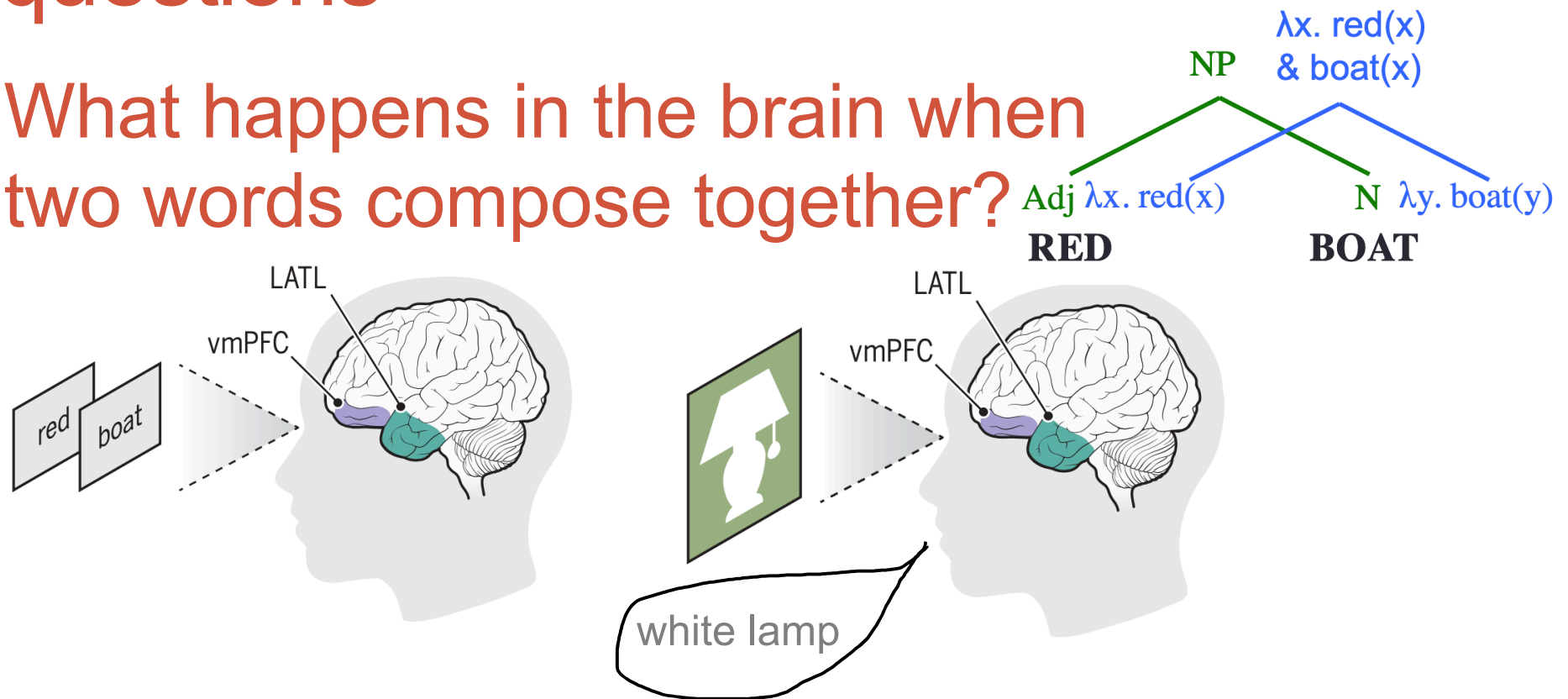


2 questions

1. What happens in the brain when two words compose together?



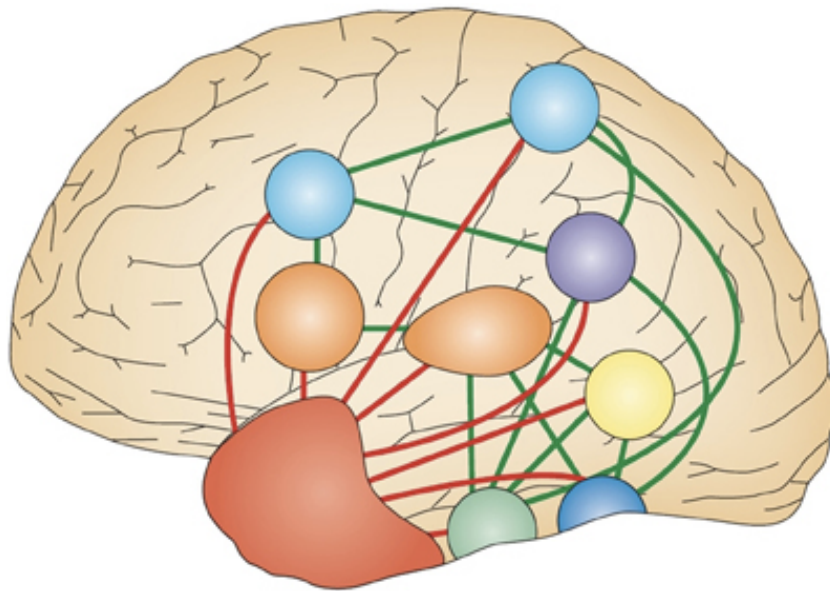
2. What specific computations do the identified effects reflect?

- What hypotheses can we rule out?

LATL (left anterior temporal lobe)

How do LATL composition effect related to effects of conceptual specificity in the same region?

- LATL as a “semantic hub,” binding together features from various cortical locations.



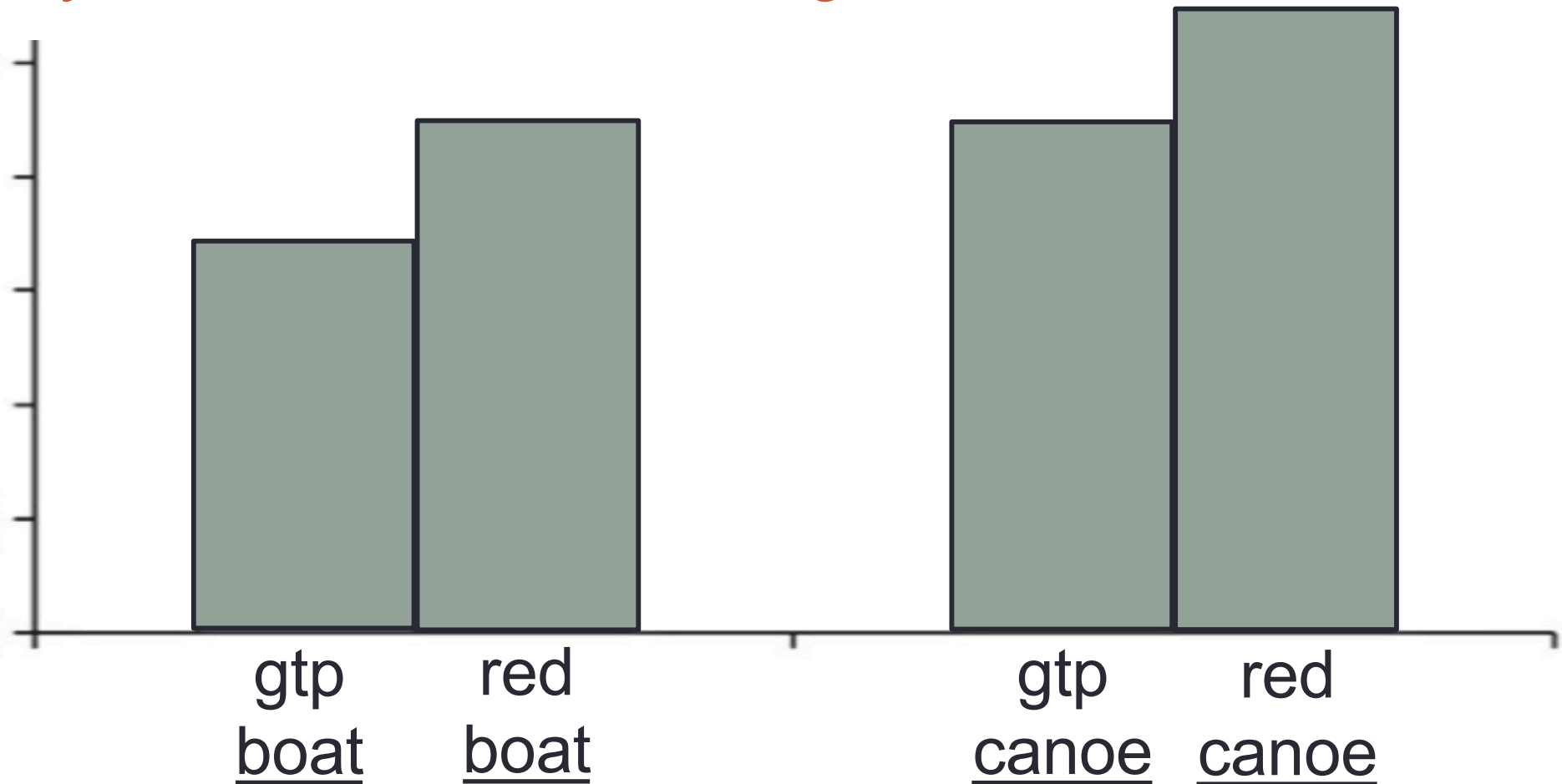
Patterson et al. 2007

apple → fruit → thing
poodle → dog → thing
sofa → furniture → thing

- LATL atrophy commonly causes loss of specificity in one’s semantic knowledge (semantic dementia).

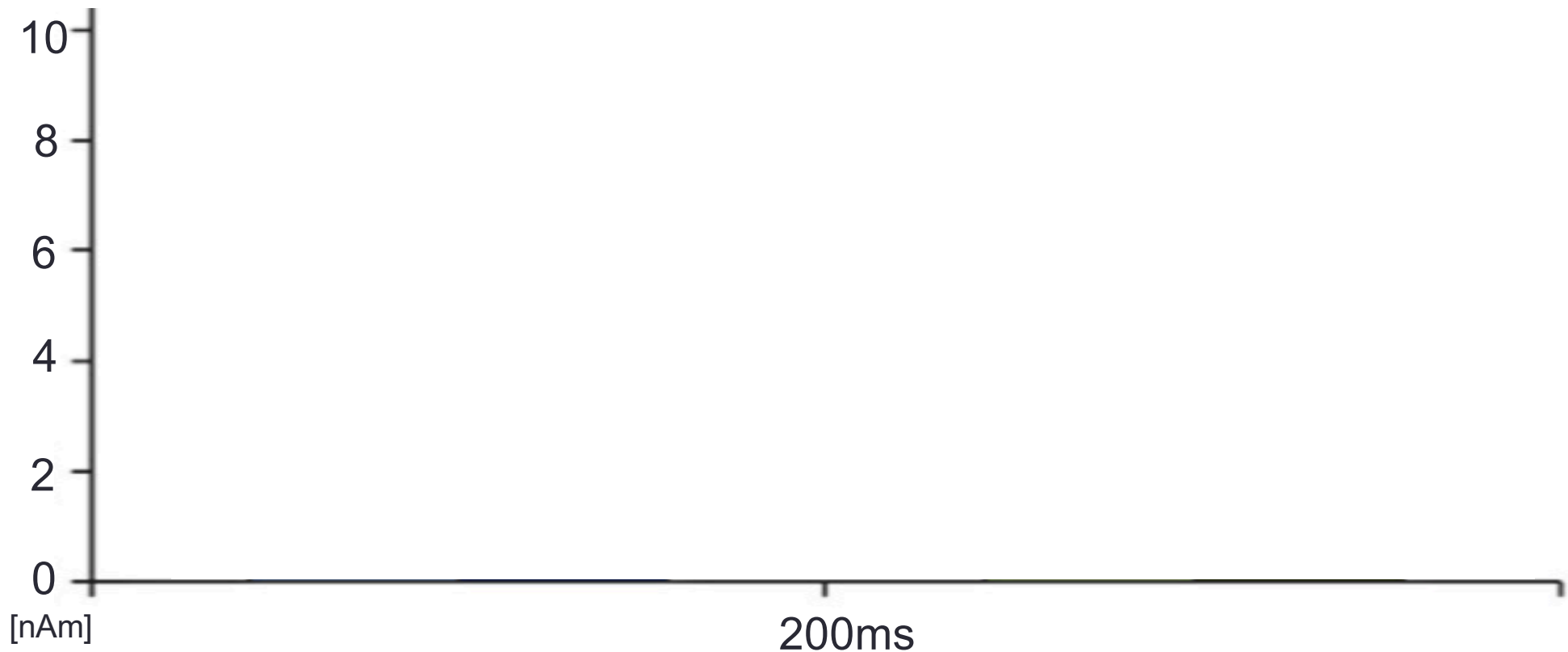
Does the LATL simply reflect the conceptual specificity of the current representation?

If yes, we should find something like this:



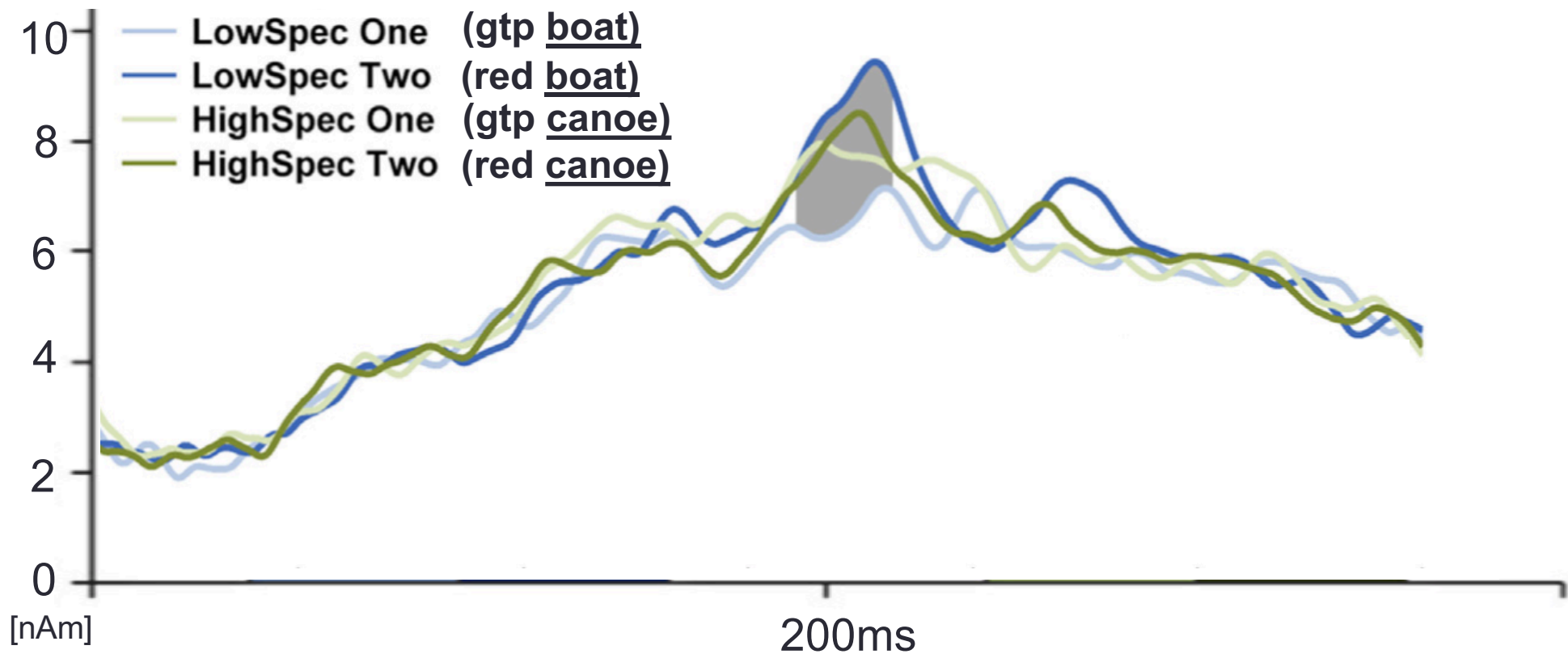
Does the LATL simply reflect the conceptual specificity of the current representation?

Actual pattern (Westerlund & Pylkkänen, 2014):



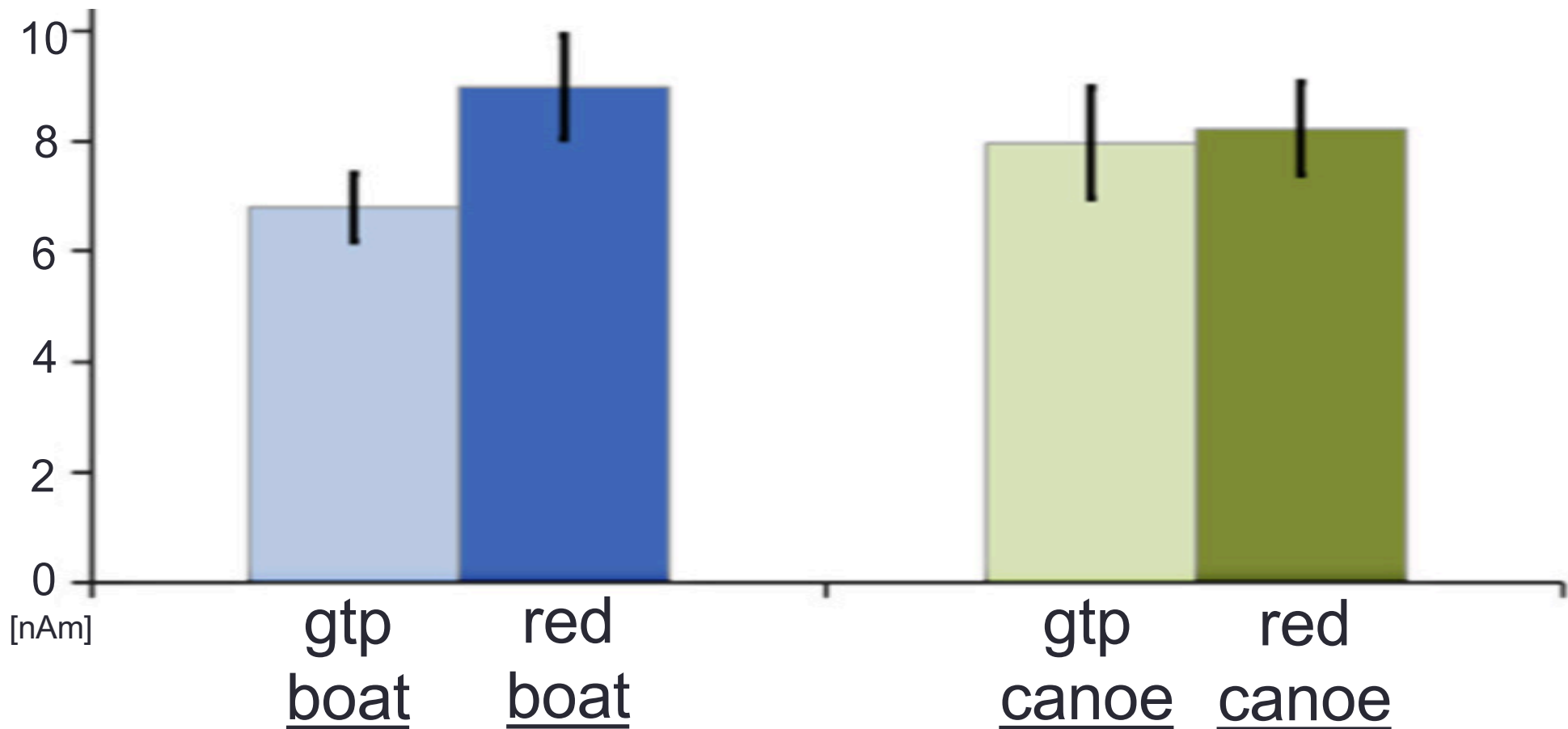
Does the LATL simply reflect the conceptual specificity of the current representation?

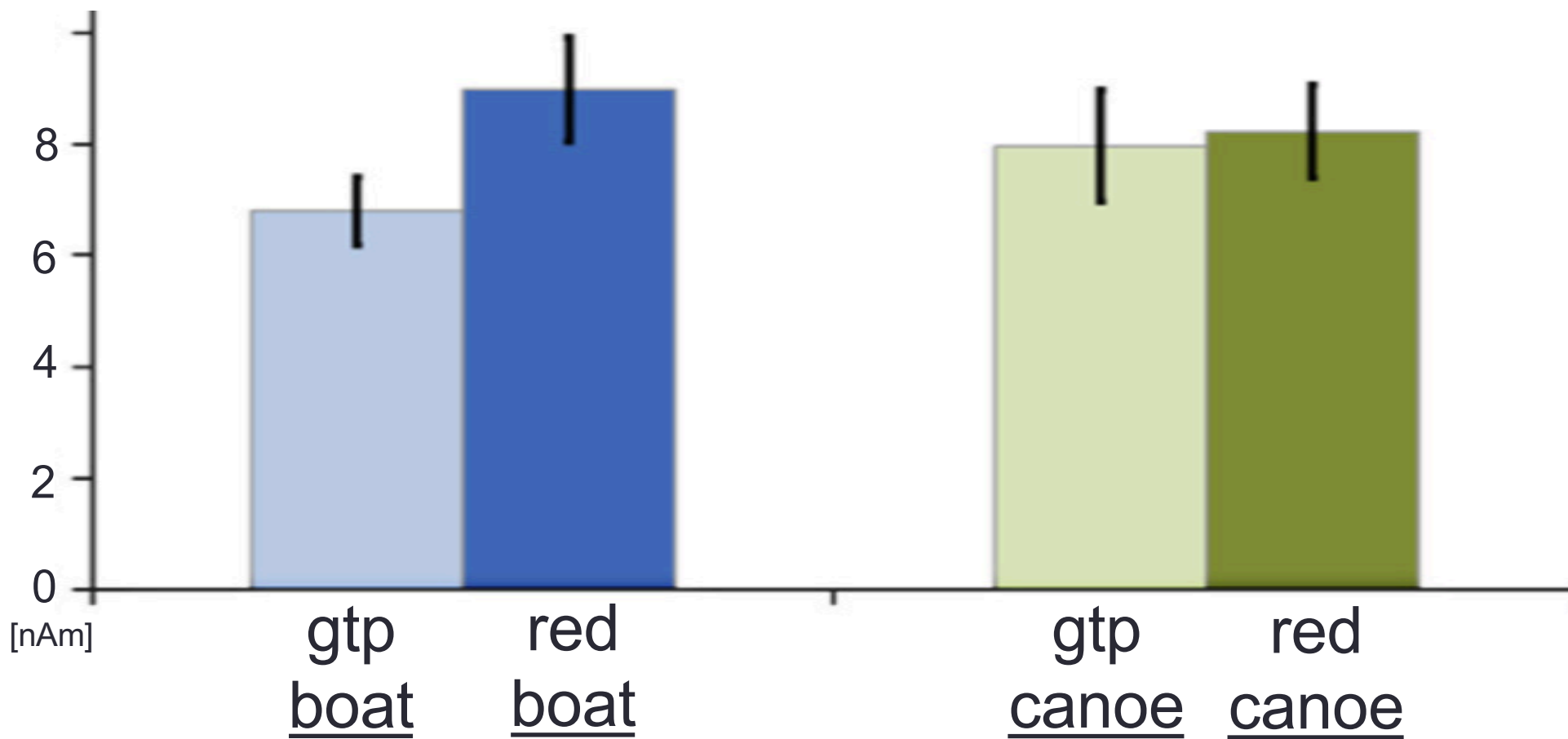
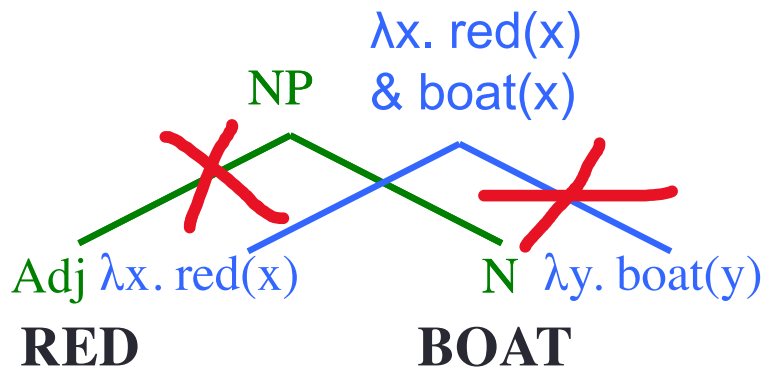
Actual pattern (Westerlund & Pylkkänen, 2014):

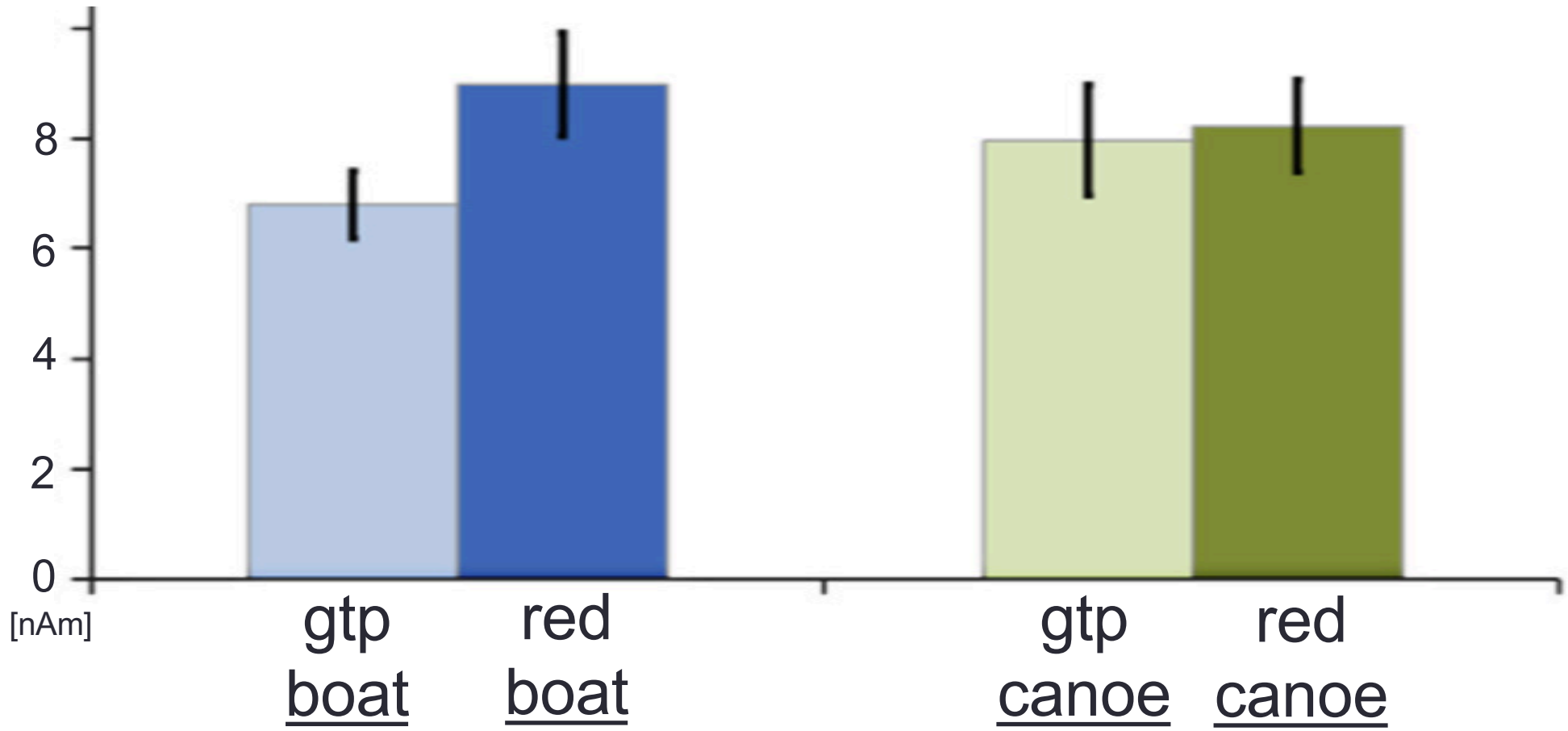
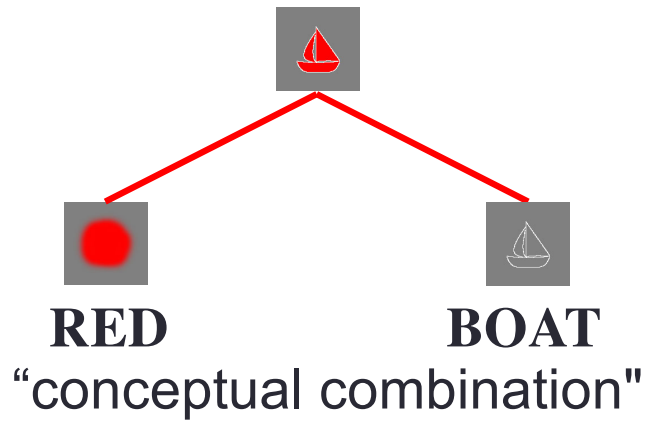


Does the LATL simply reflect the conceptual specificity of the current representation?

Actual pattern (Westerlund & Pylkkänen, 2014):





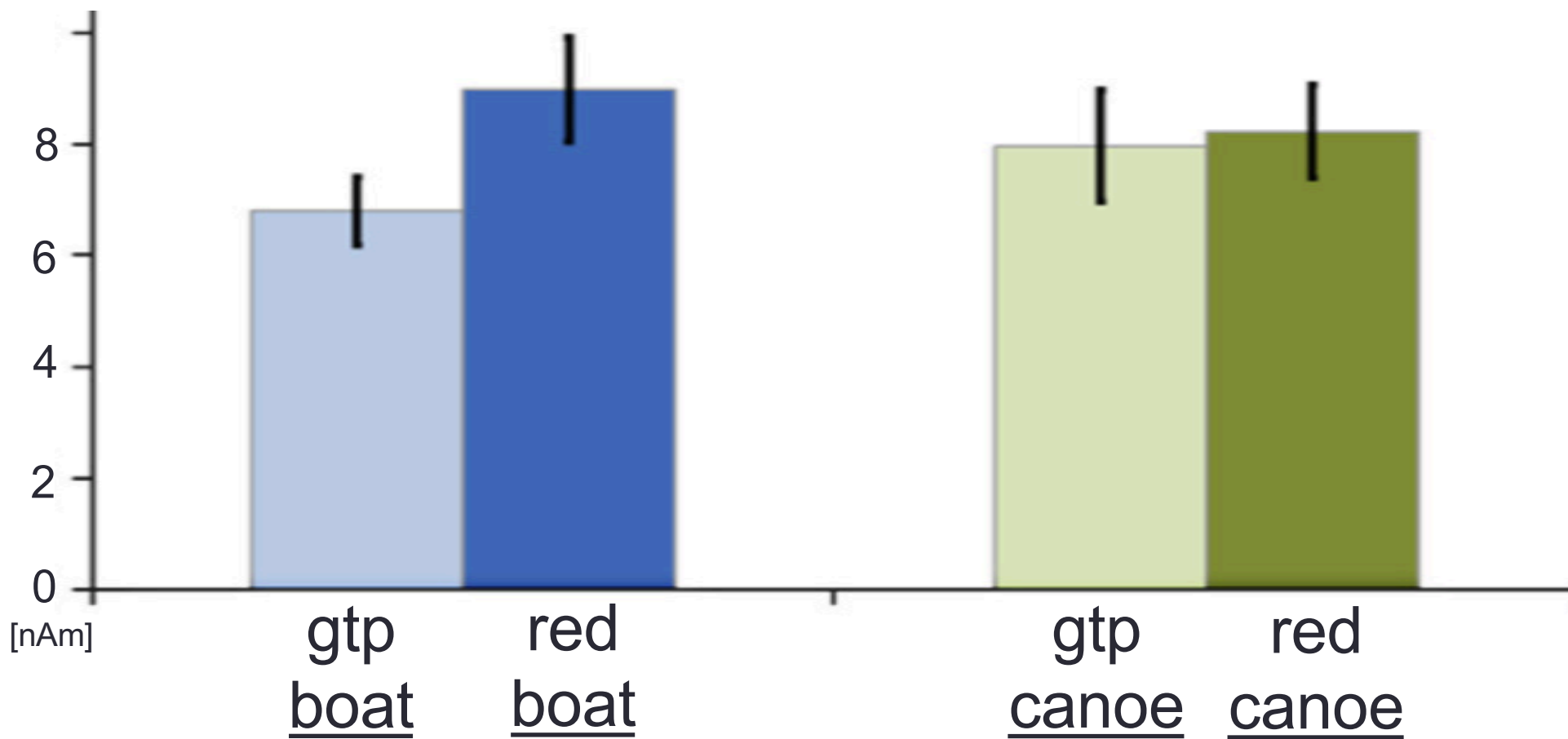


Measurable LATL effect

No measurable LATL effect

red boat

red canoe

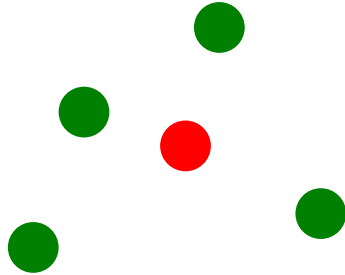


Measurable LATL effect

No measurable LATL effect

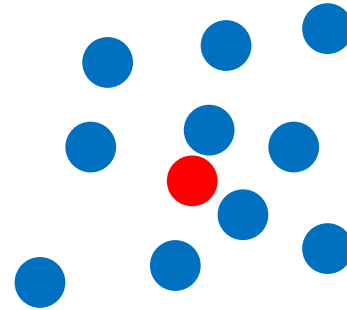
red boat

Varying head noun specificity



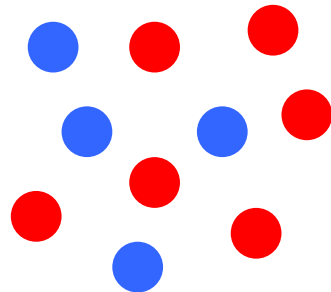
red canoe

More specific head noun decreases the composition effect



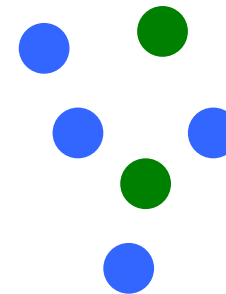
tomato dish

Varying modifier specificity



vegetable dish

More specific modifier increases the composition effect

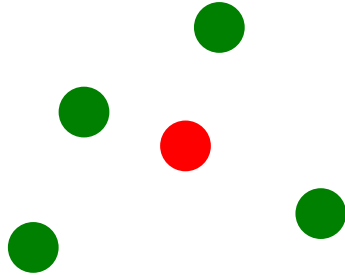


Measurable LATL effect

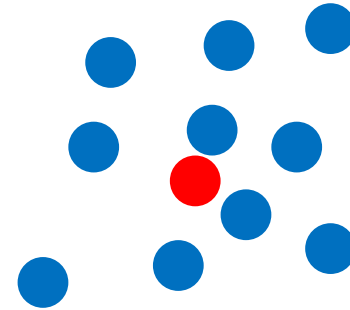
No measurable LATL effect

red boat

Varying head noun specificity



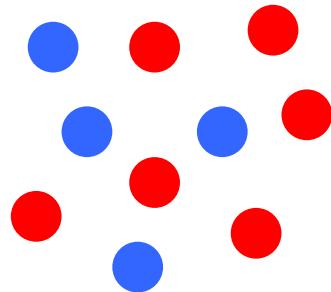
red canoe



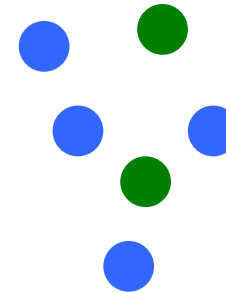
More specific head noun decreases the composition effect

tomato dish

Varying modifier specificity



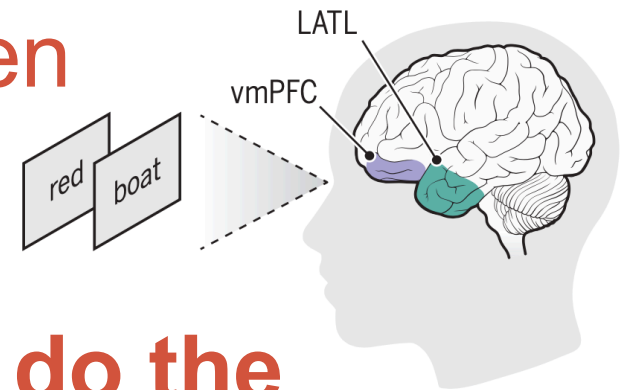
vegetable dish



More specific modifier **increases** the composition effect

2 questions

1. What happens in the brain when two words compose together?



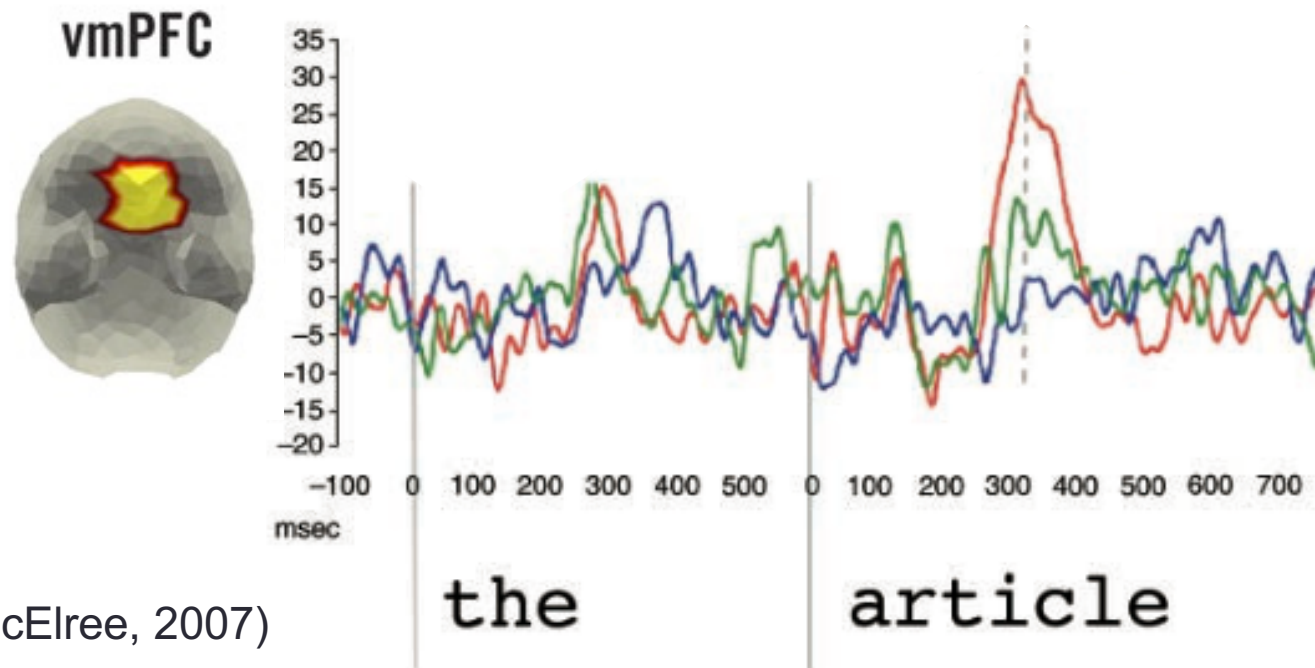
2. **What specific computations do the identified effects reflect?**

- What hypotheses can we rule out?
 - LATL (200-250ms): Syntactic and logico-semantic composition ruled out. Computation driven by the conceptual properties of the input items.
 - vmPFC?

vmPFC

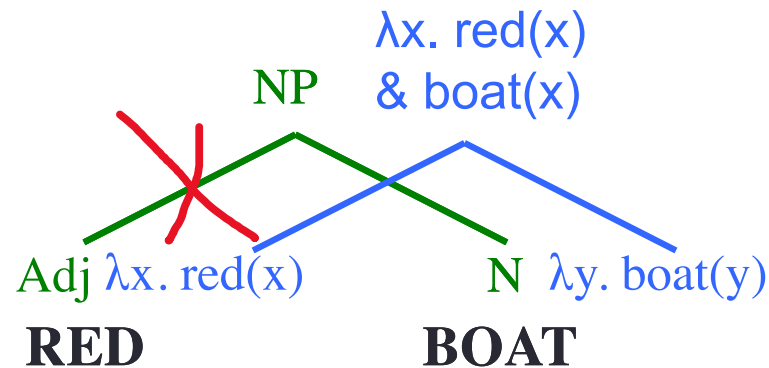
- If we keep syntactic structure constant (*at least superficially*), and vary the number of semantic steps that are needed for interpreting an expression, the vmPFC shows an increased signal when there are more steps.

- Coercion: The author began the article
- Control: The author write the article
- Anomalous: The author pleased the article.



(Pylkkänen & McElree, 2007)

vmPFC



- More generally, the vmPFC figures in almost every sub-literature within the cognitive neurosciences: semantic cognition, affect, reward, decision making, social cognition, etc. etc..
- Whatever its role in language, is it most likely an instance of a more general computation observed in many domains.
- Since the activity is relatively late (~400ms in comprehension) it may represent the final output of the entire combinatorial processing stream in a region connected to broader systems of social cognition and episodic memory (speculation!).

Non-syntactic
combinatory
hubs



LATL
combinatory
effects
(conceptual)

vmPFC
combinatory
effects



PTL
combinatory
effects
(syntax?)

LIFG

AG
sensitivity
to
argument
structure

