

Subvocal rehearsal of structured phrases in fMRI reveals syntax-specific activation in the posterior STS and production-specific activity in the pars opercularis

Evaluating Morpho-Syntactic Aspects of the Neural Working Memory Circuit

¹University of South Carolina,
Communication Sciences and Disorders

Emily Wood¹ & William Matchin¹

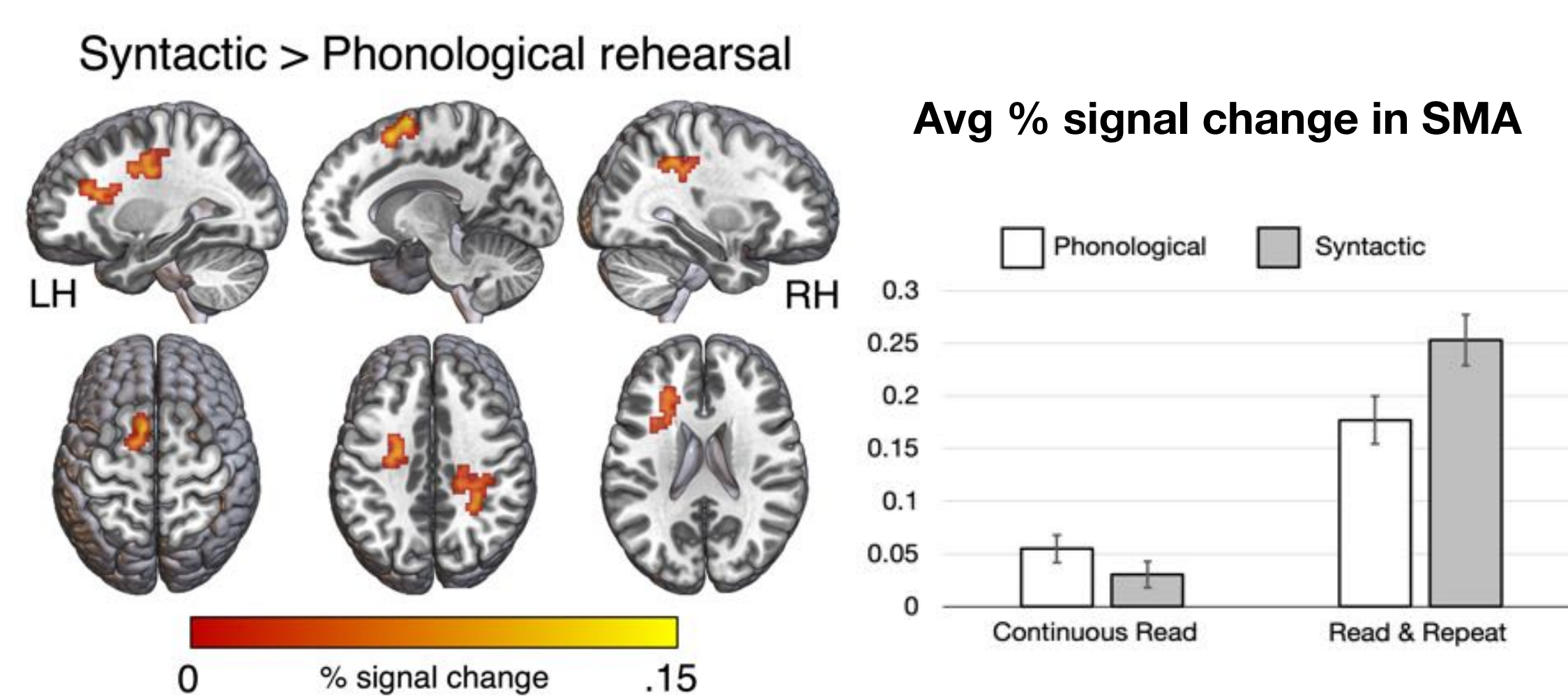
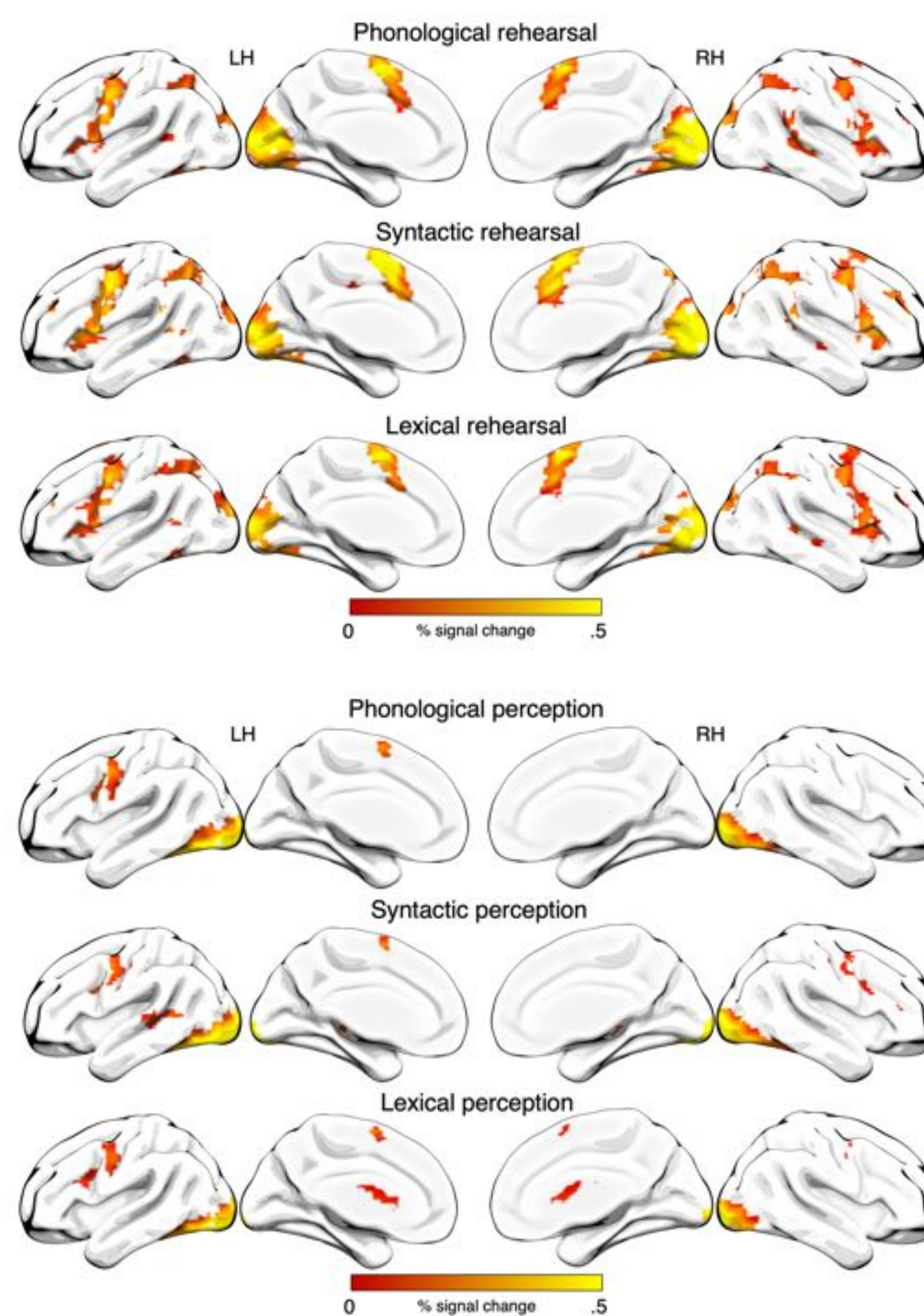
INTRODUCTION

- Working memory (WM) supports sentence processing^[5]
- Frontal-temporal loops support WM articulatory rehearsal^[1,2,4]
- Syntax: hierarchical linguistic structure, above and beyond speech-level (phonological) structure
- Question: is neural WM circuit differentiated by linguistic structure/content?
- Syntax-specific WM system thought to be comprised of pSTS & IFG, pars triangularis^[6]
- These regions, and IFG, pars opercularis, implicated in syntactic processing^[6-9]
- Goal of present study:** localize syntactic WM system by examining rehearsal of morpho-syntactic information beyond speech-level (phonological) and word-level (lexical) rehearsal

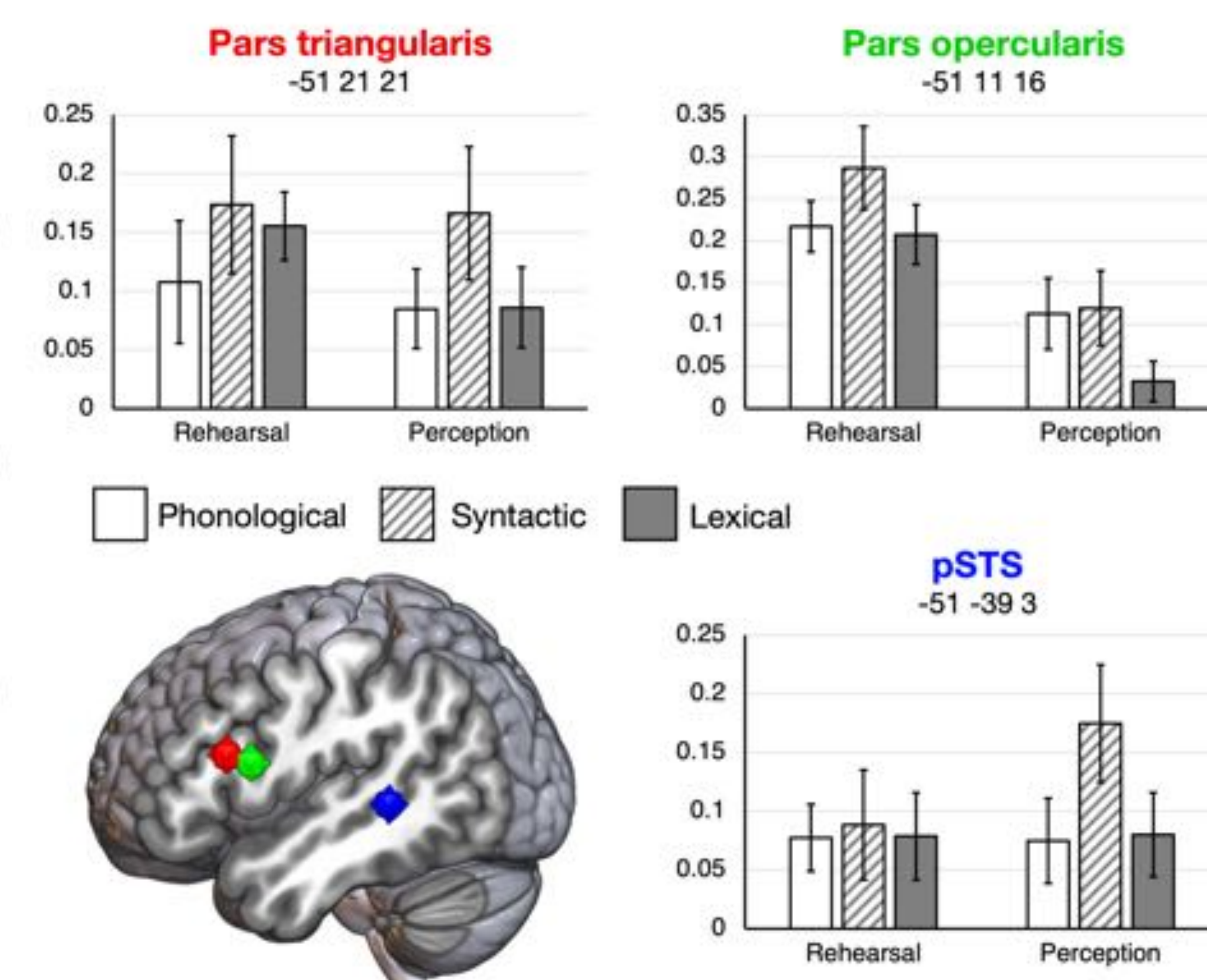
METHODS

- 20 subjects, healthy, right-handed, native speakers of English, no history of neurological dysfunction
- 3 (stimulus content) x 3 (task) design, 30 trials/condition: ^[1,2]
- Stimulus content:**
 - Phonological:* meaningless speech sequences
 - Lexical:* words, no syntax
 - Syntactic:* jabberwocky phrases
- Task:**
 - Perceive+rest:* perceive one stimulus, then blank screen
 - Perceive+rehearse:* perceive one stimulus, subvocally repeat 3 times
 - Continuous perceive:* perceive three different stimuli
- fMRI data and anatomical data preprocessed and statistically analyzed using AFNI, using standard procedures ^[3]

WHOLE BRAIN ANALYSES



ROI ANALYSES



DISCUSSION

- No strong evidence** for selective syntactic WM circuit.
- SMA and other systems: deal with prosodic demands of rehearsing structured material relative to unstructured material?
- Behavioral data indicate increased difficulty in syntactic rehearsal condition, consistent with this.
- Clear distinction** between pars opercularis, pars triangularis, and pSTS:
 - Pars opercularis:* main effect of rehearsal > perception, syntactic > lexical perception effect + *lack of syntactic > phonological perception effect* suggests phonological demands, not syntactic processing
 - Pars triangularis:* weak effect of syntax > phonology consistent with syntactic processing, but need to increase strength and require subjects to rehearse syntax
 - pSTS:* strongly implicated in syntactic processing
- Future studies:
 - Longer rehearsal periods to increase statistical strength of analysis
 - Ensure that subjects rehearse syntactic representations, not just phonological ones

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Behavioral Data

