Motivating Question: What information is present in patterns of activity in retrosplenial cortex and parahippocampal cortex?

- Do RSC/PCC and PHC contain information about individual contexts [1-5]? Do they share that information [6]?
- Are RSC/PCC representations related to memory performance [1-5]?

We extended the task created by McKenzie et al. in the Eichenbaum Lab [7] from the rodent to humans.

RSC/PCC and PHC contain contextual information

- RSC/PCC contains item-in-context information
- RSC/PCC contains item-in-order-in-context information
- RSC/PCC representations are related to associative memory performance

Take Home Messages #1

- Our results suggest that RSC/PCC and PHC contain information about individual contexts and they share that information on a trial-by-trial basis
- White entries were excluded from analysis
- White entries were excluded from analysis
- Significant Spearman’s rank correlation between model fit and performance on our associative memory task ($\rho = 0.51$, $t_{108} = 2.51$, $p < 0.05$)

Take Home Messages #2

- RSC/PCC contains “item-in-context” and “item-in-order-in-context” representations
  - Our results extend findings from the rodent hippocampus [7] to human RSC/PCC
  - Our results support the hypothesis that RSC/PCC is involved in memory performance [1-5]
  - We should expand our view of the medial temporal lobe/declarative memory system

Methods

- 20 participants
- Event-related design (6 second trials)
- 3T, 32 channel SENSE coil; 2.5 mm isotropic
- 64 presentations of each event across 16 runs
- Preprocessing: quadratically detrended, high pass filtered
- Framewise displacement threshold = 0.5 mm
- Split-halves representational similarity analysis
- Permutation analysis for significance testing
  - Randomize the model matrix and calculate $z(r)$ Spearman’s rank correlation to each subject’s similarity matrix
  - Average across subjects, using the same randomization (more conservative)
  - Randomize the model matrix and calculate $z(r)$ Spearman’s rank correlation to each subject’s similarity matrix
  - Perform the above steps 10,000 times
  - Calculate the group-level two-tailed nonparametric p-value [6,10]:
    - $p = 1 + 10^{-10} \sum_{i=1}^{10,000} I(r_i \geq |z(r)|)$
  - For the item-in-order-in-context analysis, the full permutation was tractable (12,870 combinations)

Acknowledgements

Research supported by grants from NIA (RO1 AG034613) and NIH (RO1 MH085828).
We thank Patricia Place and Samantha Rutledge for assistance with data collection, and we thank Shauna Stark and Veronique Boucquey for valuable discussions about the project.

References