

Introduction

- 1- What is the neurobiology of our ability to create an infinity of conceptual representations from the basic building blocks of language?
- 2- A broad methodologically diverse and internally consistent body of work strongly implicates the LATL as a basic site for semantic combination.
- 3- However the work on semantic combination has been quite focused on one particular domain: the adjectival modification of nouns.
- 4- When trying a different type of combination, del Prato and Pykkänen (2014) found that semantic composition but not numerical quantification elicit activity in this region.
- 5- Thus three possibilities arise:
 - a) The combination of two clear content words is required.
 - b) The modification by a content word is required.
 - c) The computations underlying numerical quantification in particular are not a valid combinatorial process.
- 6- The goal of the experiment:

Characterize which specific computations engage the LATL

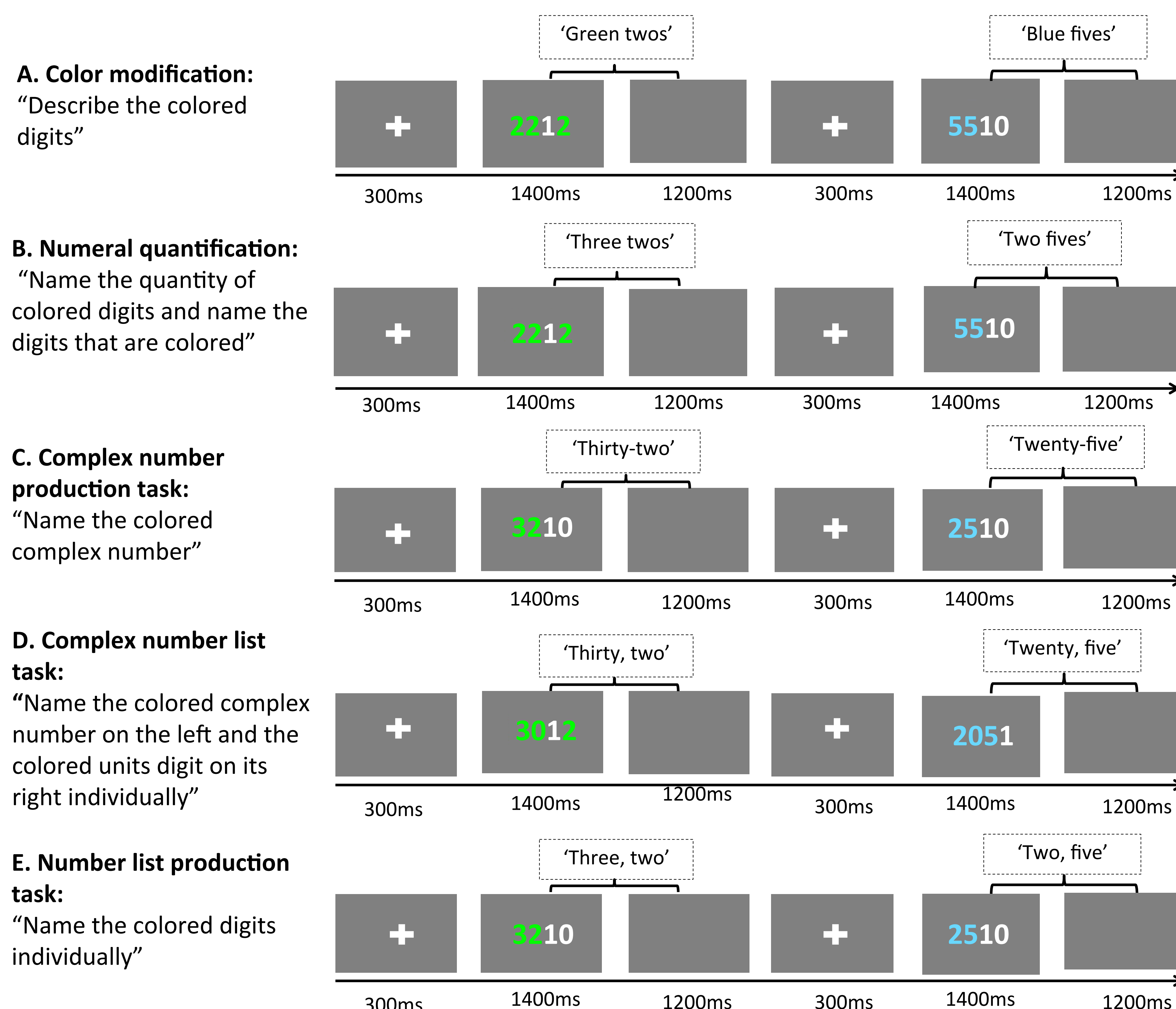
AND

which elements are valid as input to create these complex conceptual representations.

7- MEG activity was analyzed in areas previously implicated in combinatory processes, including the left anterior temporal lobe (LATL), the ventro-medial prefrontal cortex (vmPFC), the left inferior frontal gyrus (LIFG) and the angular gyrus (AG).

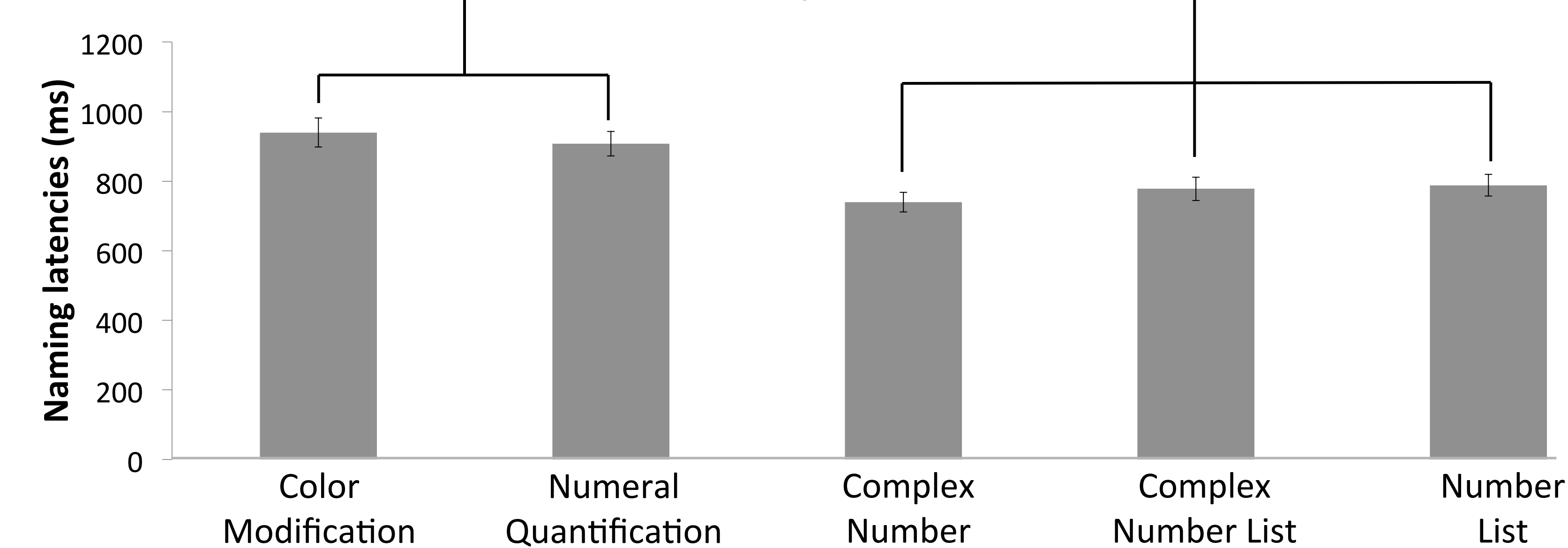
Materials and Methods

- 25 right-handed English native speakers.
- Continuous MEG data acquired during experimental session, 208 sensor array.
- Acquisition recording band 0-200Hz, sampling rate of 1000 Hz.
- Five conditions partitioned by block; pre-empted with **condition-specific instruction**.



Behavioral Results

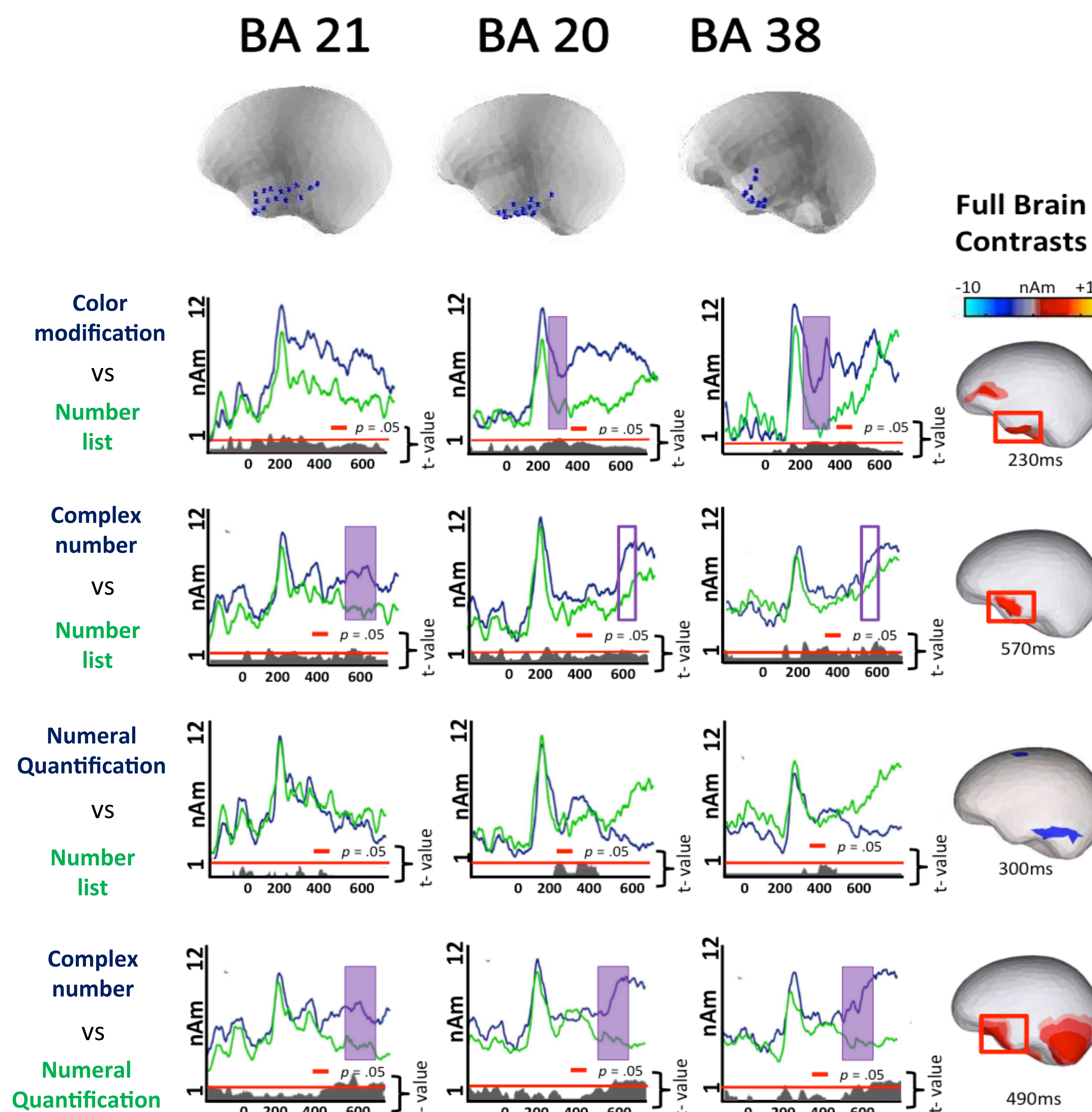
1 x 5 ANOVA:



ROI analyses: LATL

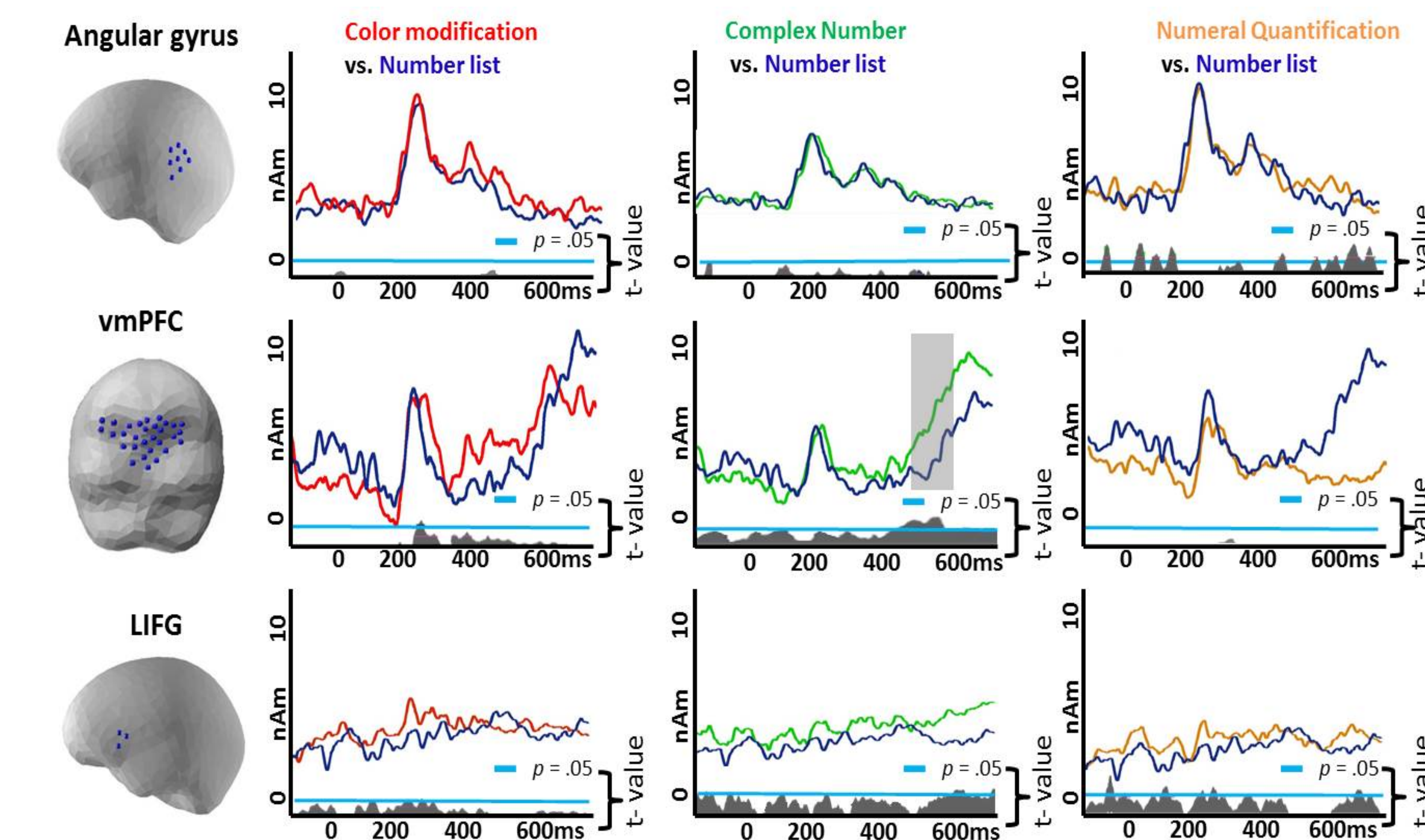
- **Pairwise comparisons.**
- **Time intervals:** 150:400 and 400:600ms.
- **Shaded regions** indicate that the difference in activity between the two tested conditions was significant at a $p = .05$ value (corrected), while the boxed region indicates marginally significant effects ($p < .1$)

Composition effects in the LATL



ROI analyses: Switching in Comprehension

- **Pairwise comparisons:**
- **Time intervals:** 150:400 and 400:600ms.
- **Shaded regions** indicate that the difference in activity between the two tested conditions was significant at a $p = .05$ value (corrected).



Conclusions

- The engagement of the LATL is determined by the computations underlying the performed combinatorial process as opposed to the nature of the input items.
- This finding suggests that the LATL is not a general purpose combiner of meanings but rather specializes in some version of **conceptual combination**.
- This conceptual combination is potentially delimited to situations where one combining element characterizes a property of the other.
- The finding of combinatorial activity for our complex number condition conforms to theories suggesting that complex numbers undergo a composition process before being produced as opposed to being holistically processed and retrieved.



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