



Hippocampal repulsion is driven by internal beliefs.

Wanjia Guo¹, Subin Han¹, Brice Kuhl¹
Psychology Dept., Univ. of Oregon, Eugene, OR



Oregon
Memory
Group

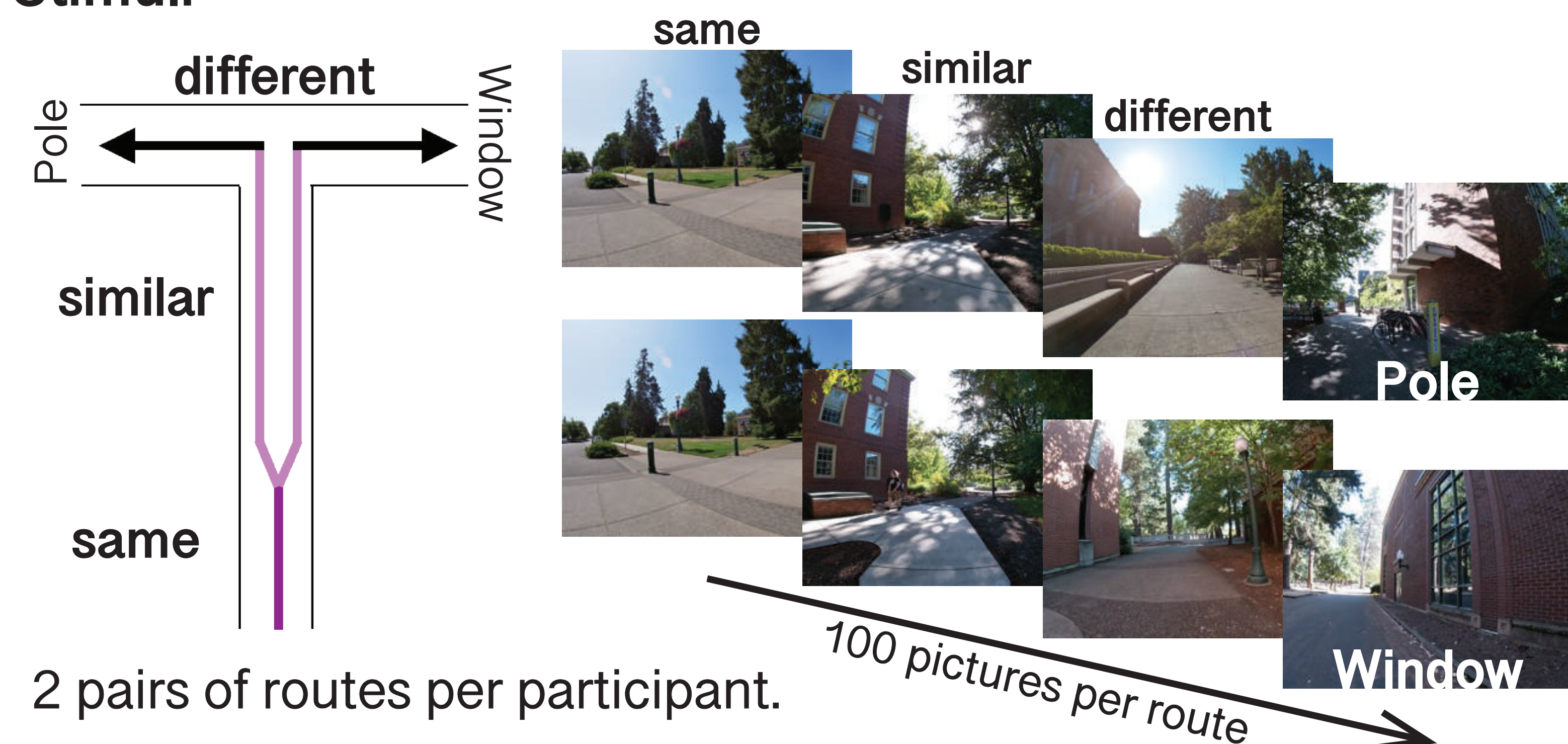
Introduction

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 interference^{3,4,5,6,7,8}.

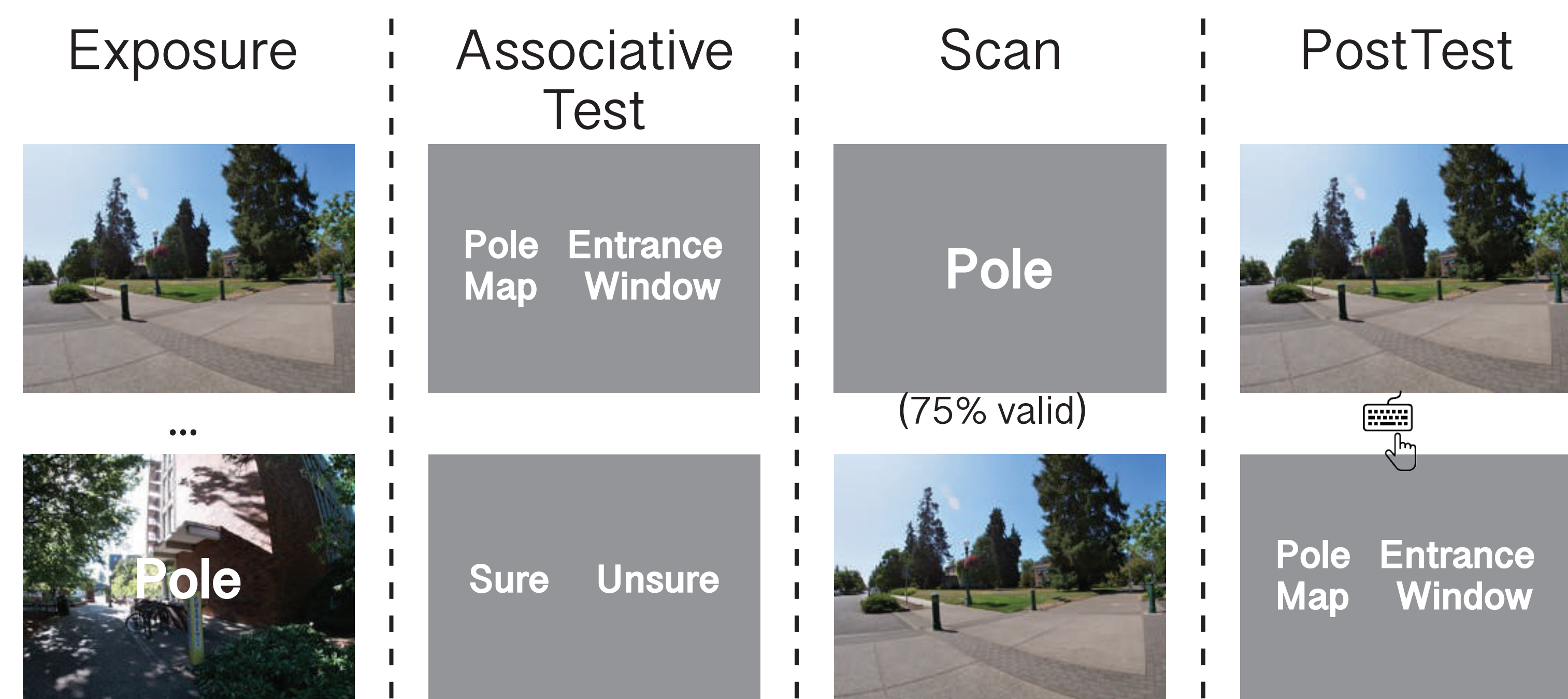
Why does repulsion occur?

Experiment

Stimuli

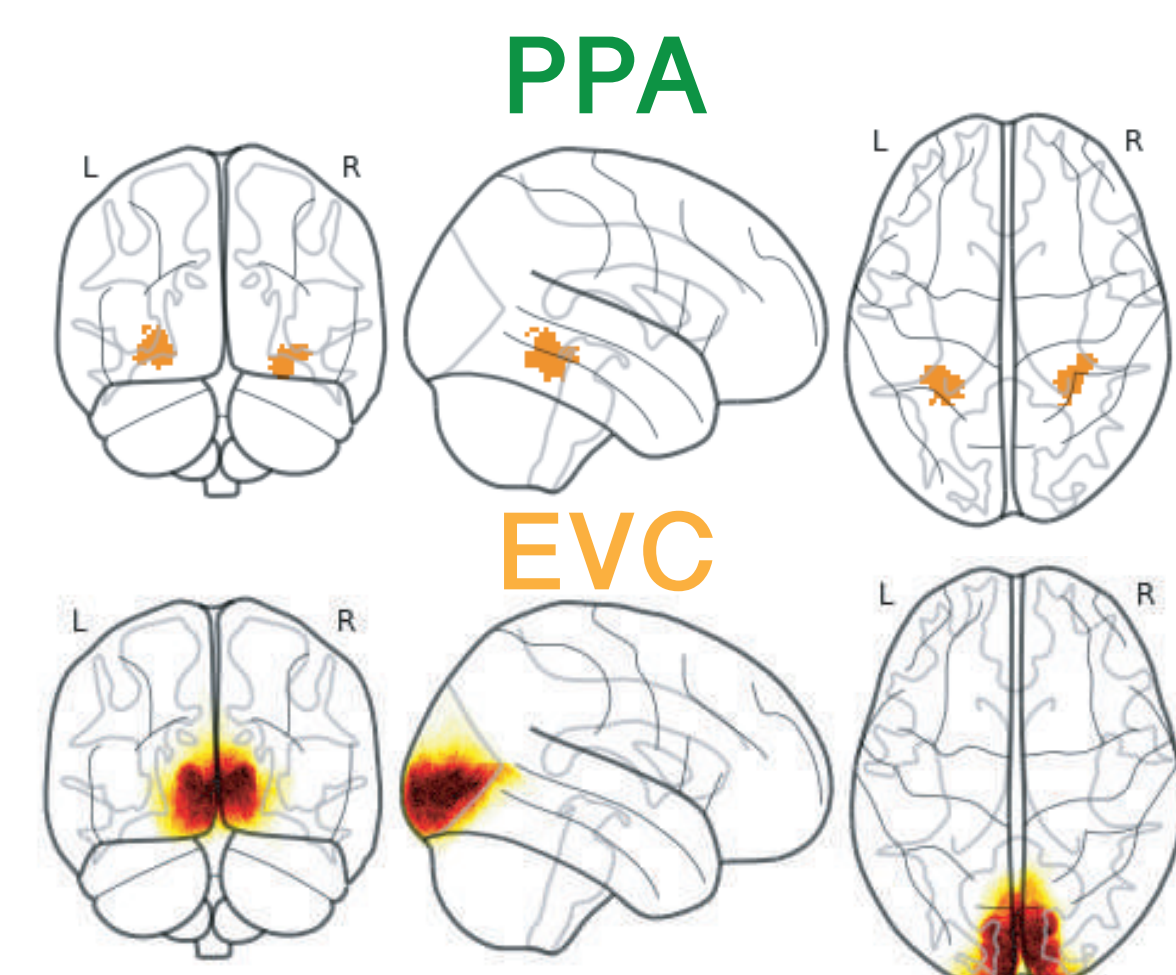
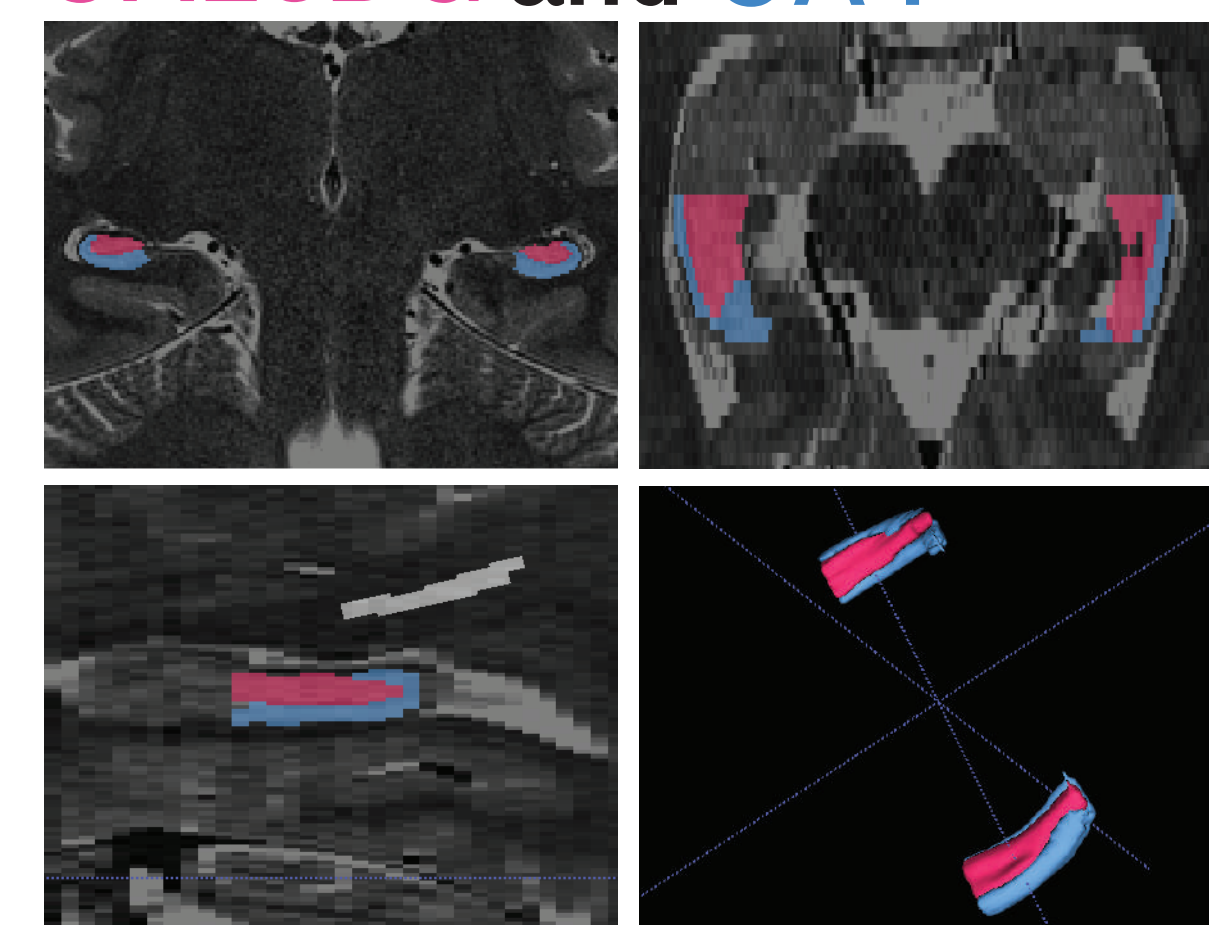


Procedure



ROIs

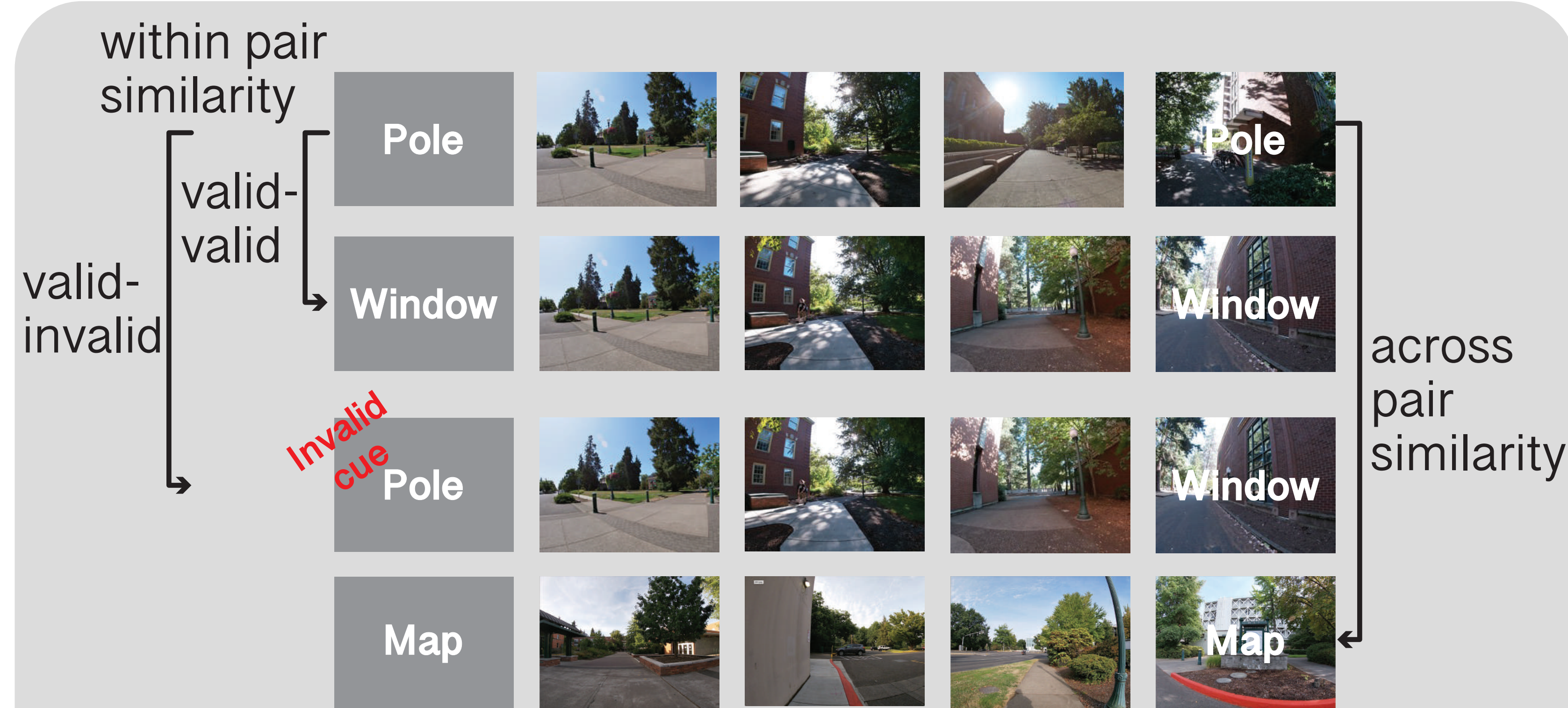
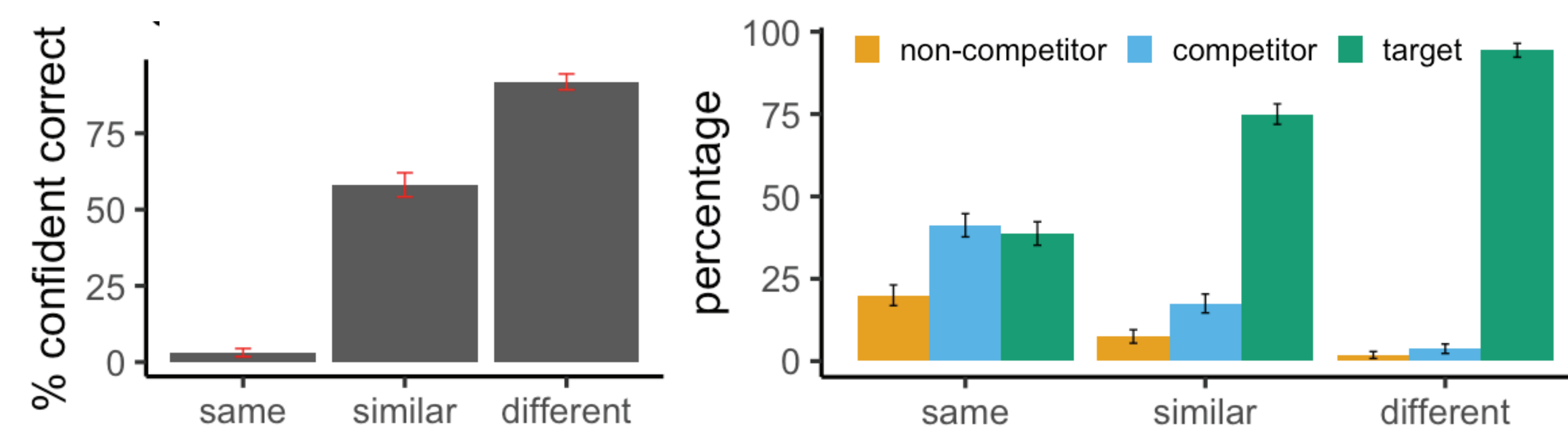
CA23DG and CA1



N = 20
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

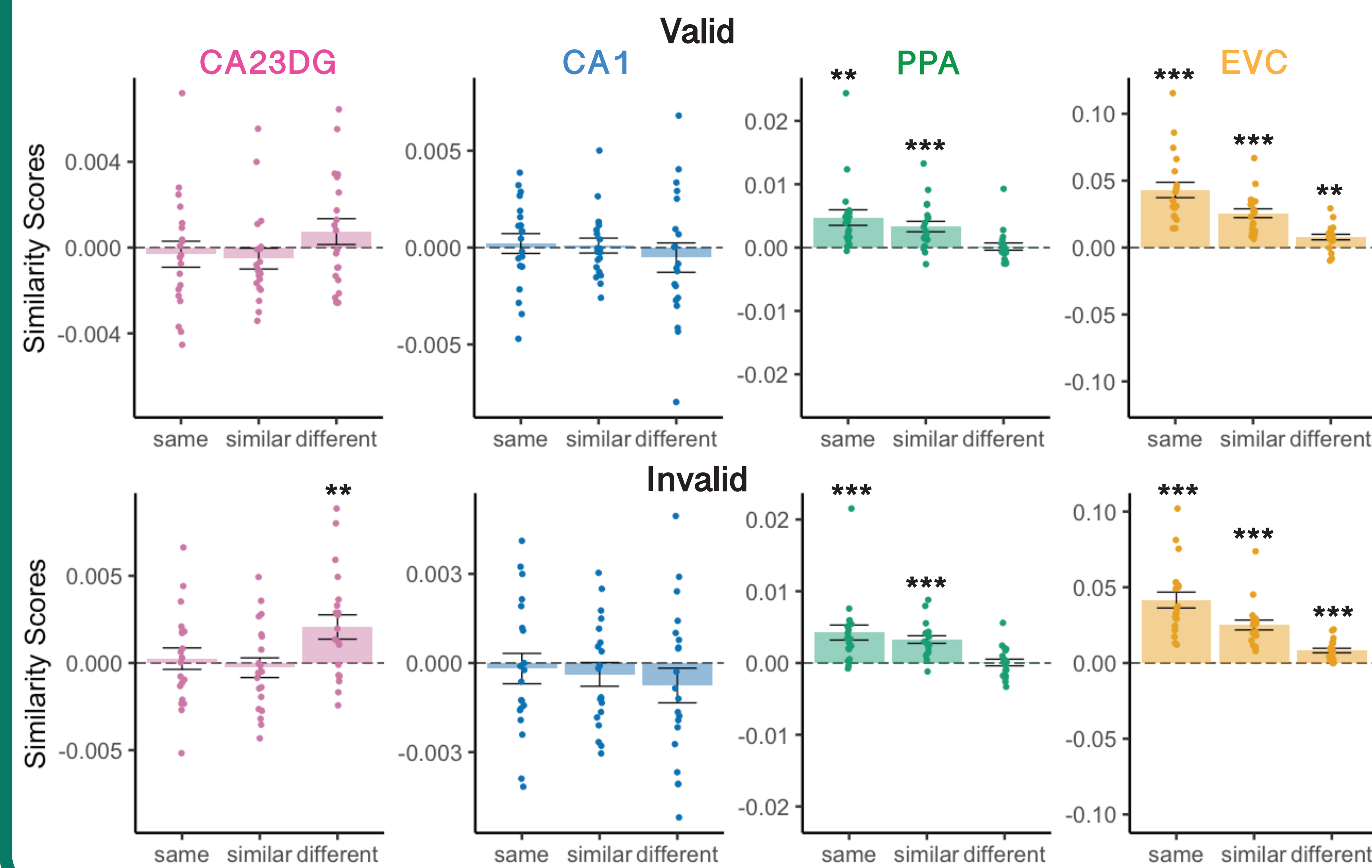
Results

Associative test performance as a function of route segment.



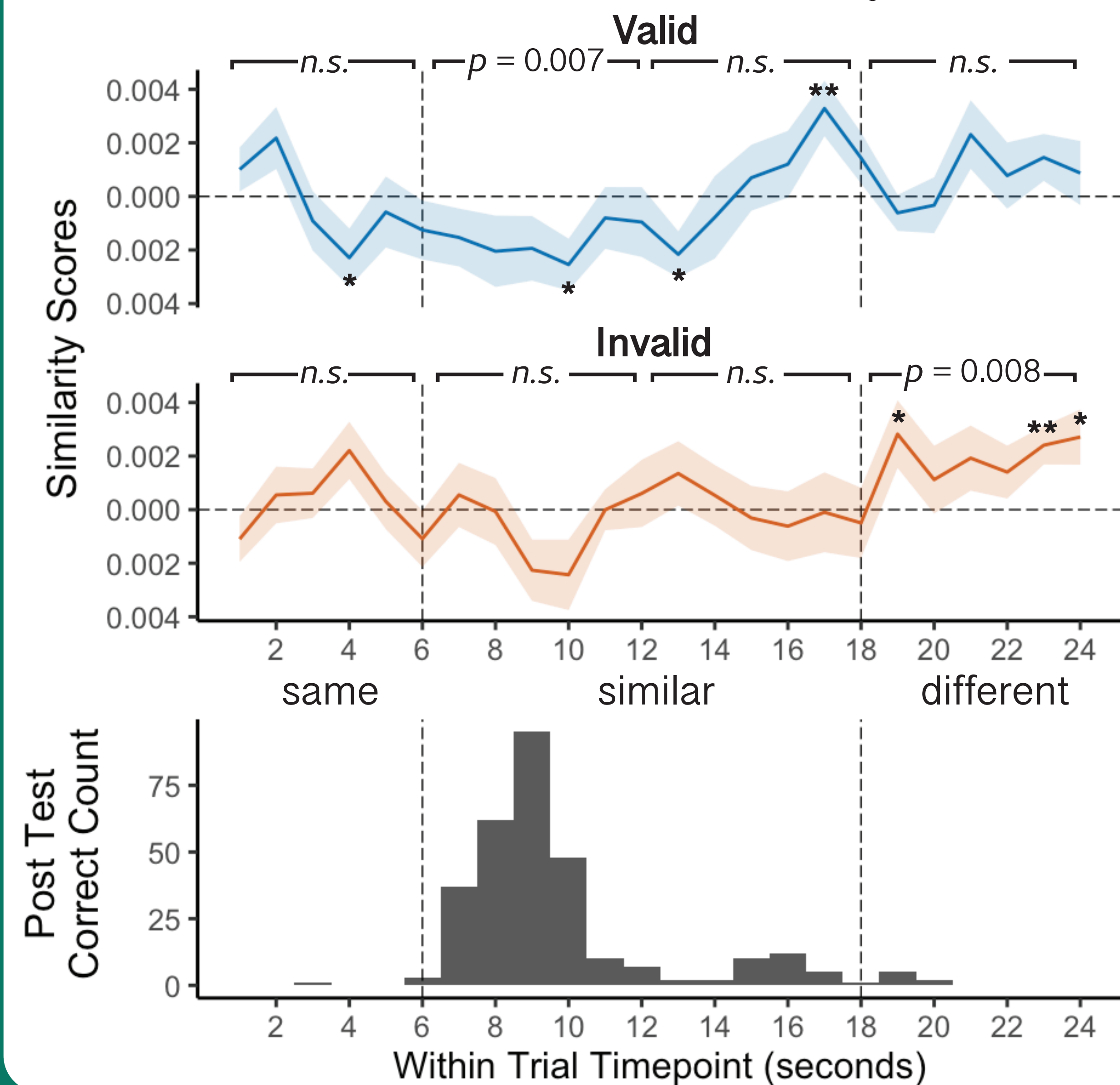
$$\text{Similarity Score} = (\text{within pair fMRI pattern similarity} - \text{across pair fMRI pattern similarity})$$

Pattern similarity increases with stimulus similarity in PPA and EVC, but not CA23DG.



CA23DG

Repulsion in CA23DG occurs early in the routes and is influenced by cues.



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. CA23DG “flips” representational structure within PPA and EVC.

CA23DG repulsion is influenced by probabilistic cues

- indicates that repulsion occurs when perceptual input is similar/ambiguous, but beliefs are distinct⁹.

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., Chanaleas, A. J., & Kuhl, B. A. (2016). Nat. Commun.
[6] Chanaleas, 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.
Acknowledgement: This research was supported by NIH-NINDS 2R01 NS089729 to B.A.K and F31NS126016 to W.G.