Distinct Connectivity Patterns of Anterior and Posterior Hippocampus

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Introduction

Memory allows us to remember both specific details about events and link across events to form generalized knowledge

Hippocampus supports both specificity and generalization, but there may be functional differences within hippocampus[1,2,3]
- Specificity → posterior hippocampus
- Generalization → anterior hippocampus

Cortical regions also differentially contribute to memory[4,5,6,7]
- Specificity → lateral prefrontal, lateral parietal
- Generalization → medial prefrontal, lateral temporal

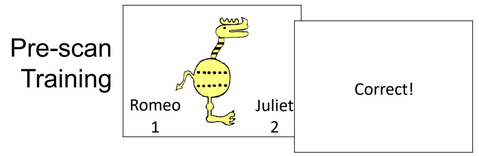
Are anterior and posterior hippocampus differentially connected to cortical generalization v. specificity regions?

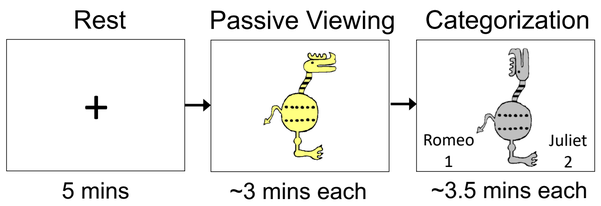
Does anterior and posterior hippocampal connectivity with cortical memory regions differentially track category generalization?

Procedures

Categorization Task

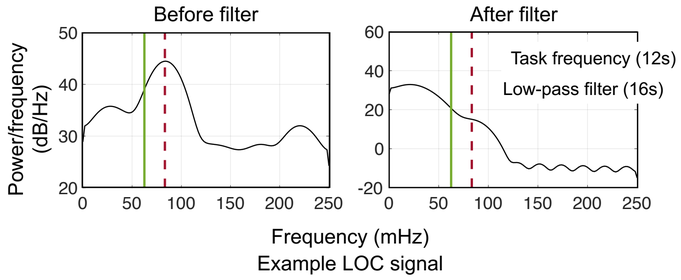
N = 26





Background Connectivity Analysis

- Task-related activation removed by low-pass filtering (cutoff 16s)

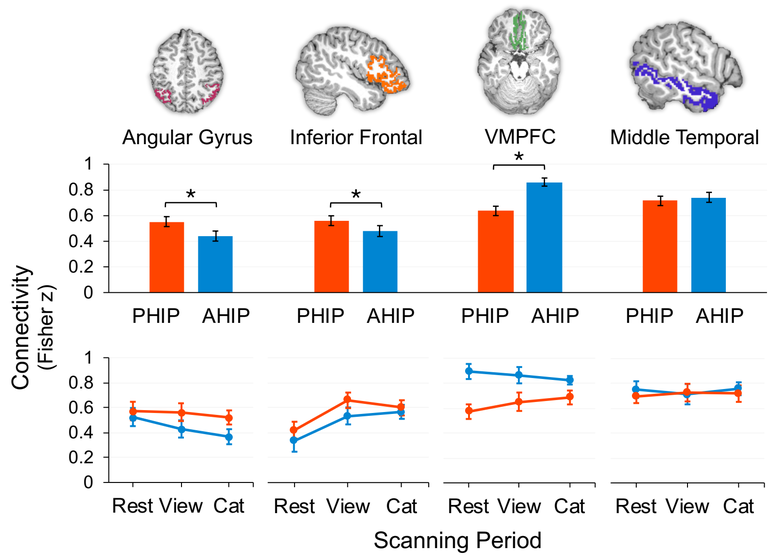


Anterior v. Posterior Hippocampal Connectivity

Predictions:

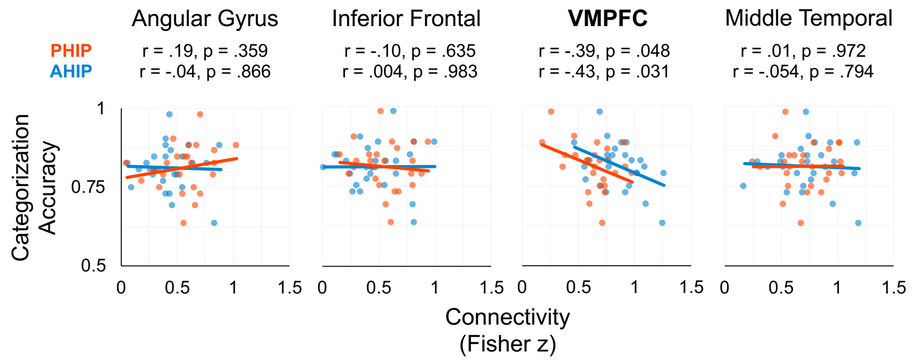
Posterior HIP → angular gyrus (ANG), inferior frontal gyrus (IFG)

Anterior HIP → ventromedial PFC (VMPFC), middle temporal gyrus (MTG)



- Stable connectivity across the task stages, except for IFG
- Anterior hippocampus showed greater connectivity with VMPFC
- Posterior hippocampus showed greater connectivity with IFG and ANG

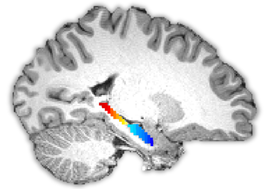
Correlations with Behavior

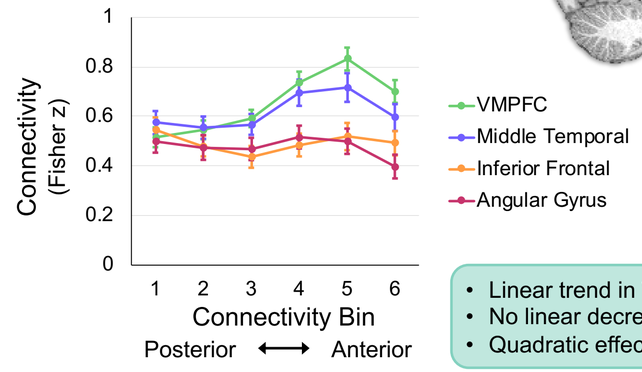


- VMPFC connectivity with hippocampus *negatively* tracked category generalization
- This relationship was not different between anterior and posterior hippocampus

Continuous Hippocampal Connectivity

Connectivity Procedure
- Connectivity measured between each hippocampal slice and each cortical ROI
- Scores were interpolated into 6 hippocampal bins
- ANOVA tested linear and quadratic trends





- Linear trend in VMPFC, MTG
- No linear decrease in IFG, ANG
- Quadratic effects in all 4 ROIs

Conclusions

- Greater connectivity of hypothesized specificity regions (ANG and IFG) with posterior than anterior hippocampus
- Greater connectivity of hypothesized generalization regions (VMPFC and MTG) with anterior than posterior hippocampus
- The strength of effects varied between dichotomous and continuous measures of hippocampal connectivity
- Connectivity changes do not follow linear gradient when measured continuously along the long-axis
- Unexpectedly, both anterior and posterior hippocampal connectivity with VMPFC were negatively associated with category generalization.[8,9]

References

1. Brunec, Bellana, Ozubko, Man, Robin, Liu, Grady, Rosenbaum, Winocur, Barense & Moscovitch (2018). *Curr Biol.* **2**. Collin, Milivojevic & Doeller (2015). *Nat Neurosci.* **3.** Schlichting, Mumford & Preston (2015). *Nat Commun.* **4.** Öztekin & Badre (2011). *Front Hum Neurosci.* **5.** Kuhl & Chun (2014). *J Neurosci.* **6.** Bowman & Zeithamova (2018). *J Neurosci.* **7.** Maguire, Mummery & Büchel (2000). *Hippocampus.* **8.** van Kesteren, Fernández, Norris & Hermans (2010). *PNAS.* **9.** Gerraty, Davidow, Wimmer, Kahn & Shohamy (2014). *J Neurosci.*

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