

Single and multiple object tracking in event comprehension

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INTRODUCTION

When an object changes state during an event, a conflict response is observed in left ventrolateral prefrontal cortex (VLPFC) ^{1, 2}

The more an object changes in state, the greater the conflict response in VLPFC.



QUESTION

Is this conflict between two **mutually exclusive states** of a single object? Or is this competition between similar sets of features?

PREDICTION

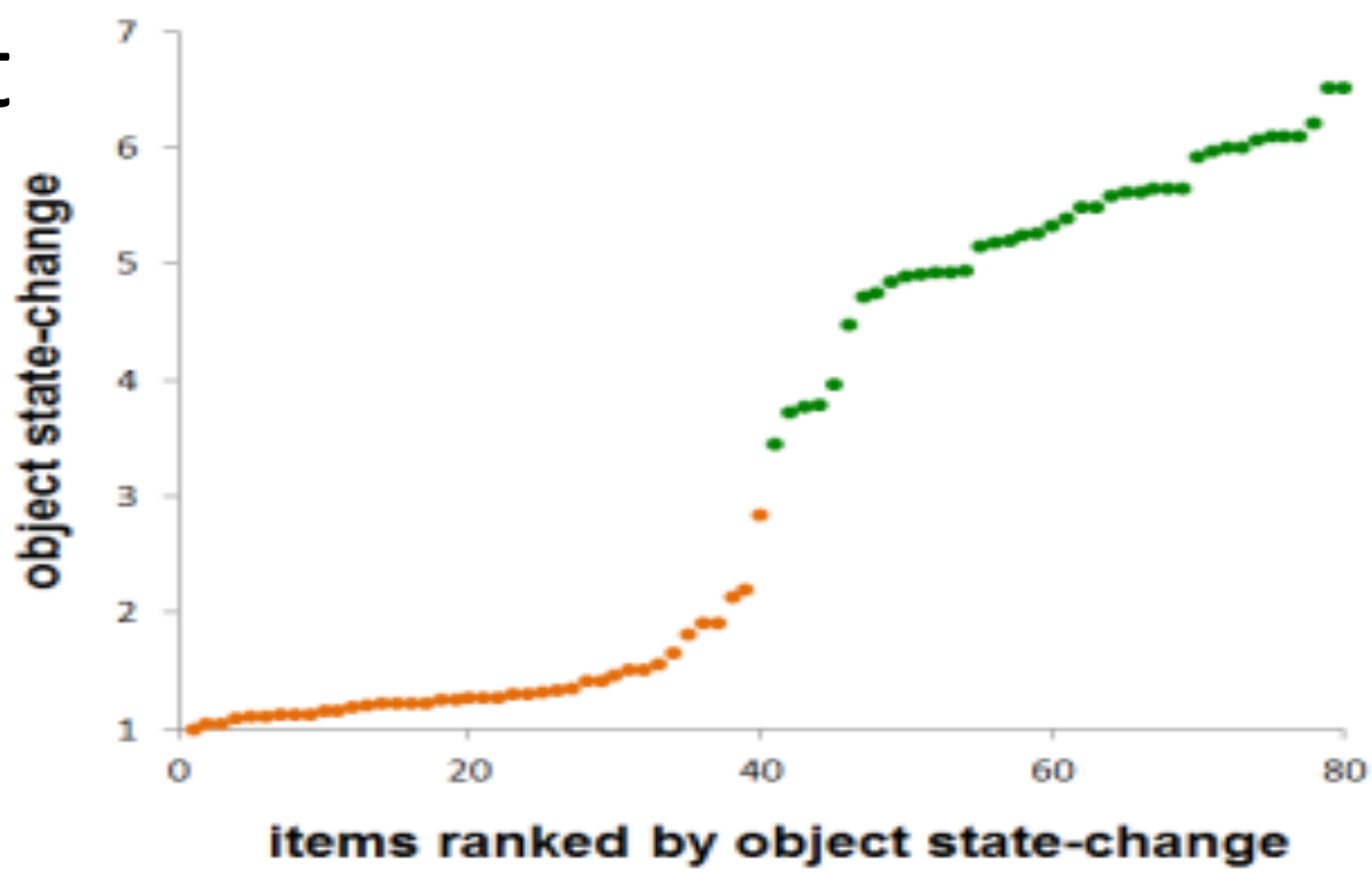
If the conflict response in left VLPFC during event comprehension is due to competition between mutually exclusive states of a single object, we should find an effect of object state change in events involving a single object, but not in events involving two different exemplars of the same category.

EVENT COMPREHENSION TASK

Subjects (N=24) read events that involve a **MINIMAL CHANGE** or a **SUBSTANTIAL CHANGE** to an object.

At the end of the event, subjects have to retrieve

- 1.) the **SAME** object involved in the event
- 2.) **ANOTHER** object of the same category OR
- 3.) a **DIFFERENT** object from a different category.



Ex. **MIN-SAME**: The woman will **pick up** an apple. And then, she will smell **the apple**.
Ex. **SUB-OTHER**: The woman will **bite** an apple. And then, she will smell **another apple**.
Ex. **SUB-DIFF**: The woman will **bite** an apple. And then, she will smell **a grapefruit**.

STROOP TASK

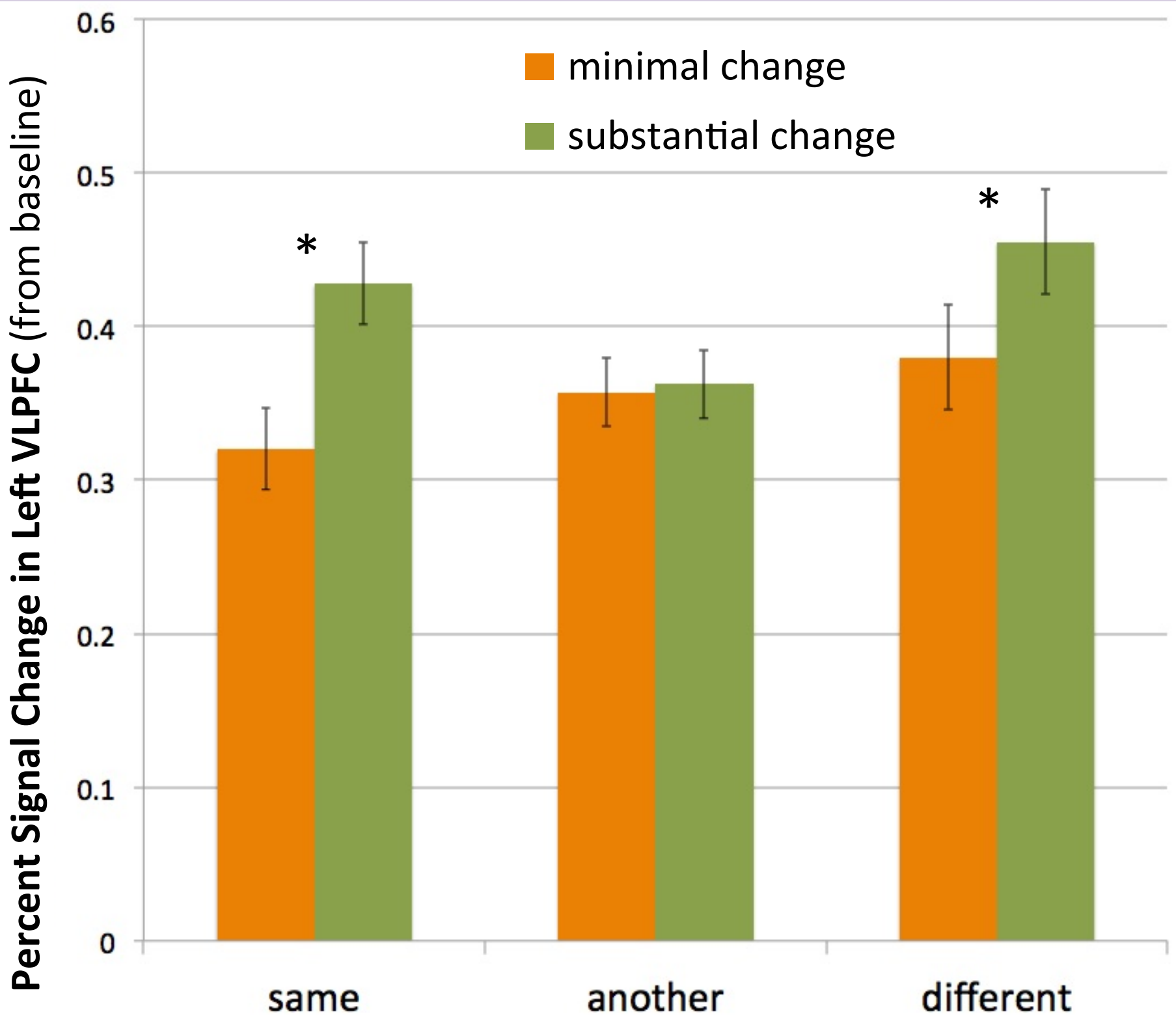
Subjects also completed a Stroop task, in order to isolate voxels in left VLPFC that are sensitive to semantic conflict.

**RED
ORANGE
BLUE
PURPLE
GREEN**

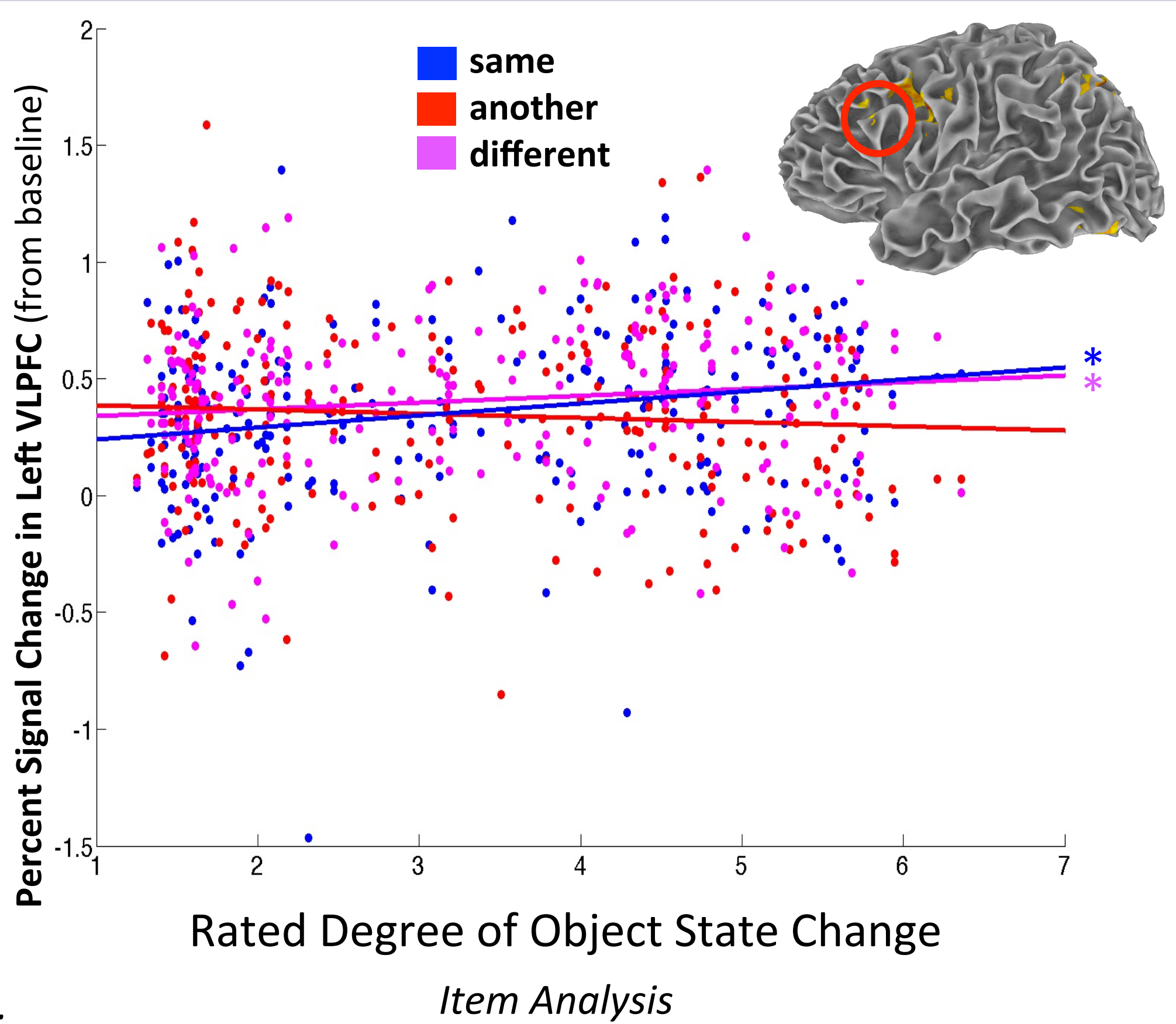
REFERENCES

1. Hindy, N.C., Altmann, G.T., Kalenik, E., & Thompson-Schill, S.L. (2012). The Journal of Neuroscience.
2. Hindy, N.C., Solomon, S.H., Altmann, G.T.M., & Thompson-Schill, S.L. (2013). Cerebral Cortex.

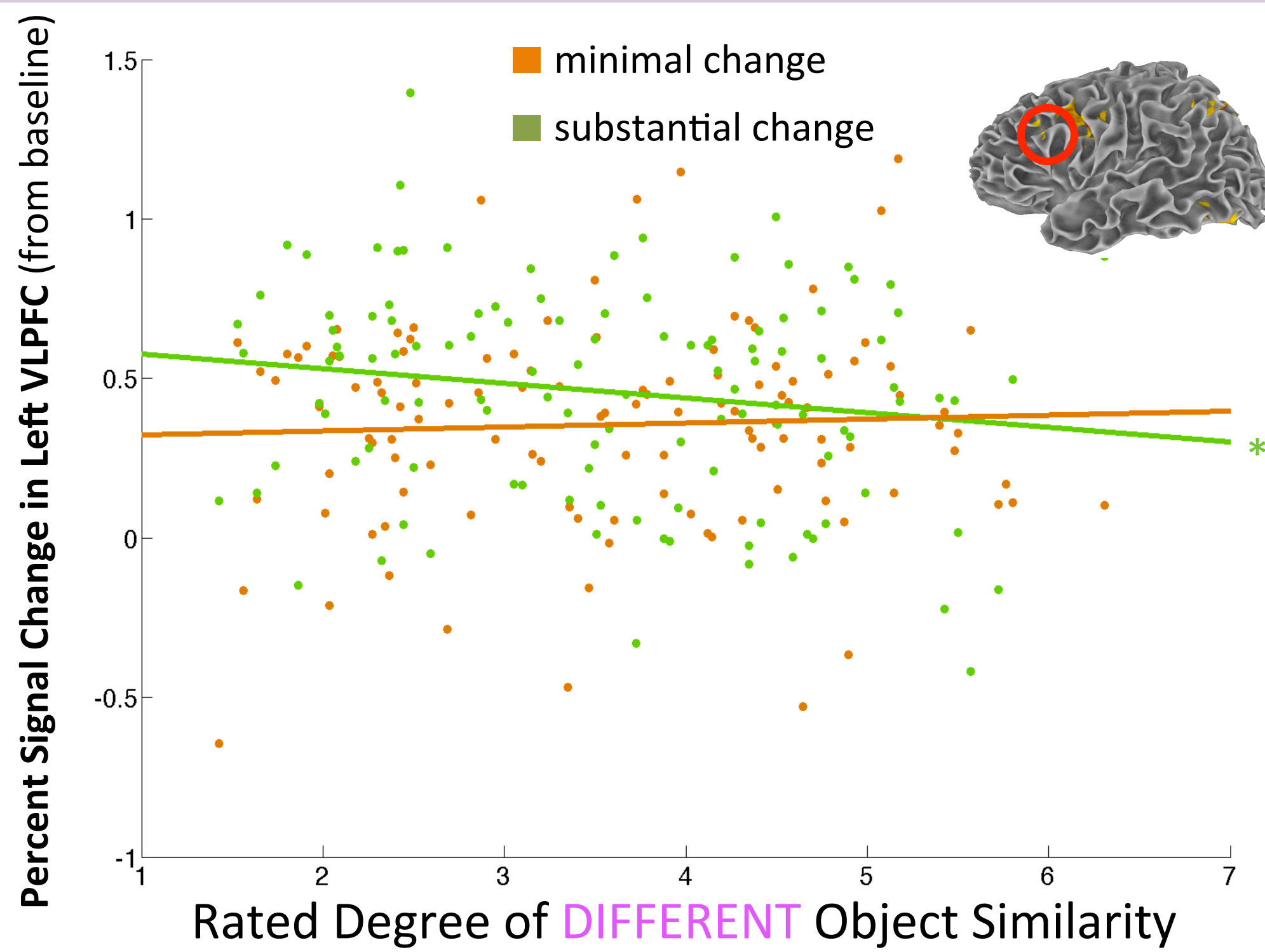
OBJECT IDENTITY MATTERS IN FRONTAL CORTEX



Degree of state change significantly affected VLPFC response in the **SAME** but not the **ANOTHER** condition, supporting the mutual exclusivity hypothesis.



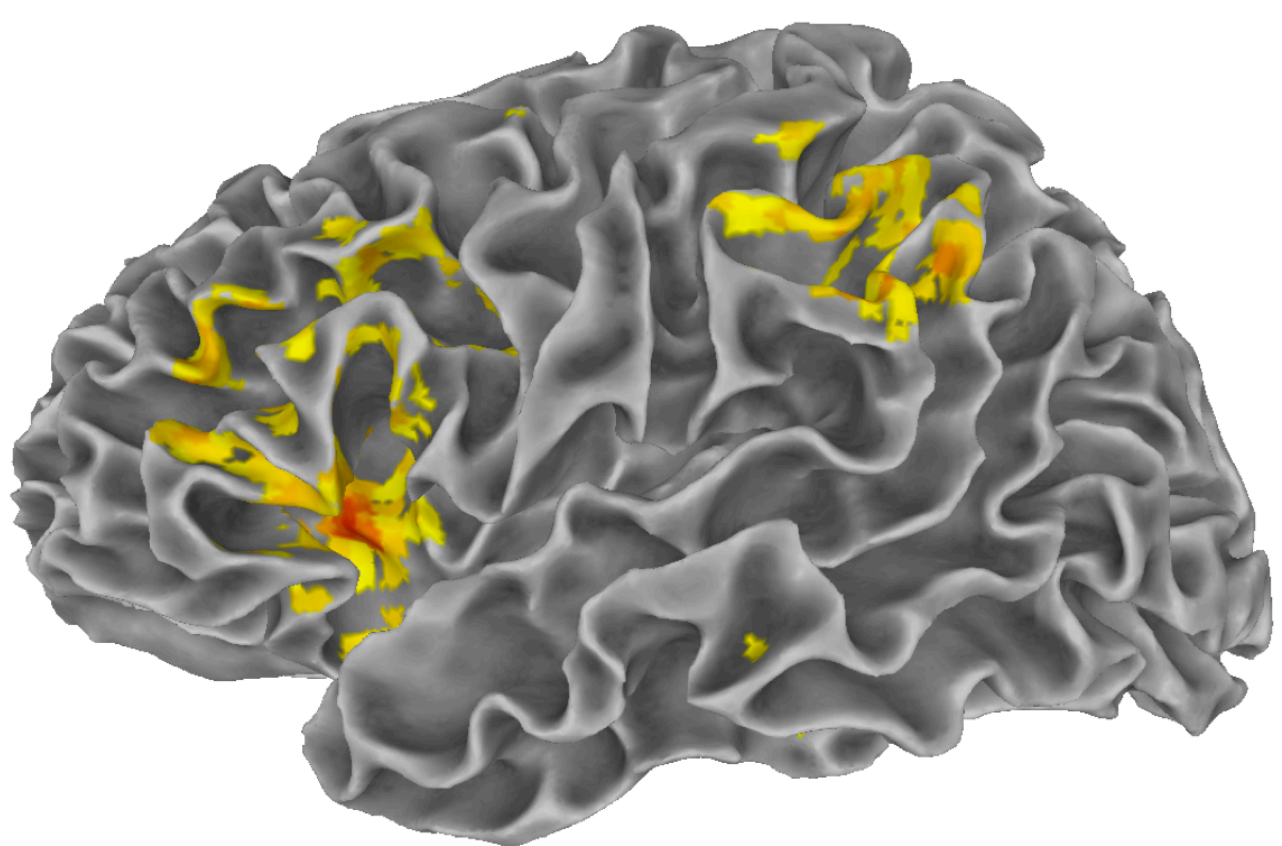
OBJECT SIMILARITY



The more dissimilar two objects are, the more the conflict response in VLPFC. But only when the first object substantially changes in state.

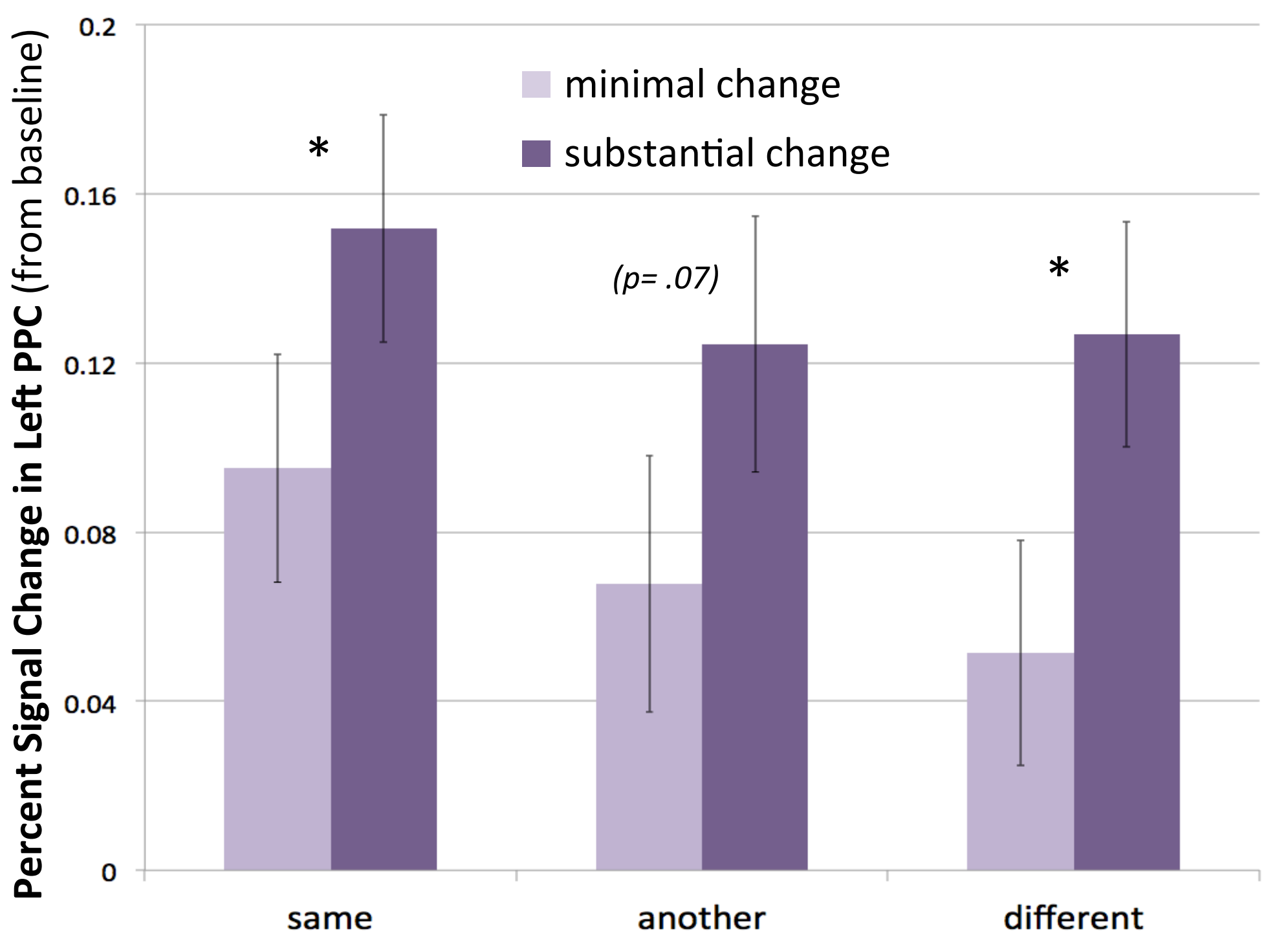
WHOLE-BRAIN ANALYSIS

What other regions are sensitive to object change?



Left parietal cortex emerged as sensitive to a **SUBSTANTIAL > MINIMAL** change contrast (collapsed across object-type). This region has also emerged in previous object state change studies ^{1,2}

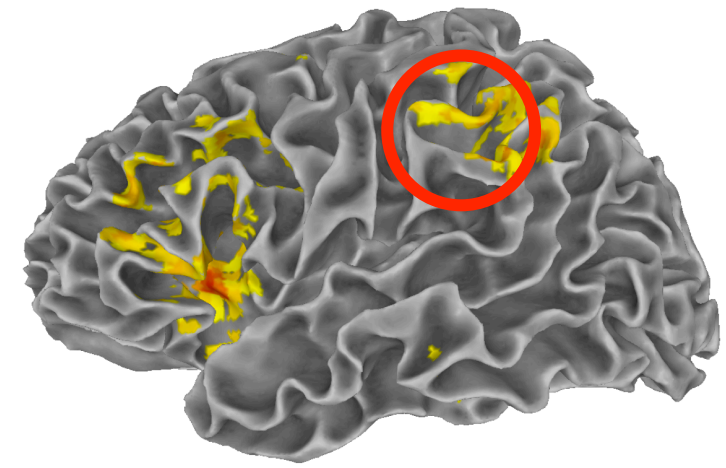
OBJECT CHANGE MATTERS IN PARIETAL CORTEX



Within an anatomically-defined ROI in **left posterior parietal cortex (PPC)**, we compared the 6 conditions to baseline.

The pattern we found in VLPFC was not replicated in PPC. That is, **object state change modulates PPC response, irrespective of object identity**.

Could suggest that PPC is involved in binding objects to an event structure.



CONCLUSIONS

- ◆ Object identity matters in left VLPFC, suggesting that there is competition between two mutually exclusive states of a single object during comprehension of object change
- ◆ When dissimilar objects are involved, left VLPFC response is modulated by other variables, such as object similarity
- ◆ Left parietal cortex does not reveal conflict between mutually exclusive object states

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