Practicing with BEARS: active ingredients in semantic feature analysis

Robert Cavanaugh[1][2] Yina Quique[3] Emily Boss[4] William D. Hula[2] Michael Walsh Dickey[1][2] William S. Evans[1]

[1]University of Pittsburgh [2]VA Pittsburgh Healthcare System [3]Northwestern University [4]Integrative Reconnective Aphasia Therapy

Introduction

Motivation

1. Ongoing need to specify active ingredients and mechanisms of aphasia treatments[1]
2. In semantic feature analysis (SFA)[2], retrieval of target words & features may strengthen connections within the lexical-semantic network
3. Thus improvement expected on trained & semantically related words with shared features.
4. In Evans et al.,[3] we found that the number of patient-generated features per trial moderated treatment response; may be an essential active ingredient
5. Semantic feature verification (SFV) is a modified SFA: features are verified in a yes/no task ("Knives, used for cutting?"), with similar results[4]
6. However, unclear whether feature verification similarly moderates treatment response
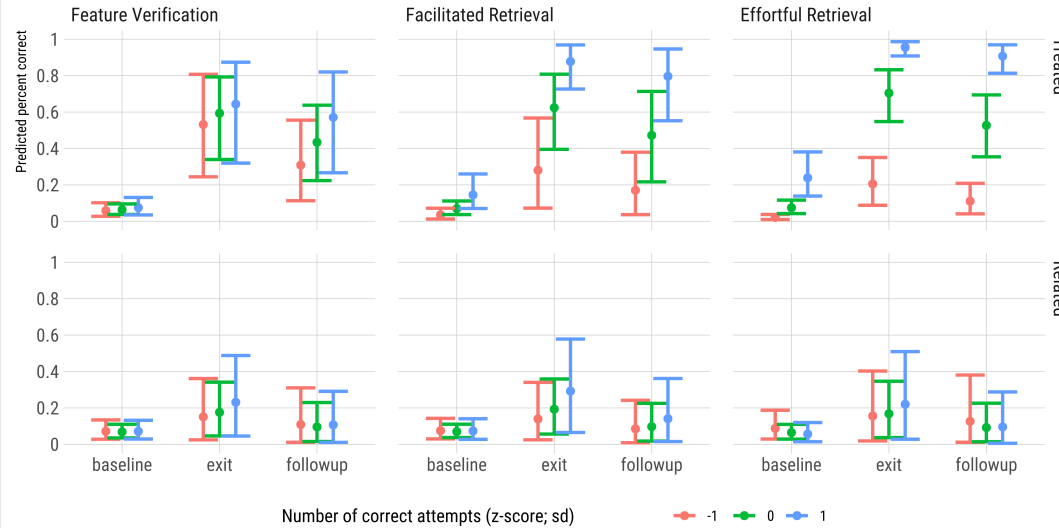7. Retrieval practice[5] may also engender treatment response in SFV.

Purpose

Evaluate the role of semantic feature verification and retrieval practice treatment components in SFV.
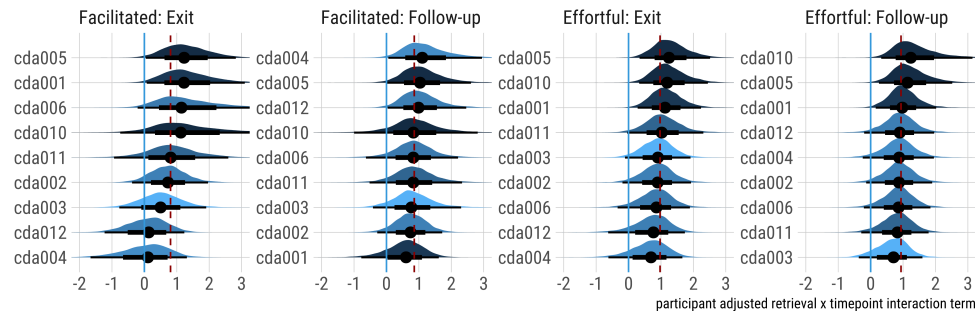
Hypothesis 1: If SFA and SFV operate under the same mechanism, successful feature verification should be associated with improvement on treated and semantically related, untreated words.

Hypothesis 2: If SFV improves lexical access via retrieval-practice, successful retrieval practice should be associated with naming outcomes for treated, but not related, untreated words.

Relationship between treatment components and treatment response

Individual differences in practice-related interaction effect

Findings

Discussion

- More successful feature verification attempts were *not* associated with any SFV outcomes (may be affected by speed-focus of treatment)
- More successful retrieval practice attempts (facilitated & effortful) were associated with greater odds of retrieval at exit, follow-up.
- Weak and uncertain evidence that facilitated or effortful retrieval is associated with related word outcomes (posterior probability < 0.75)
- Successful effortful retrieval practice effect may more important for people with more severe anomia; or items were overtrained for milder participants (not as effortful).
- Words produced correctly during effortful retrieval component may have been more stimulable
- Test-exposure effect during probes potentially confounds results
- Correlational findings: cannot distinguish practice-related and individual-level effects without experimental control

Conclusions

- These findings are inconsistent with the hypothesis that successful feature verification was an active ingredient in this implementation of SFV.
- Both retrieval components appear to moderate treatment response for trained but not related words; but not enough information to suggest causal relationship.
- Future work should focus on comparative effectiveness of different treatment components, treatment follow-up, and stimulus generalization.

Methods

Treatment

- 9 people with chronic aphasia received a SFV + meta-cognitive treatment called BEARS for 25 hours over 9-10 sessions (3-5 baseline probes).
- 40 treated; 20 semantically related words were also probed before treatment each session, the week following treatment, and at 1 month followup.
- The treatment included 3 major components: an effortful naming attempt, feature verification questions, and a second (facilitated) naming attempt.

Statistical Analysis

- Separate item-level bayesian mixed-effects models[6] evaluated the relationship between the number of correct attempts during treatment for each component and naming performance from baseline to the last 3 treatment probes (noted ceiling effects).
- Near maximal random effect structures (increase uncertainty but protect against type-1 error)
- Covariate: Aphasia Severity (CAT mean T-score)
- Posterior predictions visualized participant-level relationships between baseline naming severity and effect of each component.

References & Acknowledgements

1. Turkstra LS, Norman R, Whyte J, Dijkers MP, Hart T. Knowing What We're Doing: Why Specification of Treatment Methods Is Critical for Evidence-Based Practice in Speech-Language Pathology. *American journal of speech-language pathology / American Speech-Language-Hearing Association.* 2016;25(2):164-171. doi:10.1044/2015_AJSLP-15-0060
2. Boyle M. Semantic feature analysis treatment for aphasic word retrieval impairments: What's in a name? *Topics in Stroke Rehabilitation.* 2010;17(6):411-422. doi:10.1310/tsr1706-411
3. Evans William S., Cavanaugh Robert, Gravier Michelle L., et al. Effects of Semantic Feature Type, Diversity, and Quantity on Semantic Feature Analysis Treatment Outcomes in Aphasia. *American Journal of Speech-Language Pathology.* Published online 2020. doi:10.1044/2020_AJSLP-19-00112
4. Kiran S, Roberts PM. Semantic feature analysis treatment in Spanish and French bilingual aphasia. *Aphasiology.* 2010;24(2):231-261. doi:10.1080/02687030902958365
5. Middleton EL, Schwartz MF, Rawson KA, Traut H, Verkuilen J. Towards a theory of learning for naming rehabilitation: Retrieval practice and spacing effects. *Journal of Speech, Language, and Hearing Research.* Published online 2016. doi:10.1044/2016_JSLHR-L-15-0303
6. Bürkner PC. Advanced Bayesian multilevel modeling with the R package brms. *R Journal.* Published online 2018. doi:10.32614/rj-2018-017