Activity patterns in CA3/dentate gyrus diverge when spatial routes were most similar

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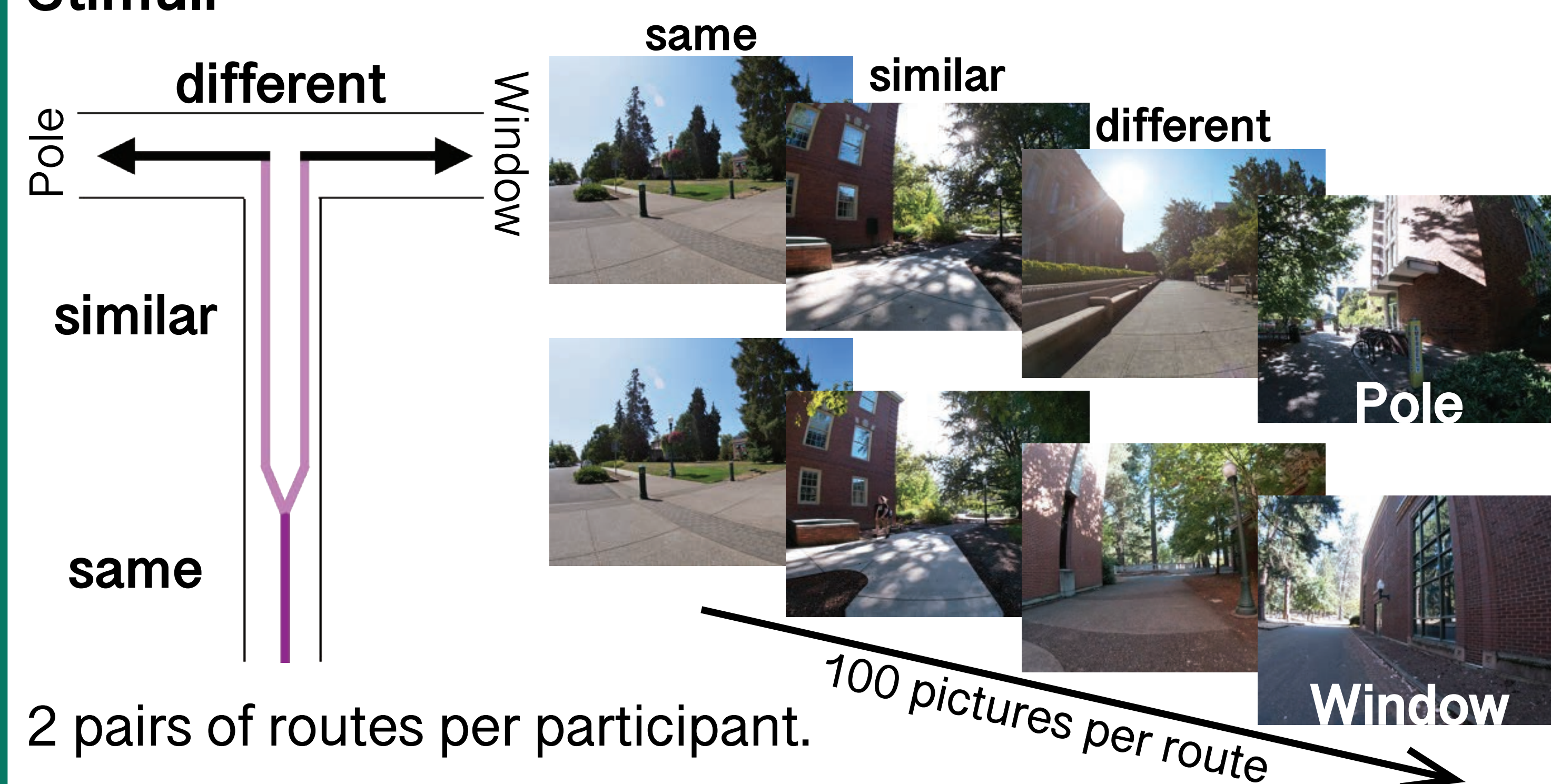
Introduction

Memory Interference occurs when two memories are similar to each other[1,2]. **"Repulsion"** of hippocampal activity patterns (lower fMRI pattern similarity for overlapping events vs. non-overlapping events) is associated with reduced memory interference[3,4,5,6,7,8].
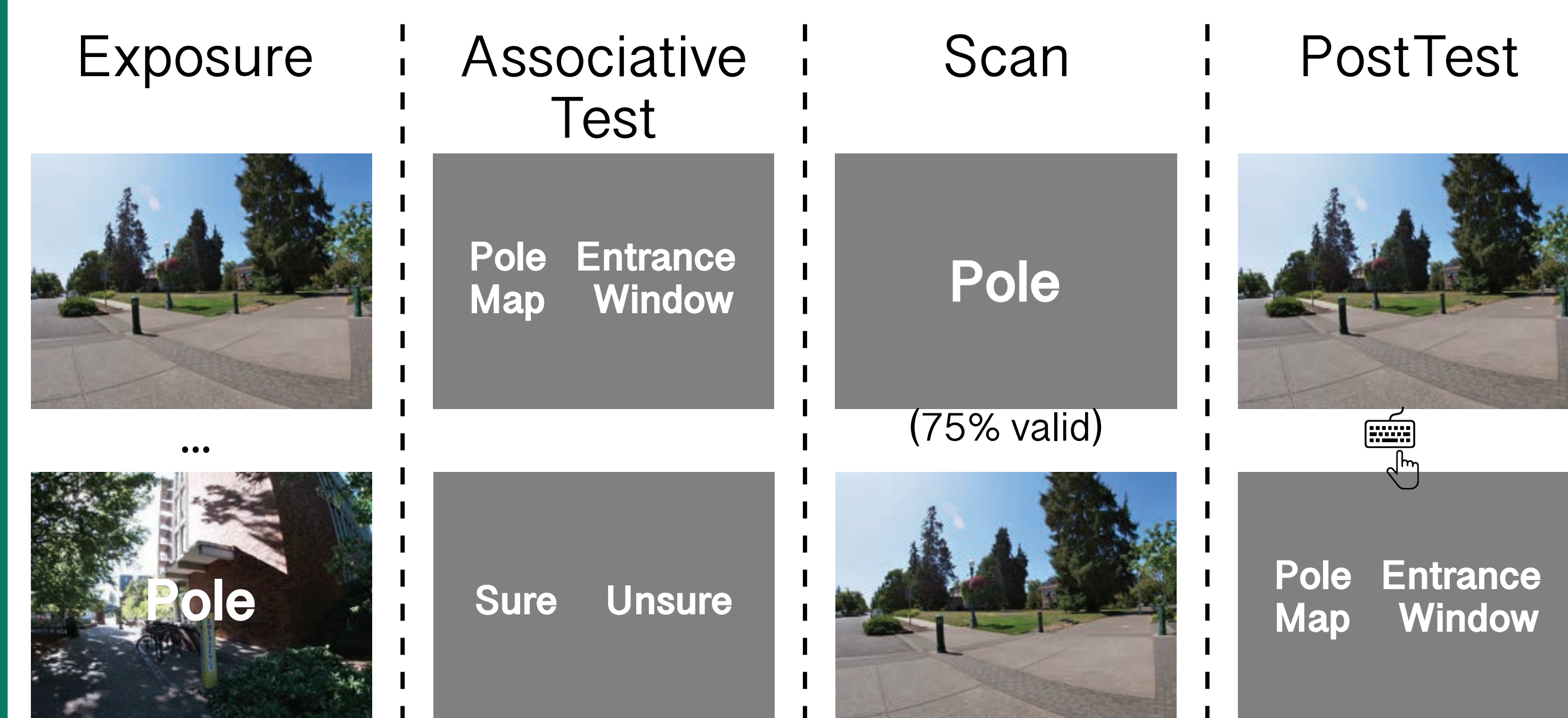
Why does repulsion occur?
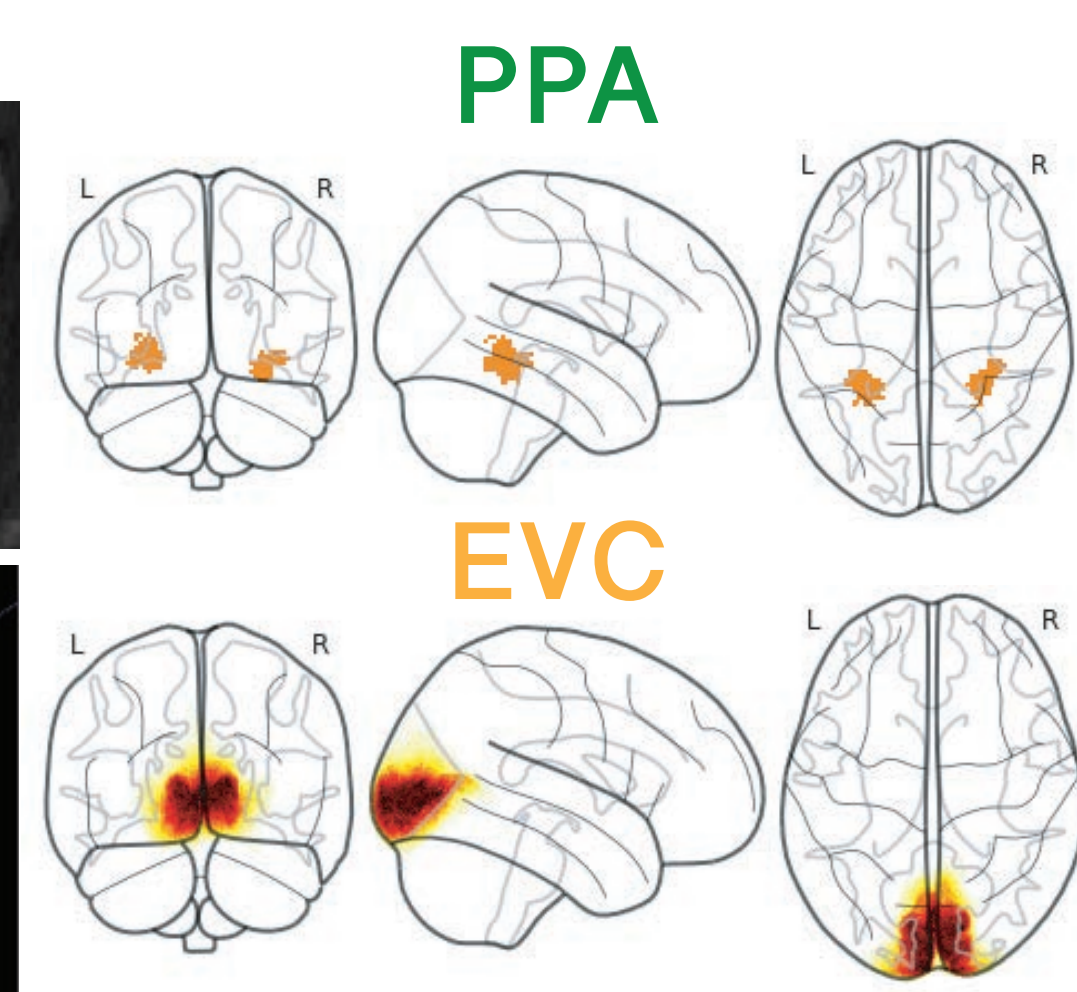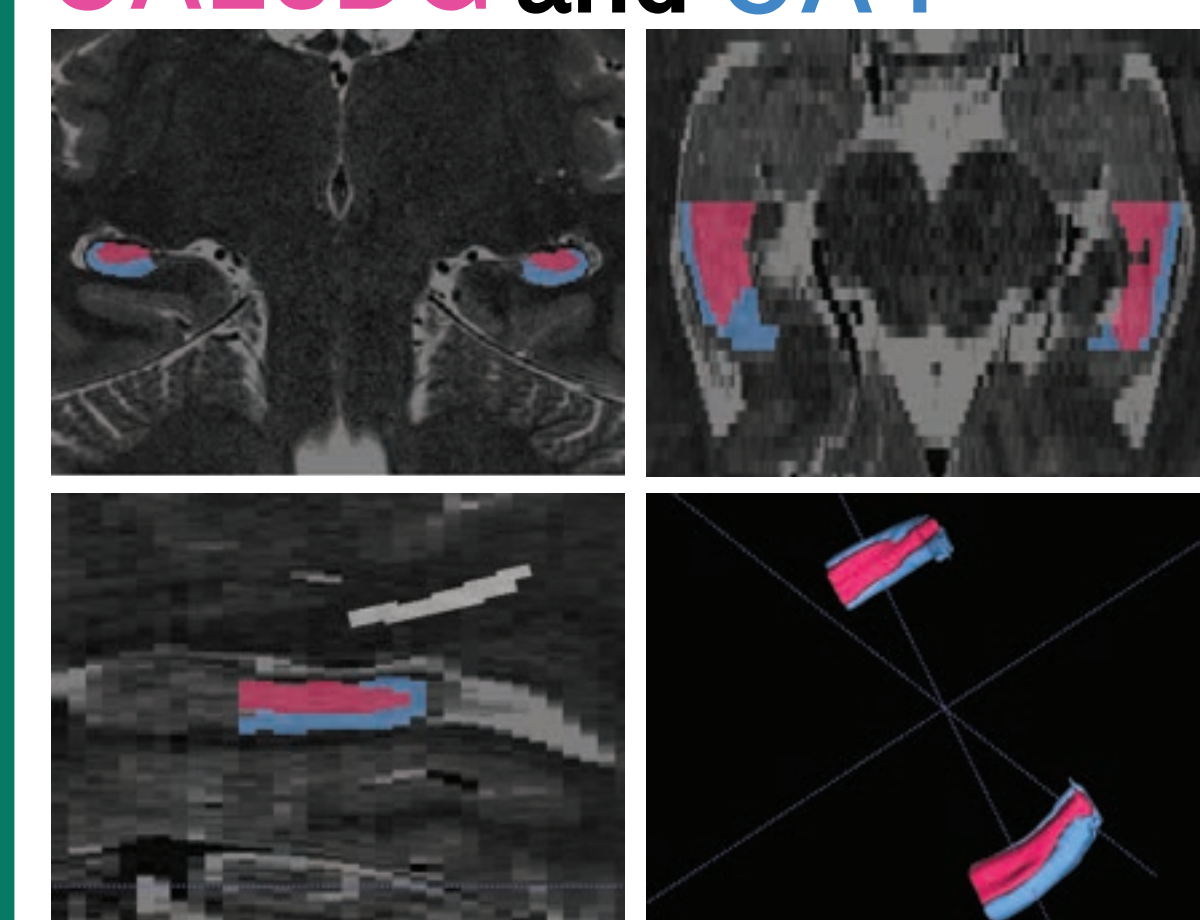
Experiment

Stimuli

2 pairs of routes per participant.

100 pictures per route

Procedure

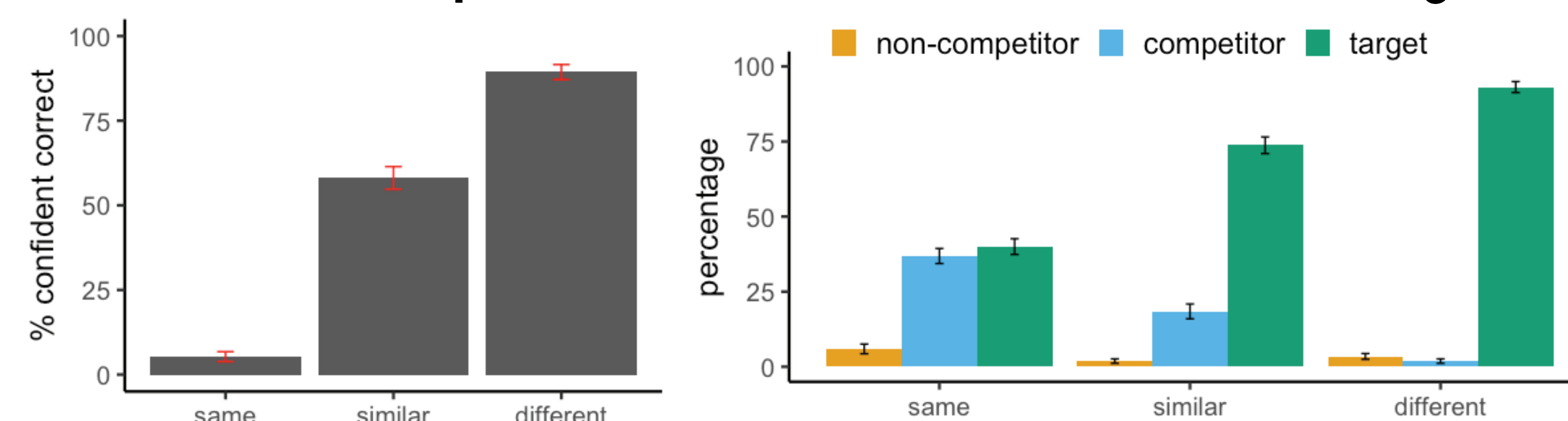| Exposure	Associative Test	Scan	PostTest

(75% valid)

ROIs

CA23DG and **CA1**

N = 40
Siemens 3T Prisma
T1: 1mm isotropic
T2: 0.43 * 0.43 * 1.8mm
EPI:
1.7mm isotropic
Repetition Time = 1s
Echo Time = 33ms
10 EPI runs
Preprocessing:
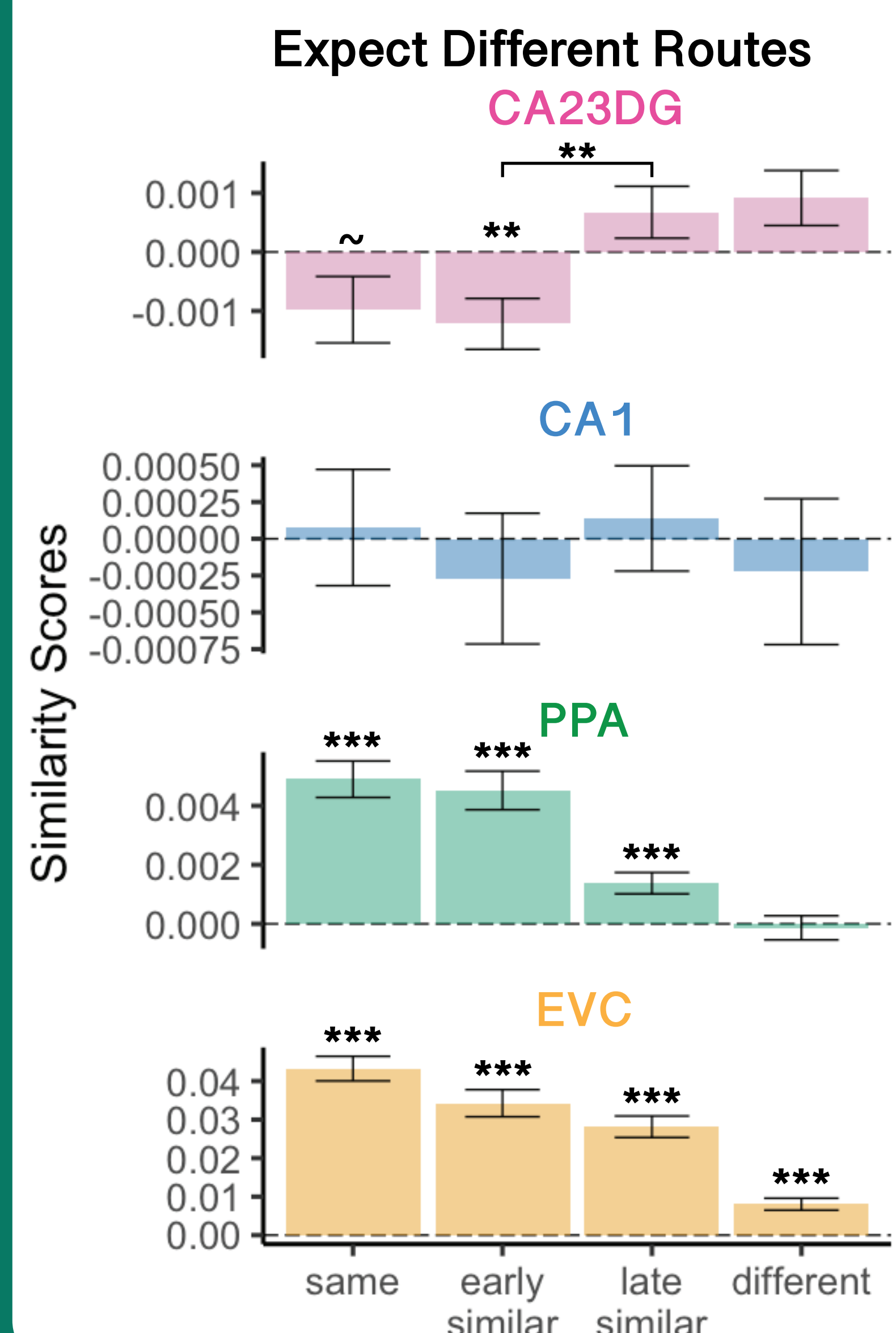fMRIprep 21.0.1
Subfield segmentation:
ASHS

Results
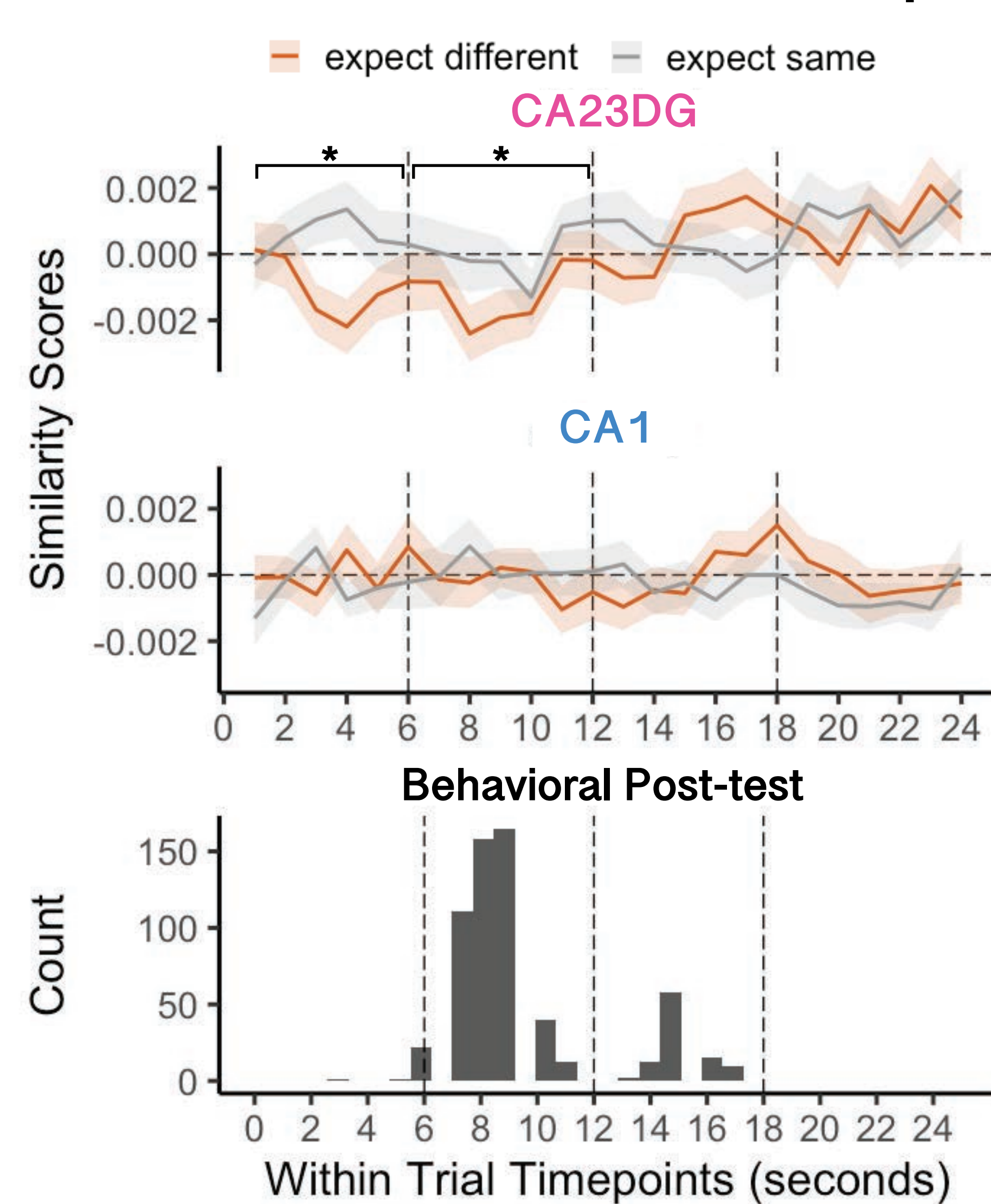
Associative test performance as a function of route segment

Similarity Score = (within pair - across pair fMRI similarity)

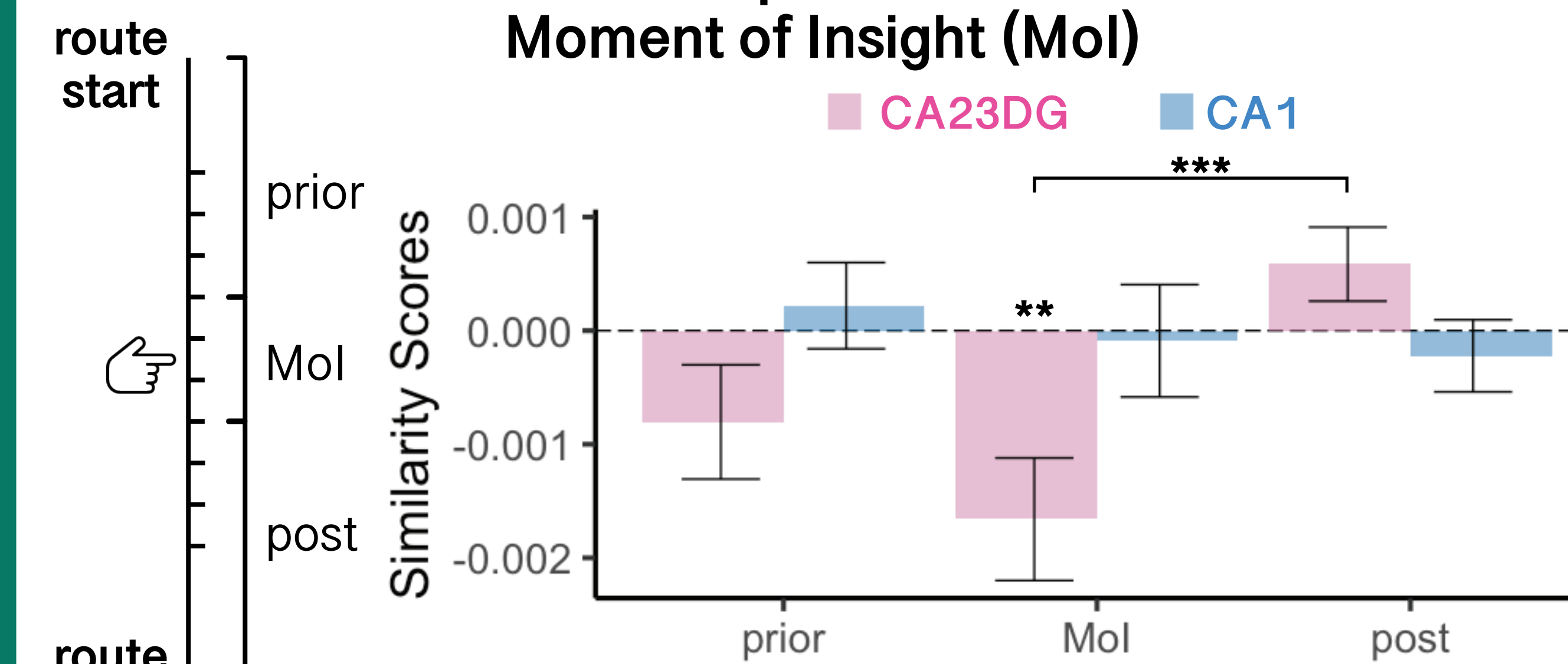### Pattern similarity in CA23DG is low when the overlap is high

Expect Different Routes

In CA23DG, distinct beliefs lead to repulsion effects even with identical visual input

Behavioral Post-test

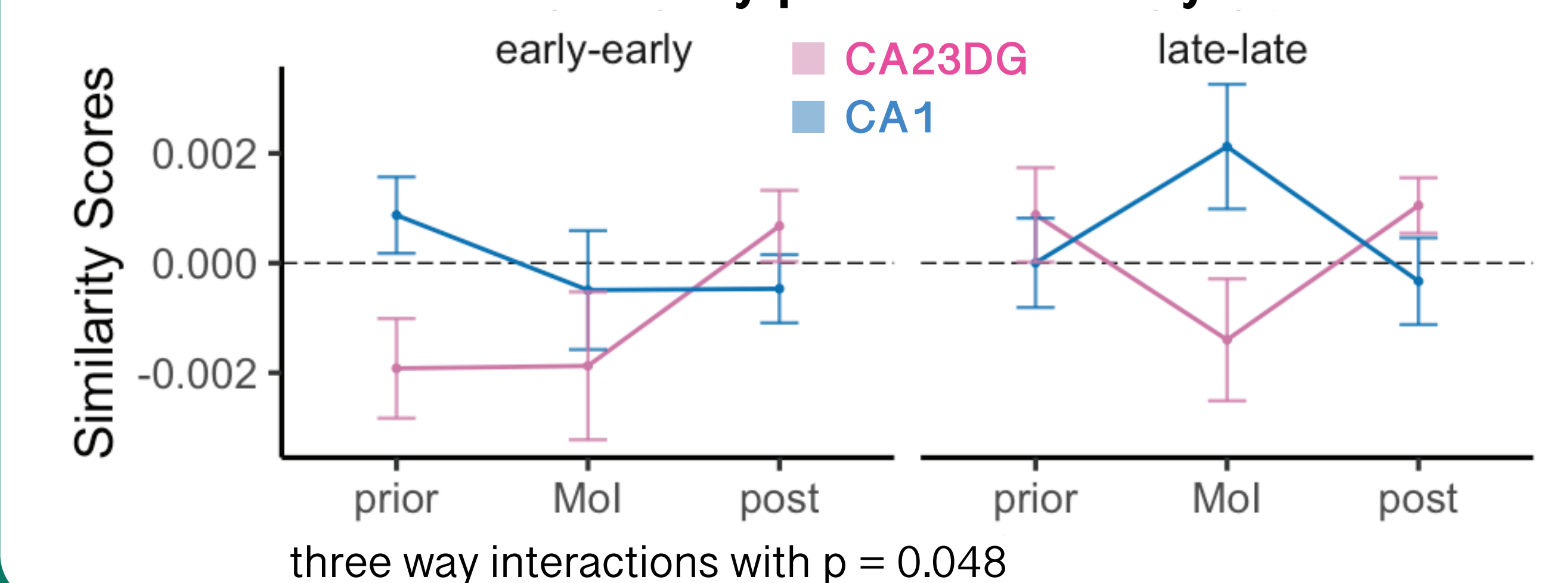Within Trial Timepoints (seconds)

Insight related change

CA23DG showed Repulsion effect centered at Moment of Insight (MoI)

Repulsion is consistent across rounds at MoI in CA23DG
Effect of cues is only present for early rounds

three way interactions with p = 0.048

Conclusions

Hippocampus (specifically CA23DG) shows repulsion effects (lower similarity for overlapping vs. non-overlapping routes), but only when routes are most similar.

- disappears/reverses once routes are more distinct or after moment of insight.

CA23DG "flips" representational structure of visual regions including PPA and EVC.

CA23DG repulsion is influenced by probabilistic cues.

- indicates that repulsion occurs when perceptual input is similar/ambiguous, but beliefs are distinct[9].

References

[1] Colgin, L. L., Moser, E. I., & Moser, M. B. (2008). Trends Neurosci. [2] Yassa, M. A., & Stark, C. E. (2011). Trends Neurosci. [3] Hulbert, J. C., & Norman, K. A. (2014). Cereb. Cortex. [4] Kim, G., Norman, K. A., Turk-Browne, N. B. (2017) J Neurosci. [5] Favila, S. E., Chanales, A. J., & Kuhl, B. A. (2016). Nat. Commun. [6] Chanales, A. J., Oza, A., Favila, S. E., & Kuhl, B. A. (2017). Curr Biol. [7] Molitor. R. J., Sherrill, K. R., Morton, N. W., Miller, A. A., & Preston, A. R. (2021). J. Neurosci. [8] Wanjia, G., Favila, S. E., Kim, G., Molitor, R. J., & Kuhl, B. A. (2021). Nat. commun. [9] Sanders, H., Wilson, M. A., & Gershman, S. J. (2020). Elife.