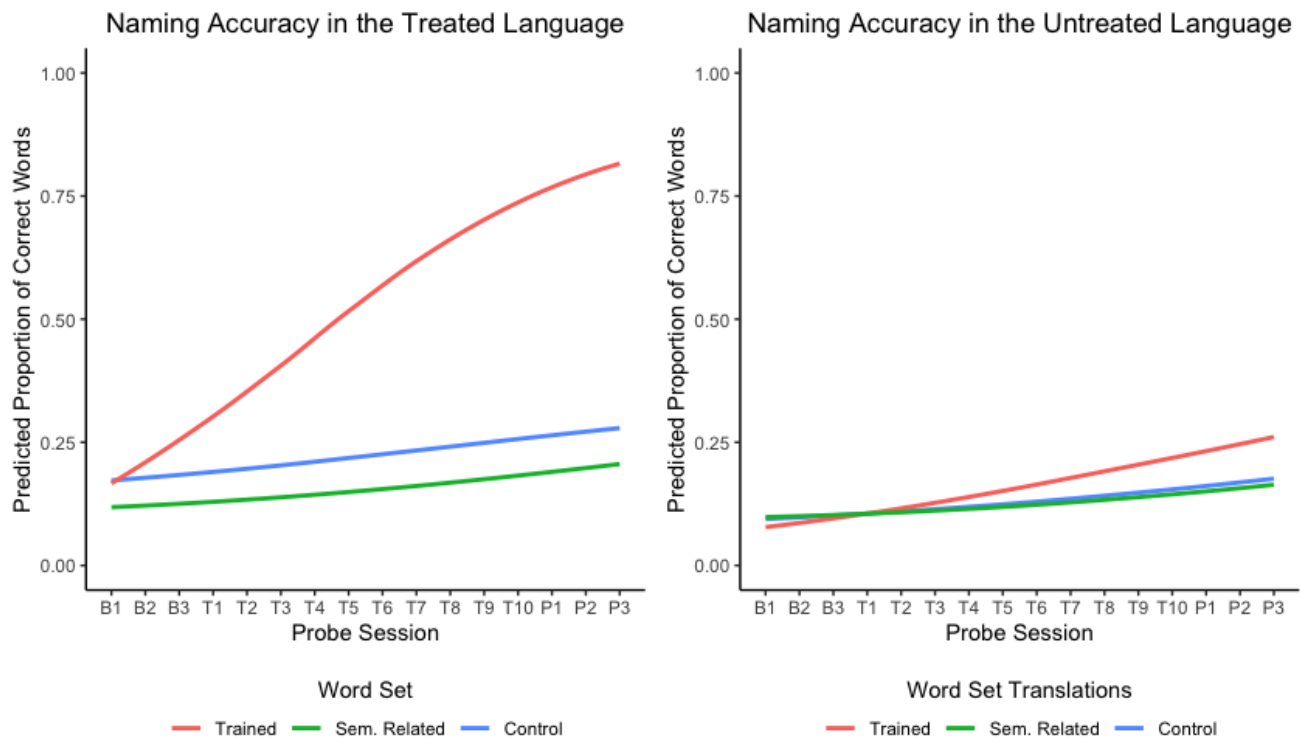
Note. 'B1-B3'=Baseline naming probes; 'T1-T10'= Treatment naming probes completed immediately before every other treatment session; 'P1-P3'=Post-treatment naming probes completed in the first three assessment sessions immediately following treatment