Cognitive Control of Inappropriate Senses of Homographs During Sentence Comprehension: A Pilot ERP Study

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Background

- Selective attention has the important task of actively inhibiting task-irrelevant information (Gernsbacher & Faust, 1991).
- Explain basic findings of Expt. 4 (Gernsbacher, Varner, & Faust, 1990), of suppression of inappropriate homograph senses over time (with longer delays) for better readers, but not for poor readers.
- Explain finding of recent schizo study in terms of N400 effect for appropriate versus inapparopriate senses of homographs, and how effect goes away in Schizophrenia. Explain N400 semantic mismatch effect.
- Explain sentence verification task, and how it might produce different N400 results. Give examples: "He dug with the **spade**" ACE, example of homograph ending sentence with test word unrelated to the overall meaning of the sentence, but related to inappropriate sense of homograph, "He dug with the **shovel**" ACE, example of nonhomograph ending sentence, no relationship of test word to overall meaning of sentence OR to (local) meaning of sentence-final nonhomographic word. Also, half the sentences are correct yes trials where test word is related to sentence.

Methods

- Participants (N=7) Sentence Verification task.
- Sentences 1 word at a time, 200 ms per word, 50 ms blank screen between, so 4 words per second rate.
- Test word following 100 ms (short) or 2000 ms (long) delay
- Measure response latency for correct trials
- Also measure EEG time-locked to onset of test word, event-related potential (ERP)

Hypotheses

- **Predict equivalent N400 semantic mismatch effect equivalent for test words following homographs and nonhomographs that are unrelated to overall meaning of sentence at short delay.**
- **Predict equivalent N400 semantic mismatch effect LARGER for test words following homographs at long delay.**

References

Gernsbacher, M.A., & Faust, M.E. (1991). Less-skilled comprehenders have less-efficient suppression mechanisms. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *17*, 245-262

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Acknowledgment

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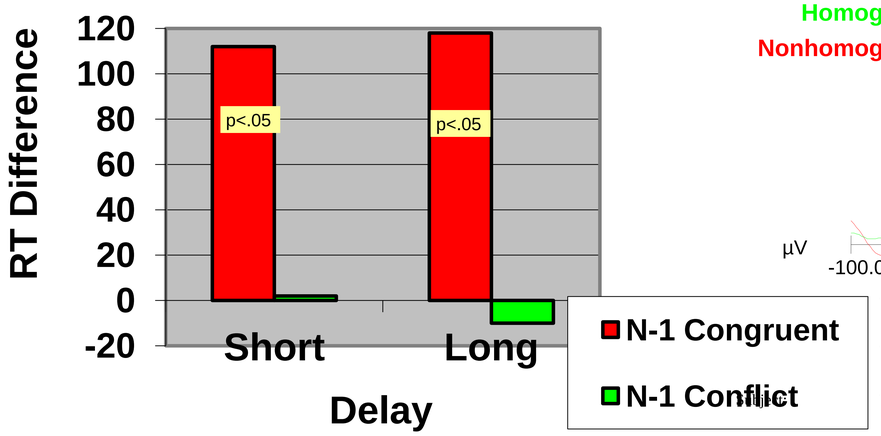
Easy Stroop Sequence



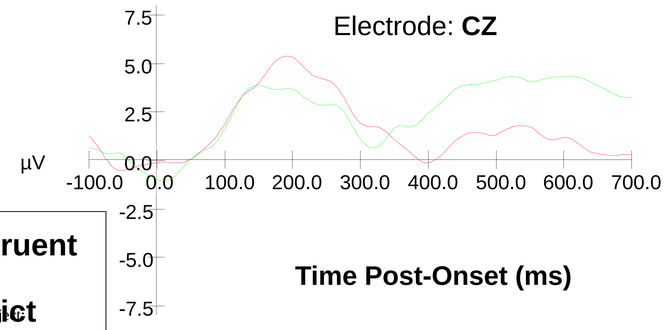
Results

- Redo bar graph. Horizontal Axis: Delay (short & long), Vertical Axis: Mean RT (ms)
- Key Labels: Red Bar: Nonhomograph, Green Bar: Homograph
- Mean RTs: Short-Homograph= 1127, Short-Nonhomograph=1062, Long-Homograph=997, Long-Nonhomograph=892
- Change graph title: Sentence Verification Task
- Interference Effect (Mean RT Homograph versus Mean RT Nonhomograph): Significant at short delay (p=.050), Significant at long delay (p = .010)
- Note: For ERP results in Figures we measured AREA under curve in 3 time windows for each curve (cell in design): 150-250 ms (often called P2, amplitude known to vary with attention processes), 350-450 ms (N400, negative going trough-like potential found in language studies when a test word does not fit semantically with sentence, semantic mismatch potential), 500-650 (late positive wave, often associated with post-identification processing of word and error checking on task)
- Short Delay: Greater late positive potential for test words following homograph sentences than following nonhomograph sentences in the 500-650 ms window (p = .045, Cohen's d = .98, Cohen's d is a measure of effect size that is independent of sample size, which is very small)
- Long Delay: No sig. differences, but given small sample size and low power to detect sig. differences, should note marginal (nonsignificant trend in sample) for P2 to be greater for test words following nonhomographs than for homographs in early 150-250 ms window. Indicates possible difference in early attentional processing (p = .065, Cohen's d = .97).

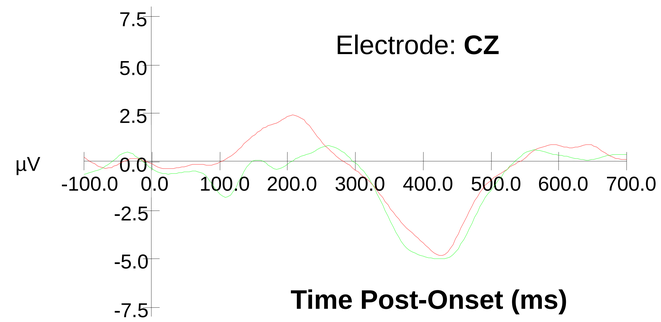
ERPs to Test Word

Homograph –
Nonhomograph –

Short Delay (100 ms)



Long Delay (2000 ms)



Discussion

- No suppression of interference over time in mean RTs
- More late cognitive activity for test words associated with sentence-final homographs with a short delay
- Late cognitive effect goes away with delay, may reflect suppression of inappropriate sense of homograph that does not show up in behavioral (RTs) responses.
- No differences in N400 semantic mismatch effect at either delay
- Early attentional processing of test words following a long delay may differ depending on the local association to the sententce-final word [note remember that test words associated with one sense of homographic but not nonhomographic sentence-final-words]