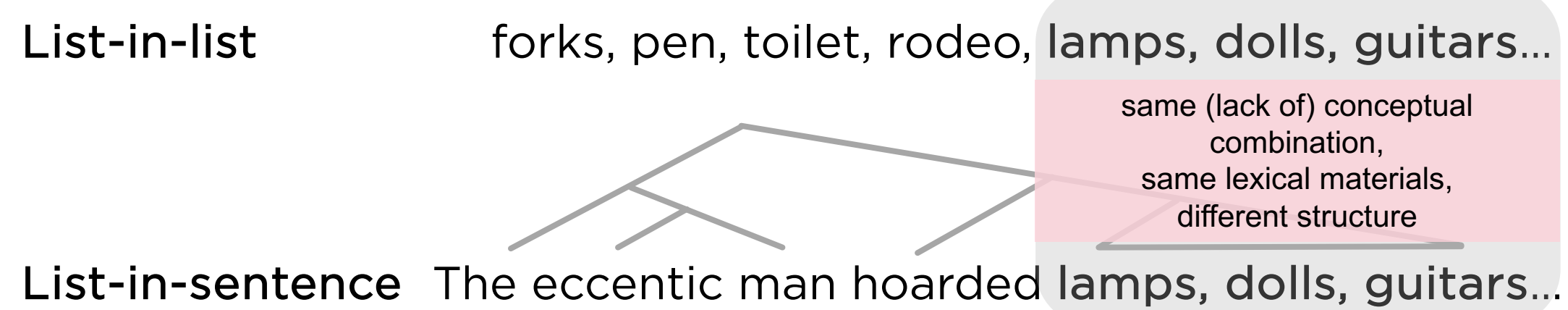


# Lists with and without syntax: Neural correlates of syntactic structure

## INTRODUCTION

- A fundamental challenge for the neurobiology of syntax is de-confounding syntax from semantics
- Our little trick: embedding the same noun lists in longer lists (without structure) and in sentences (with structure)



- Embedded list items were matched in word meaning and local semantic composition (e.g. 'lamps' and 'dolls' don't form a phrase)

## QUESTION

With these robust modulators of brain activity controlled, will correlates of purely structural processing emerge?

## METHODS

- 16 participants read stimuli word-by-word
- Memory probe task at end of each trial
- KIT 208 channel MEG system
- Varied word association (cosine similarity among content word vectors) among words 1-7

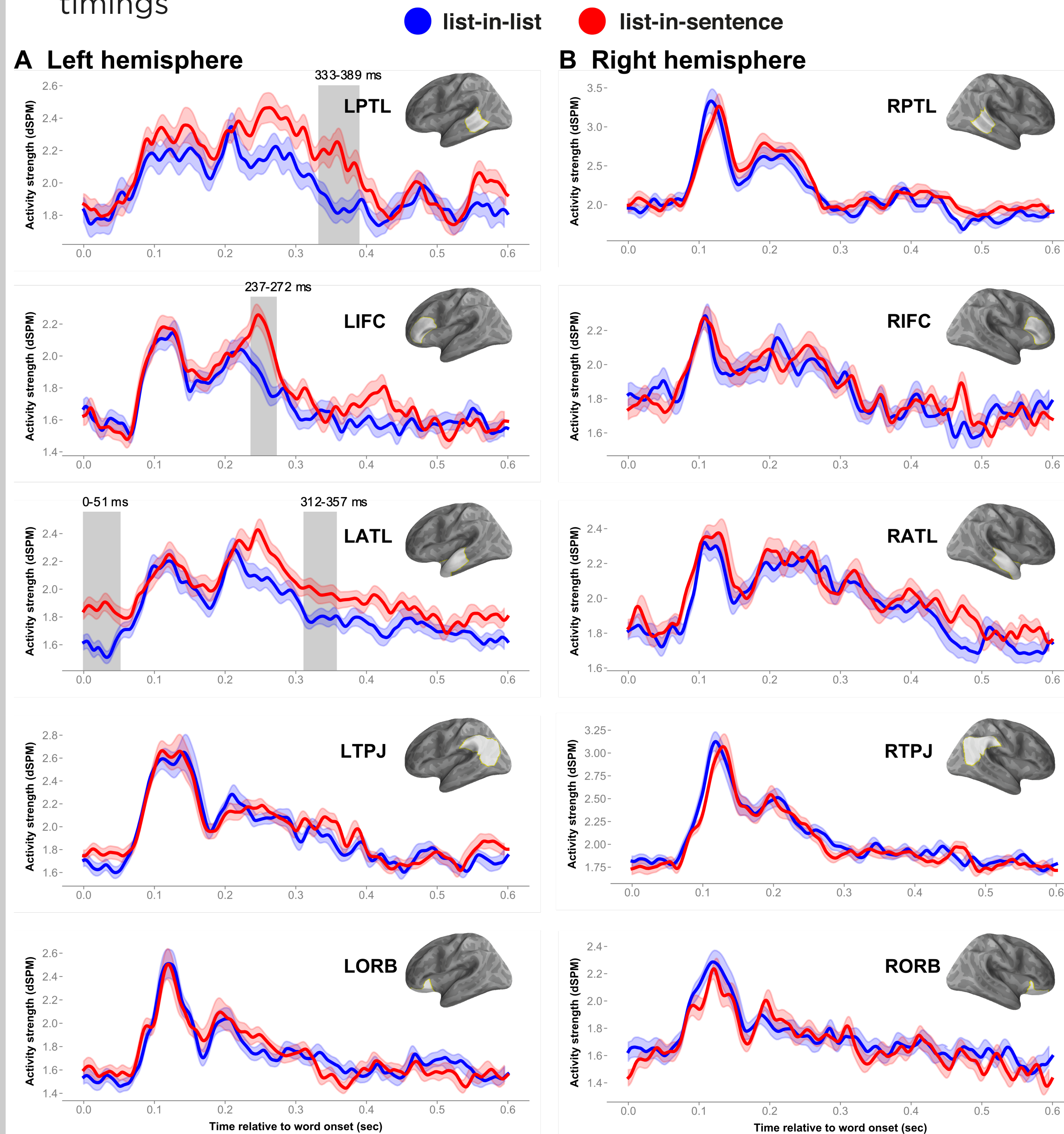
		Words 5-7	
List-in-list Low Assoc	forks pen toilet rodeo	lamps dolls guitars	wood symbols straps
List-in-sent Low Assoc	The eccentric man hoarded	lamps dolls guitars	watches and shoes.
List-in-list High Assoc	theater graves drums mulch	pianos violins guitars	crates knuckle cocoa
List-in-sent High Assoc	The music store sells	pianos violins guitars	drums and clarinets.

## ANALYSIS

- (generalised) linear mixed models on reaction times and accuracy
  - structure reduced RTs ( $\chi^2=44.73^{***}$ ) & improved accuracy ( $\chi^2=20.24^{***}$ )
- Cluster-based permutation tests<sup>[1]</sup> on regions of interest activity across words 5-7 (collapsed)
  - 2X2X3 (structure by association by position) repeated-measures analysis of variance at each time sample

## NEURAL EFFECTS OF STRUCTURE

- The presence of structure increased activity in the left posterior temporal, inferior frontal, and anterior temporal cortices at distinct timings

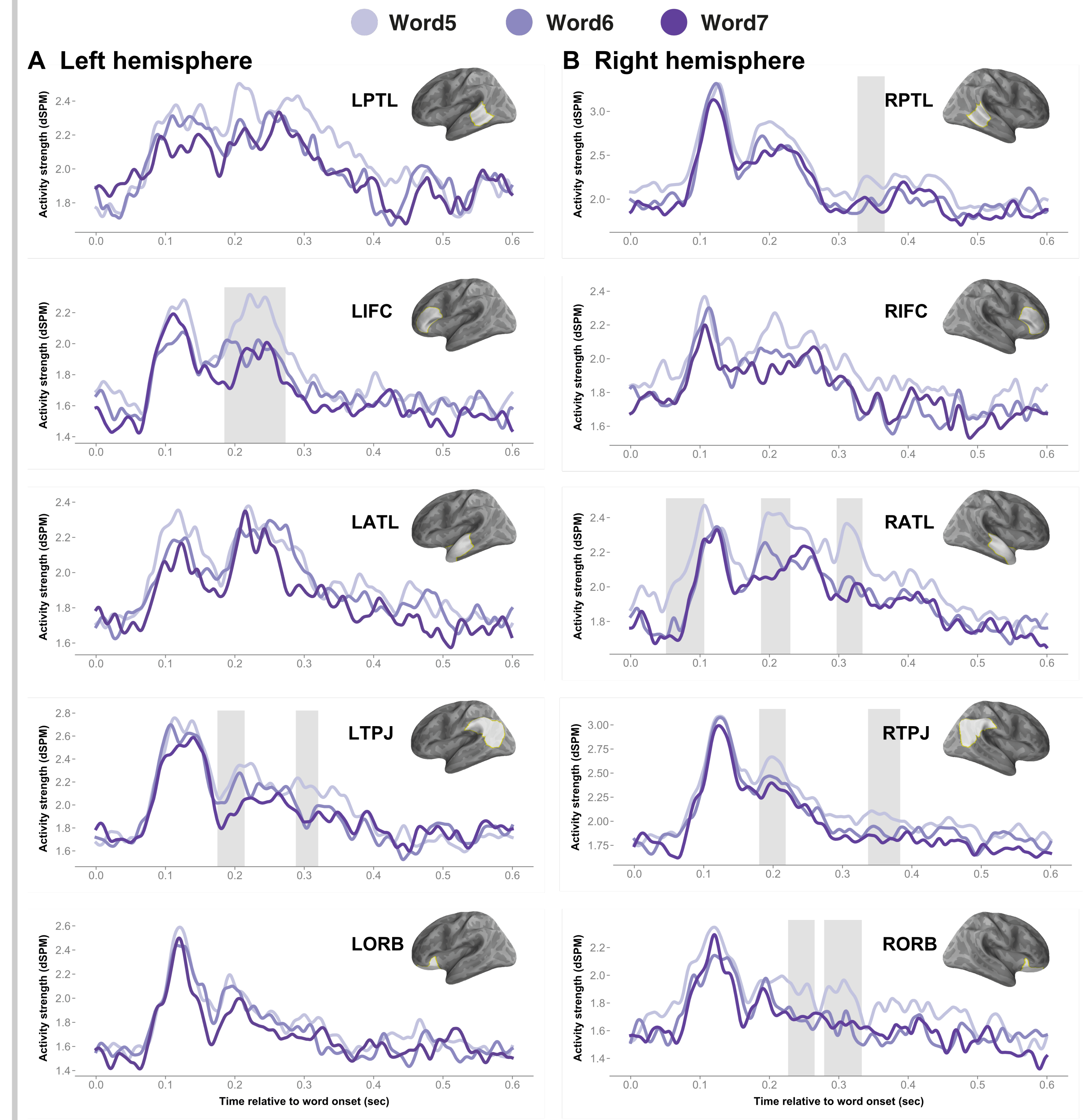


- When including region as a factor, the permutation test revealed a structure by region interaction: only left posterior temporal lobe showed structure effect at ~330-380 ms

## NEURAL EFFECTS OF ASSOCIATION

- Activity increased for more associative items in the left temporoparietal junction relative to less associative items at ~400 ms post word onset
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## NEURAL EFFECTS OF POSITION



## CONCLUSIONS

- The presence of structure is reflected on-line in the left posterior temporal, inferior frontal, and anterior temporal cortices at different time points
- We are able to rule out contributions from word meaning and local semantic composition to activity associated with structure
- Associative based semantic relationships are reflected in the left temporoparietal junction with a (roughly) N400 timing
  - but activity was higher for more associative items<sup>[c.f. 2]</sup>
- Activity increased for word 5 but not words 6 & 7 in general.
  - contra studies that showed activity increased as sentences progressed<sup>[3,4]</sup>