

Revealing the structure of affective schematic representations in the medial prefrontal cortex

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Introduction

The rostral and ventral medial prefrontal cortex (mPFC) has been associated with the representation of memory schemas^{1,2} and with the processing of value³⁻⁶. Recent evidence indicates that it encodes representations of elements from our everyday life (e.g., familiar people and places)⁶.

Hypothesis: The mPFC encodes affective schematic representations. These representations

entail information about both, individual elements (i.e., the nodes) and their overall associations (i.e., the edges). More important elements (as determined by centrality, experience, and affective value) exhibit overall stronger neural associations.

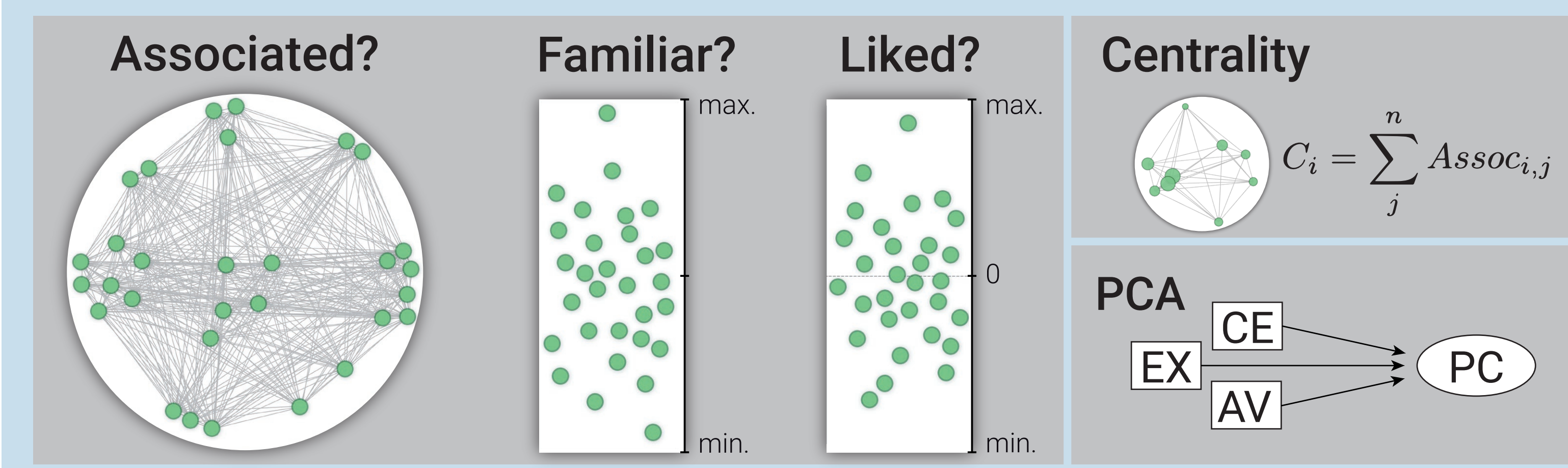
Prediction 1: mPFC encodes representations of individual nodes (i.e., people and places) from our environment.

Prediction 2: Centrality, experience, and affective value share a common factor (i.e., a principal component). A node's value on this factor reflects its importance to the affective schema.

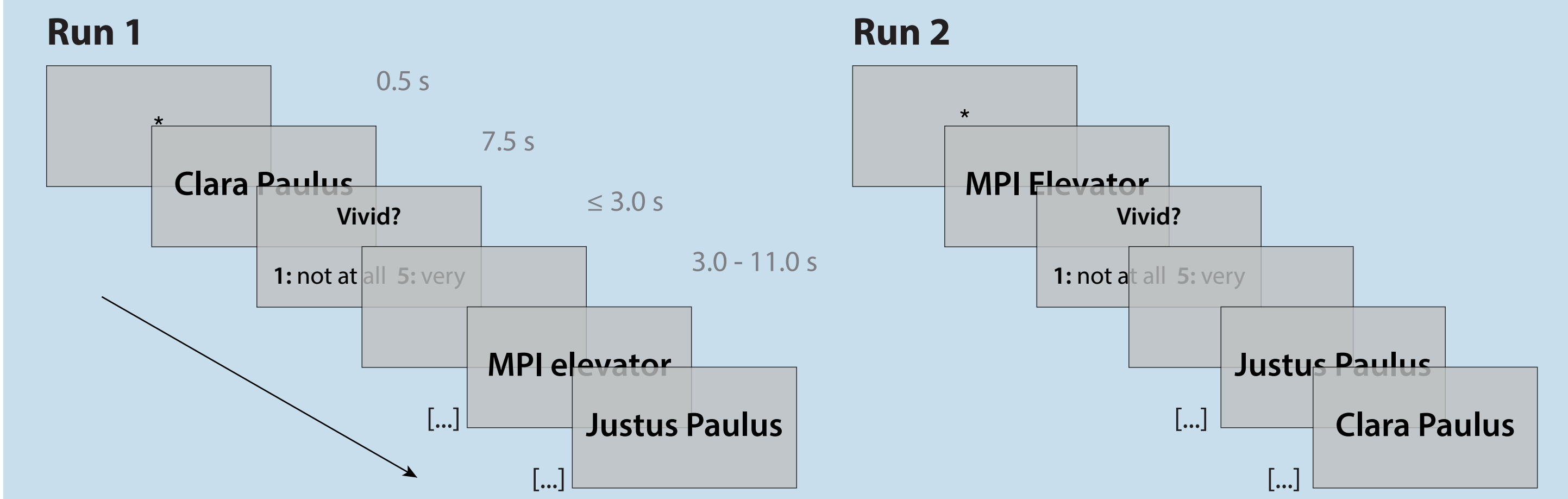
Prediction 3: The strength of the edges should reflect the importance of the nodes. Stronger edges should manifest in overall higher pattern similarities of the connected nodes. We thus predict greater neural pattern similarity for more important nodes.

Method

Session I. Assessing centrality (CE), experience (EX), and affective value (AV)

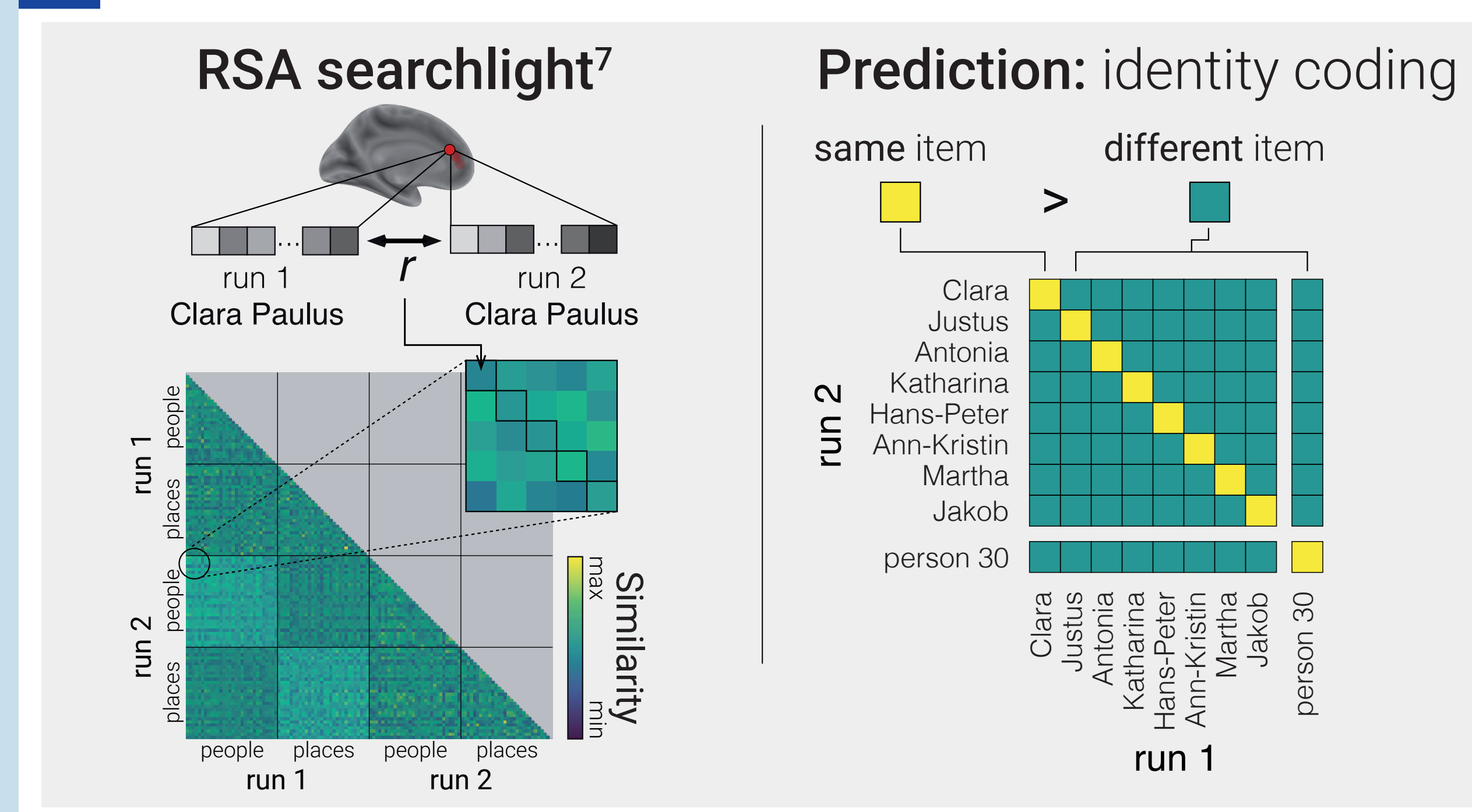


Session II. Assessing neural representations

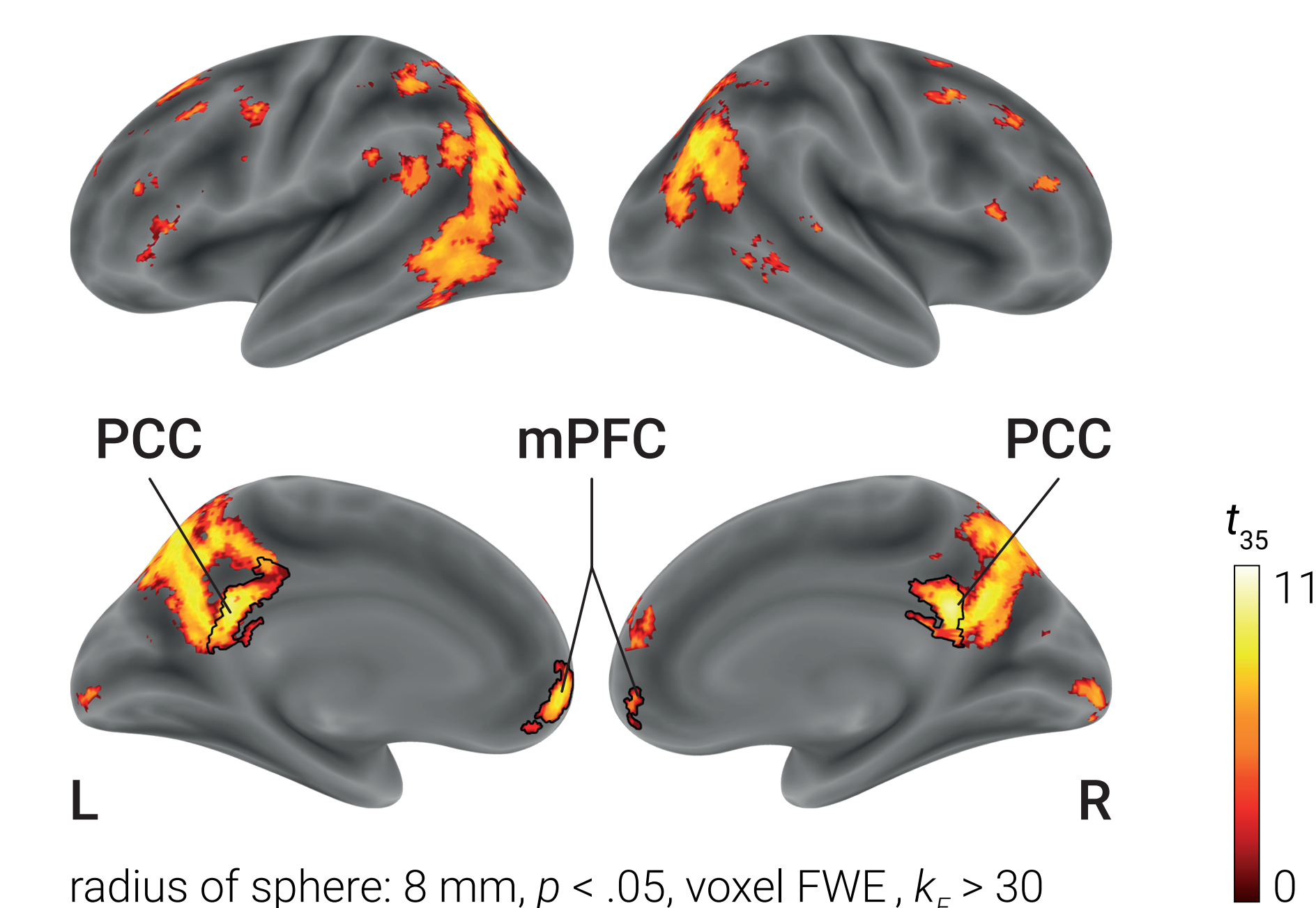


Results

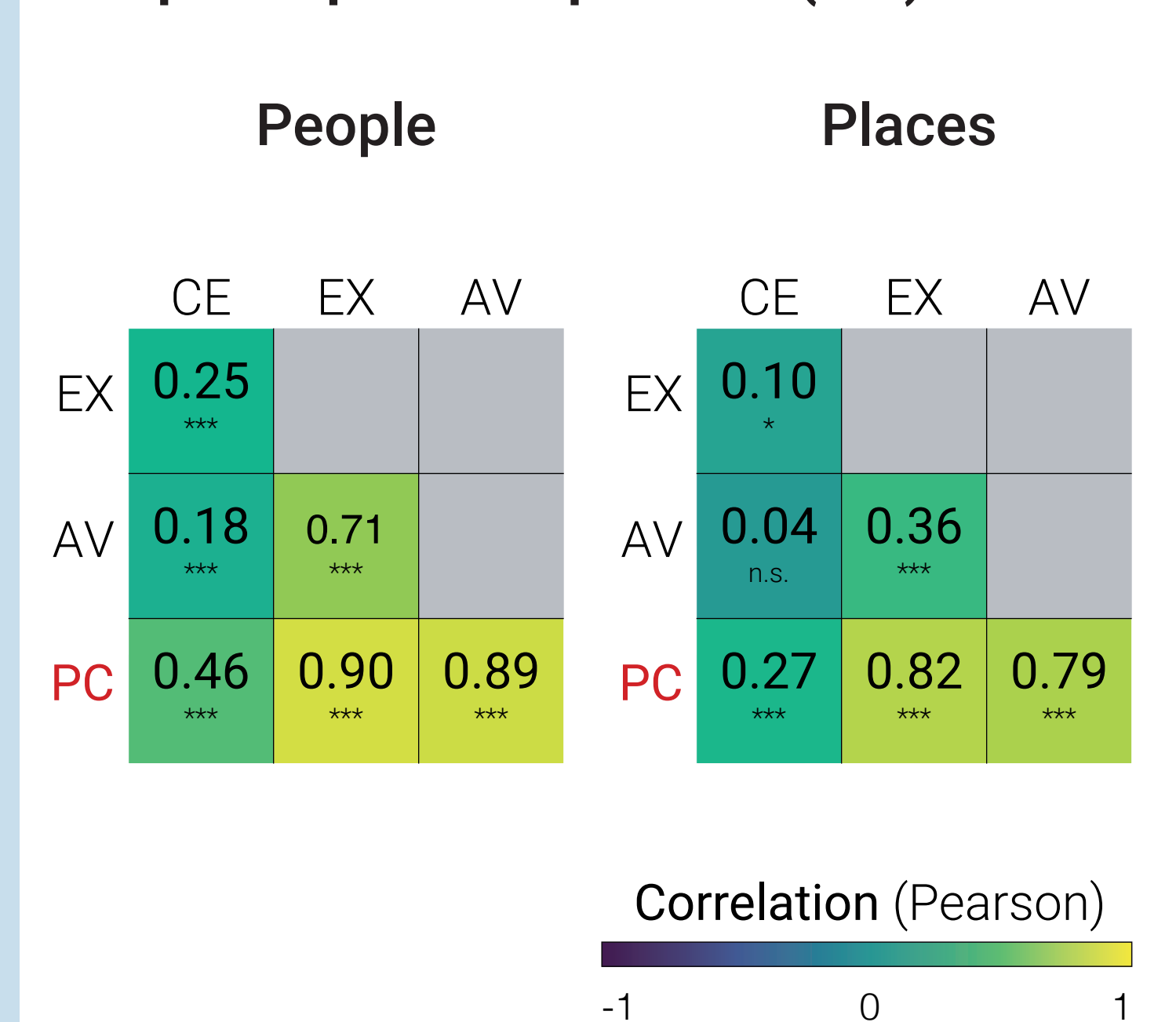
1 mPFC codes for the identity of known people and places



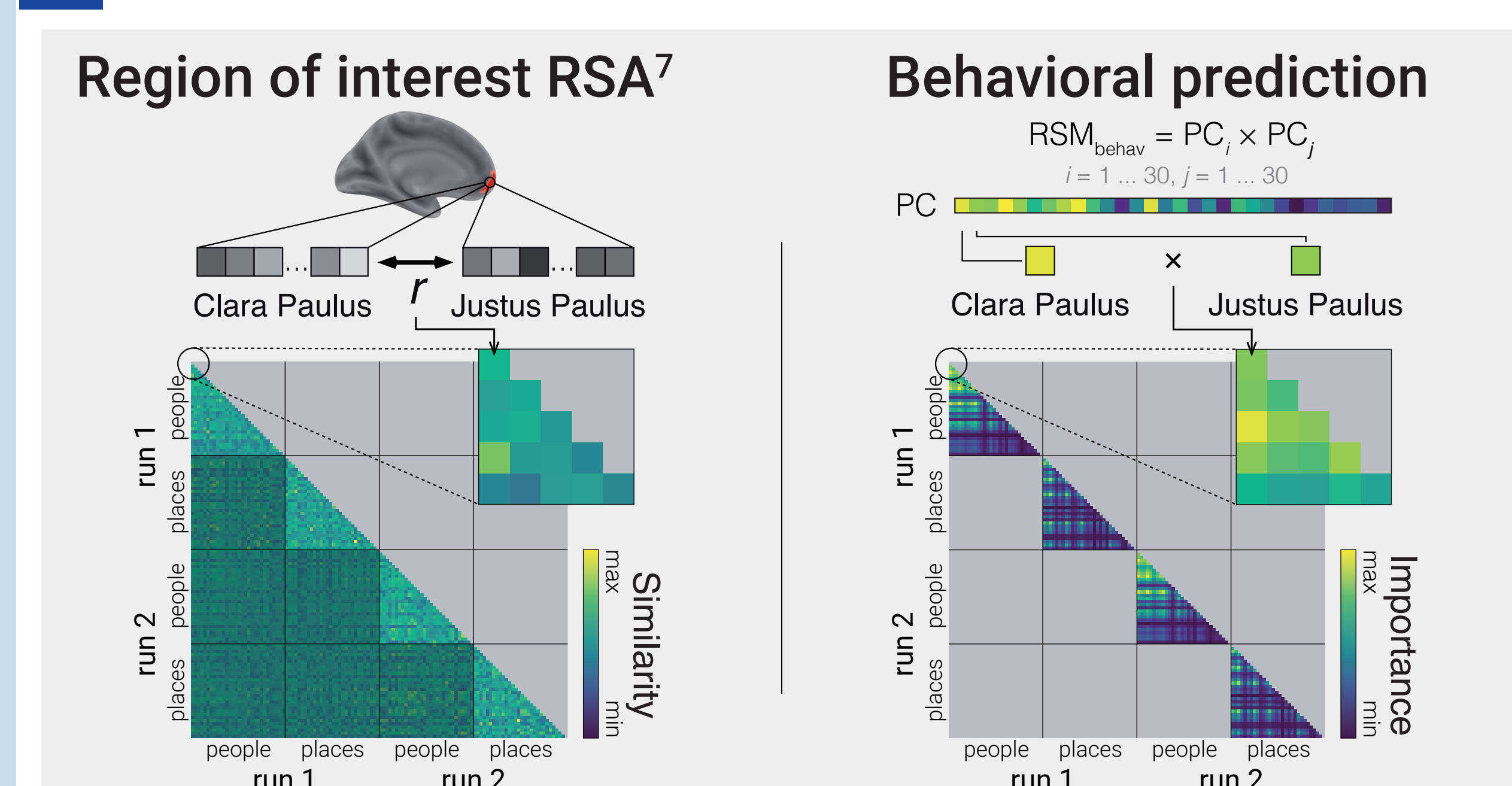
Regions encoding individual representations of both people and places (i.e., the nodes)



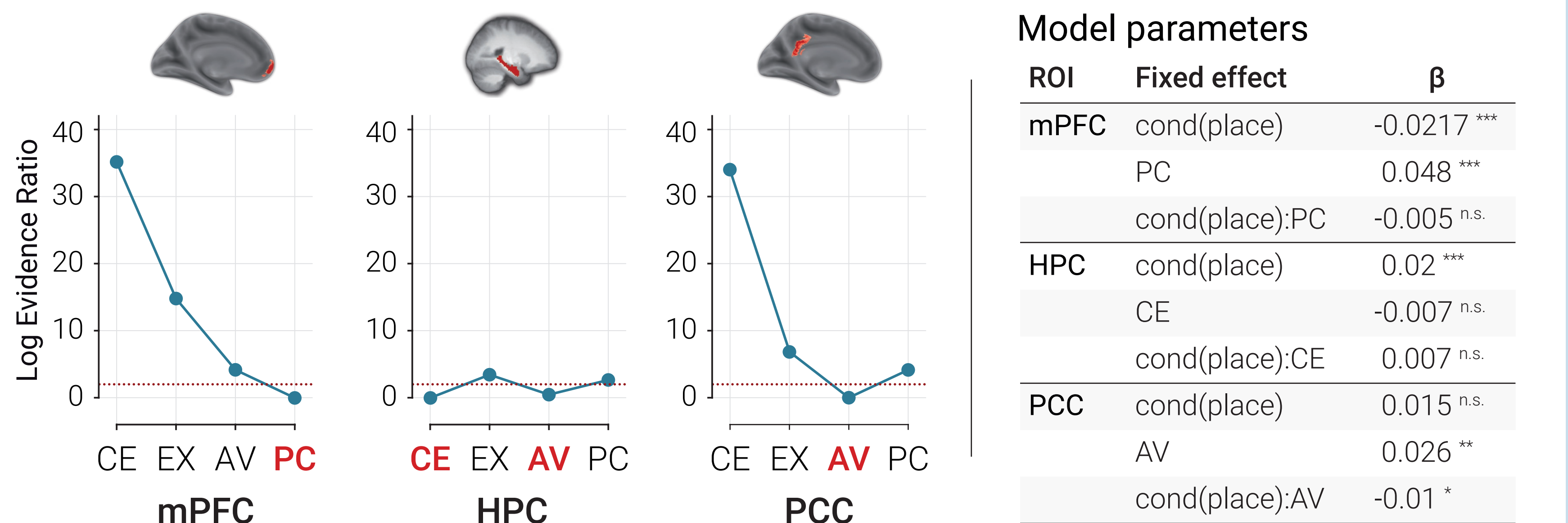
2 CE, EX, and AV load on a shared principal component (PC)



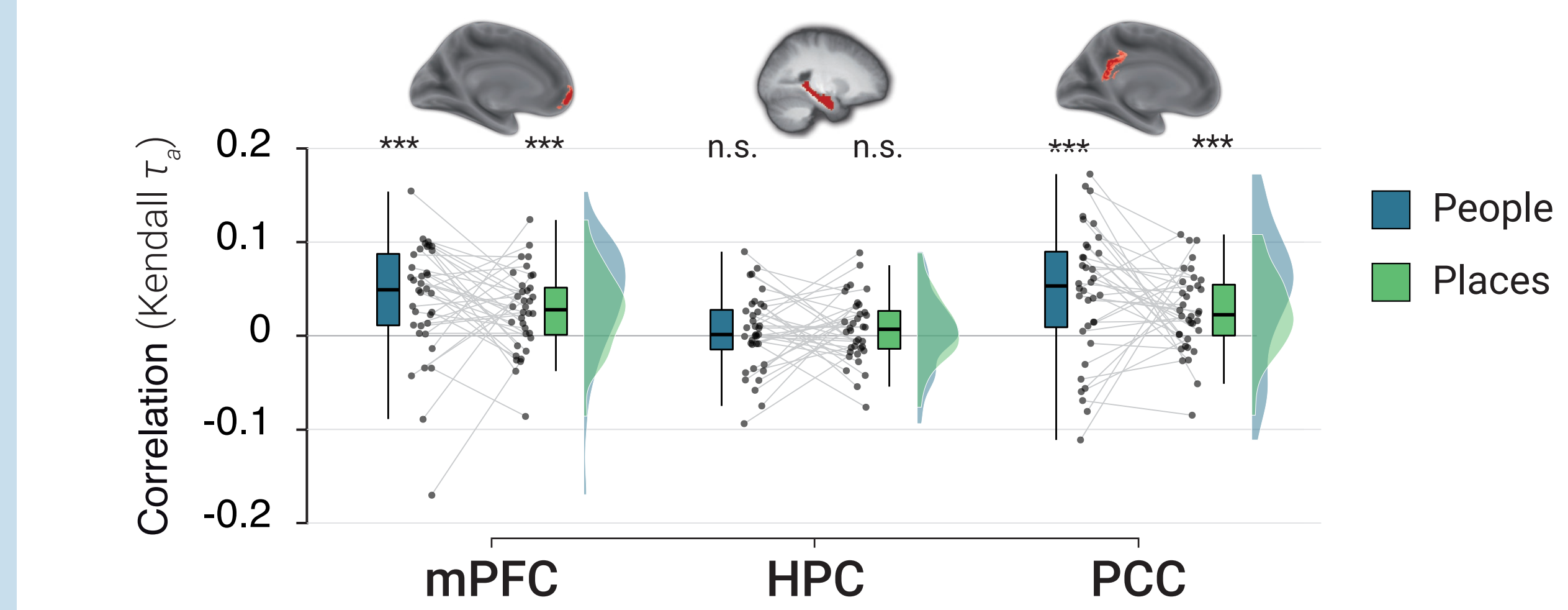
3 mPFC encodes affective schematic representations



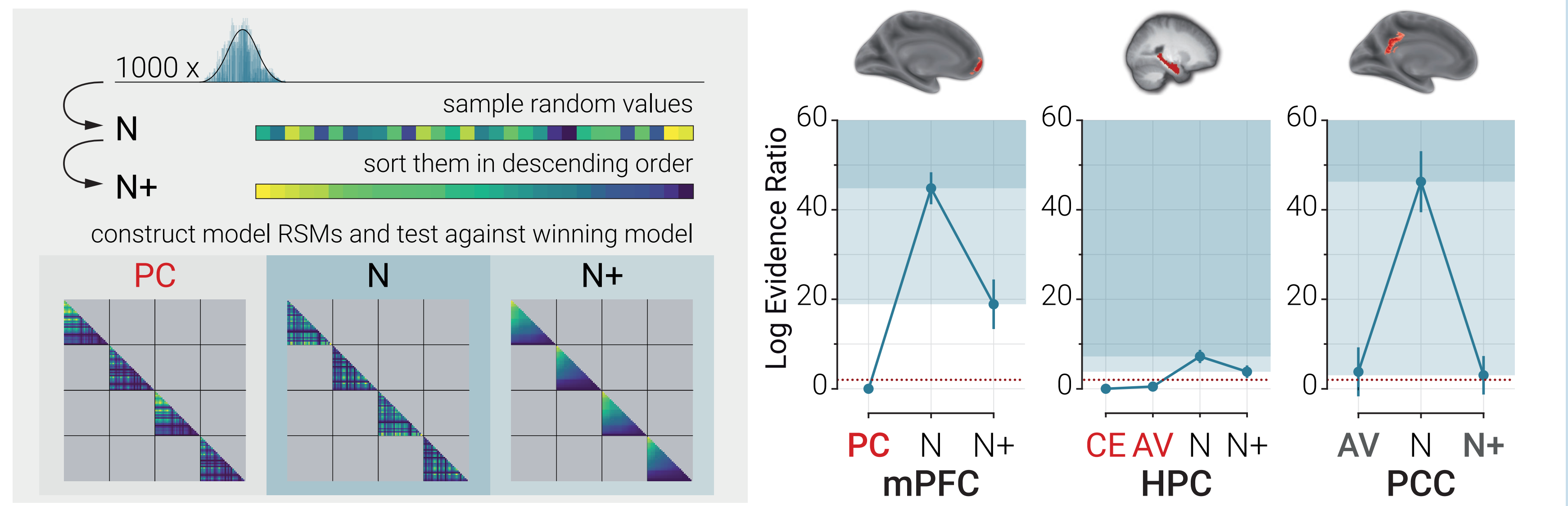
The principal component accounts best for the structure of representations in the mPFC only



Representations in mPFC and PCC correlate with the predicted structure



In the mPFC and HPC, the winning models perform better than noise models



Summary

- The mPFC encodes representations of familiar people and places (i.e., the nodes).
- Centrality, experience, and affective value load on the same latent factor (i.e., their first principal component) that reflects the importance to the affective schema.

- The structure of neural representations in the mPFC is best described by importance and thus by the affective schema.
- This hypothesis can account for the overlap of seemingly disparate functions in the mPFC, such as memory, valuation, and self-referential processing⁸.

References

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