

# Lists with and without syntax: MEG effects of syntactic structure

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## SYNTAX AND SEMANTICS ARE LINKED

- A fundamental challenge for the neurobiology of syntax is to vary syntax while de-confounding semantics.
- The literature has typically used sentences as condition of interest and word lists as unstructured controls.
- A candidate sensitive to structure: **posterior temporal lobe**, when local conceptual combination occurs in both conditions but syntactic merge only in one.<sup>[1]</sup>
- A novel control for semantics: lists can either occur in a sentence (thus with structure) or occur inside longer lists (thus without).

### LIST-INSIDE-SENTENCE

The music store sells **pianos violins guitars...**

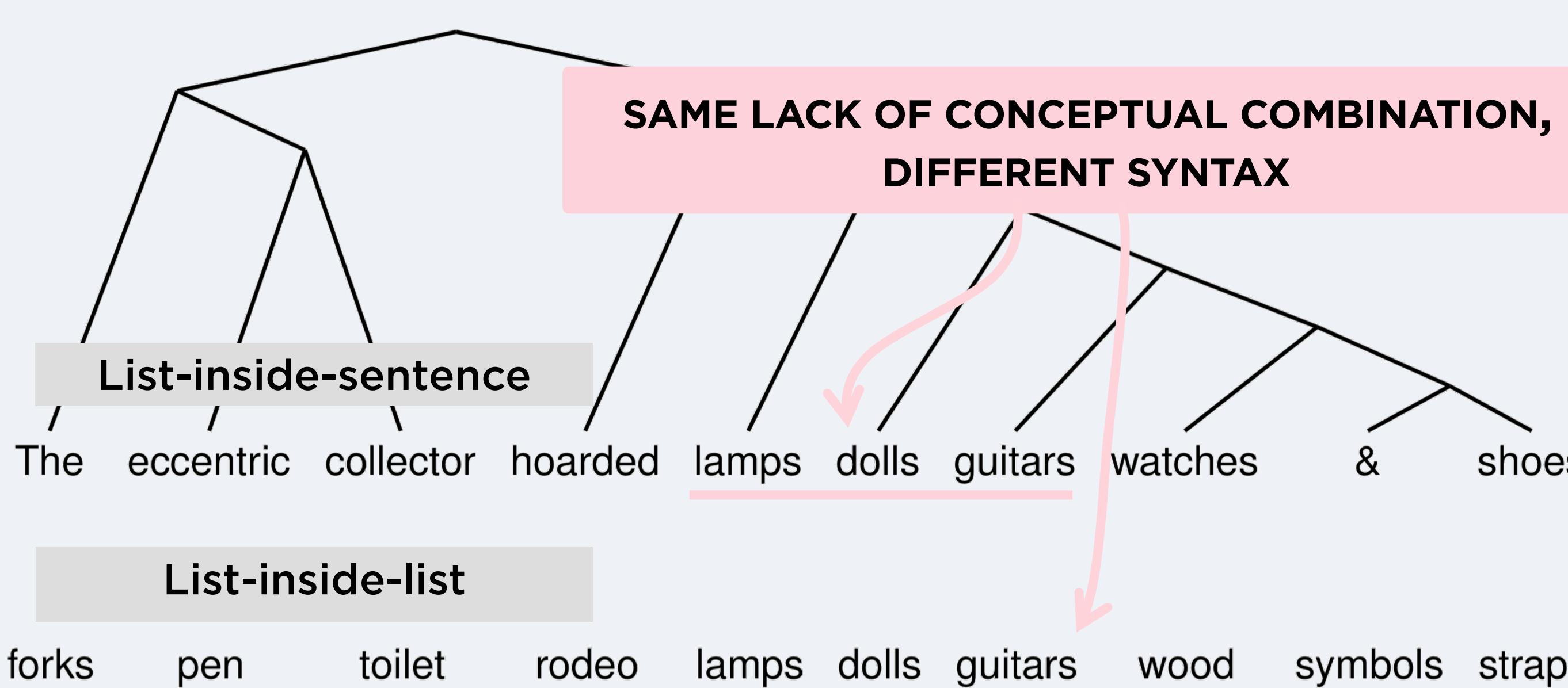
### LIST-INSIDE-LIST

theater graves drums mulch **pianos violins guitars...**

- Here, no conceptual combination among **bold words** in either case, but they are incorporated into a structured representation.

## QUESTION

What are the neural correlates of syntactic structure when there are no local combinatorics?



References ► [1] Flick & Pylkkänen (2018) [2] Bozic, Tyler, Ives, Randall, & Marslen-Wilson (2010) [3] Friederici (2011) [4] Pylkkänen, Oliveri, & Smart (2009)

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<https://github.com/rylaw/wrdlst>

## METHOD

**Stimuli** ► Word association among words 1-7 (as Latent Semantic Analysis scores) also varied.

	Words 1-4	Word5	Word6	Word7	Words 8-10
High Sent	The music store sells	pianos	violins	guitars	drums & clarinets.
High List	theater graves drums mulch	pianos	violins	guitars	crates knuckle cocoa
Low Sent	The eccentric collector hoarded	lamps	dolls	guitars	watches & shoes.
Low List	forks pen toilet rodeo	lamps	dolls	guitars	wood symbols straps

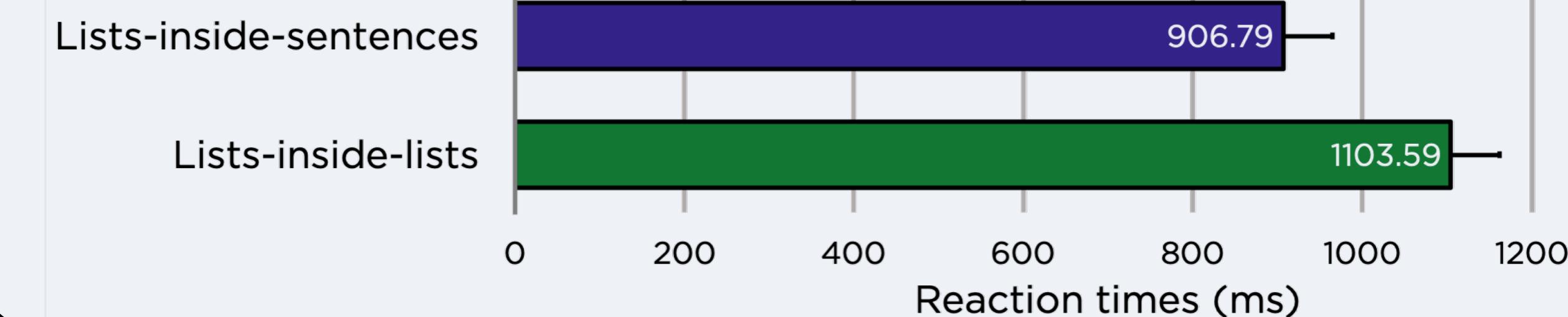
End of trial memory probe; 19 native English speakers

**Cluster-based permutation analyses across words 5-7**

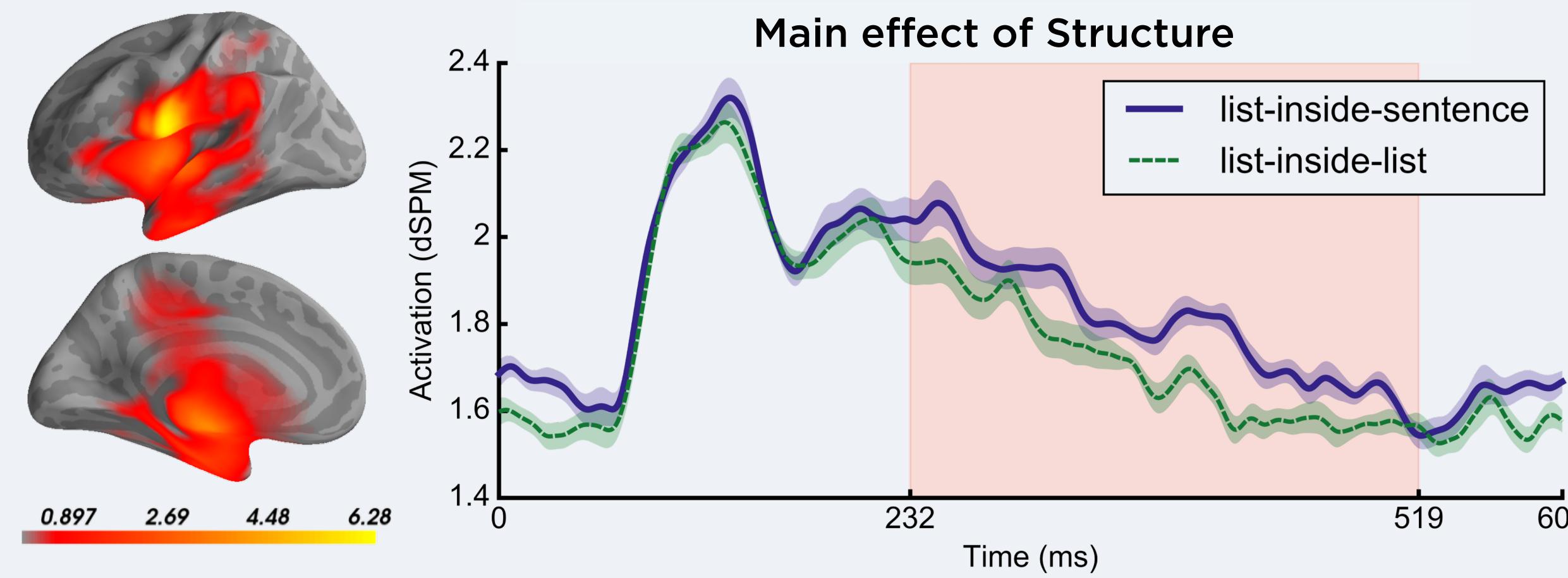
- whole brain spatiotemporal analysis + region of interest (ROI) analyses

## BEHAVIOURAL RESULTS

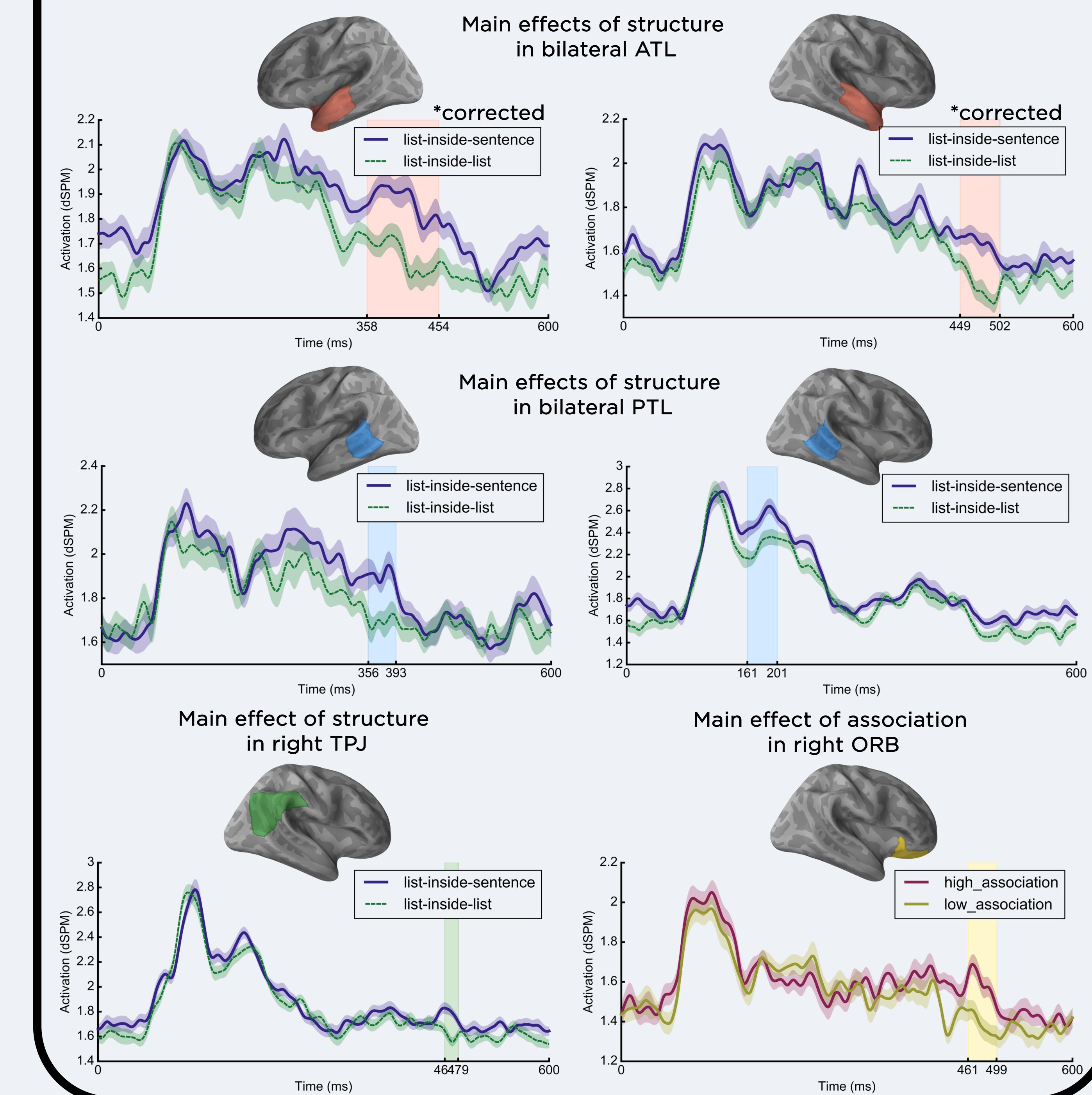
(all  $p$ -values reported here are  $< 0.05$ )



## WHOLE BRAIN SPATIOTEMPORAL ANALYSIS



## REGION-OF-INTEREST ANALYSES



## DISCUSSION

- Activity increased when words occurred in syntactic structures relative to unstructured lists.
- This increase was also observed in the right hemisphere.
- Lexical semantics and local combinatorics cannot account for these bilateral effects.<sup>(cf. [2] or [3])</sup>
- Word association did not modulate behavioural responses but activity in the right orbitofrontal cortex – possibly reflect evaluation of content for semantic composition.<sup>[4]</sup>

## FOLLOW UP QUESTION

Is global semantic context driving these effects?