An Investigation of the Effects of Syntactic Complexity, Task Demand, and Rate of speech Input on the Neural Correlates of Sentence Comprehension

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Introduction

Background

• Prior research indicates that alterations of the rate of speech input may compromise the integrity of automatic lexical and syntactic language processing in normal populations (i.e. Camblin et al., 2007; Love et al., 2007)

Materials

• Stimuli were adapted from Love et al. (2006) and consisted of 45 syntactically simple (subject-relative[SR]) and syntactically complex (object-relative[OR]) sentences, presented across three levels of task difficulty: PASSIVE LISTENING, PROBE VERIFICATION, & THEMATIC ASSIGNMENT.

Methods

Experimental Task

SR: "The girl who saw the boy went into the room."
OR: "The girl who the boy saw went into the room."

Auditory Probe Word: "Girl"

Subject Decision:

PASSIVE LISTENING

PROBE VERIFICATION

THEMATIC ASSIGNMENT

SR OR

Y

Y

Y Y

N

N

Results

• Individual Z-score maps of activation from each participant in each condition were submitted to a 3-way repeated-measures mixed-effects analysis of variance (ANOVA), with sentence condition (2 levels, fixed effect), task demand (3 levels, random effect), and subjects (10 levels, random effect) as factors.

• All analyses used a voxel-wise threshold of p < .001 (FWHM autocorrelation estimator = 8mm) and an overall corrected alpha level of 0.05.

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• Studies have not yet examined possible neural interactions between linguistic complexity and task difficulty at a slowed rate of speech input

• Lack of a main effect of sentence complexity indicated similar patterns of neural activation across varied levels of syntactic complexity and task demands?

Conclusions

• What are the neural correlates of sentence comprehension for slowed speech stimuli, presented across varied levels of syntactic complexity and task demands?

• Is there an interaction between syntactic complexity and task demand during sentence comprehension of slowed speech?

References


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On April 14th, 2006 the scientific community lost a great leader in the field of psycholinguistic and neurolinguistic research. Dave's influence was broad reaching. His friends and colleagues miss him deeply. Please visit http://davewww.ucsd.edu

Activities Compared Across Conditions

• Given results from Love et al. (2006) an a priori hypothesis predicted stronger modulation of neural activity during the THEMATIC ASSIGNMENT task. This hypothesis was borne out by the data, which indicated significantly broader engagement of non-reflexive language processing than either of the other two tasks.

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• A contrast between Passive Listening and Probe Verification revealed few significant differences between these conditions (Passive Listening showed greater activation in Bilateral Posterior Cingulate (BA23), Bilateral Precuneus (BA7), and Bilateral Cuneus (BA18), but these two tasks were collapsed for further analyses.

• The slices presented indicate -5 mm, 0 to +8 mm, +13 to +21 mm, +26 to +34 mm, & +39 to +47 mm superior to the line of the anterior commissure (AC-PC) line in Talairach coordinates.

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Questions

• What are the neural correlates of sentence comprehension for slowed speech stimuli, presented across varied levels of syntactic complexity and task demands?

• Do the neural underpinnings of sentence comprehension at a slowed rate indicate an engagement of non-reflexive language processing strategies?

• Is there an interaction between syntactic complexity and task demand during sentence comprehension of slowed speech?

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