Hippocampus Engagement Early in Learning Supports Concept Formation

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Introduction

Hippocampus (HPC) is a key structure in category learning, forming organized concepts from individual episodes.[1]

Concept updating is crucial during early learning. But evidence for HPC role in concept formation relies on neural measures from end of learning.[2-5]

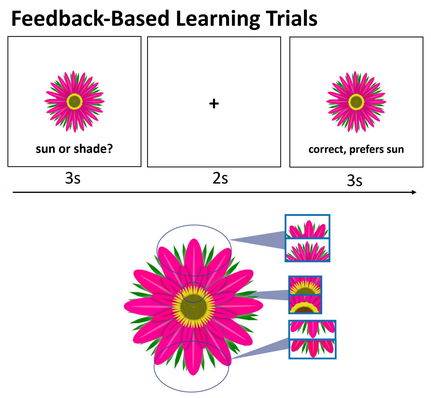
Posterior HPC	Anterior HPC
Distinct representations	Generalization

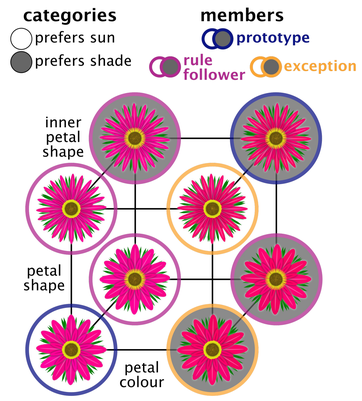
How do hippocampal processes early in learning support flexible knowledge formation?

Methods

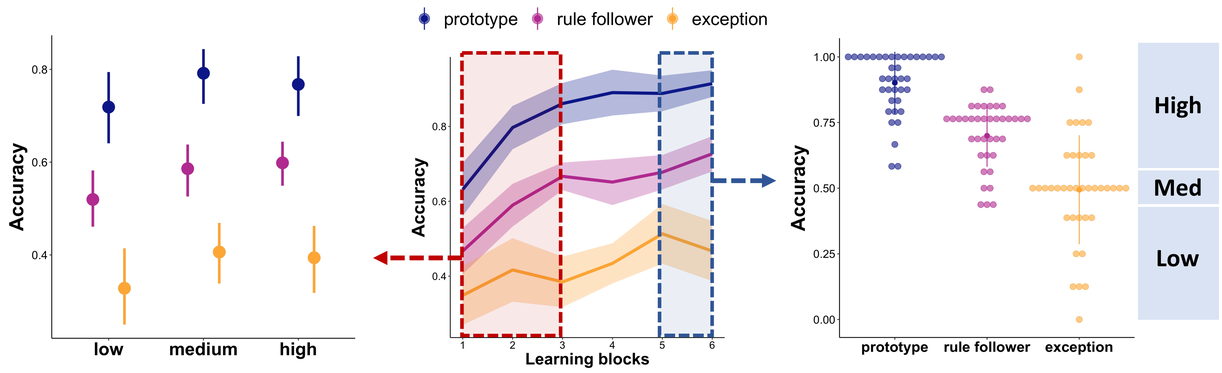
Category Learning Task[6,7]

- N=37 healthy young adults
- fMRI with 1.7x1.7x1.7mm voxels
- Hippocampal segmentation with ASHS[8]
  - T2-weighted coronals
  - Perpendicular to HPC long axis
  - 0.34x0.34x2mm voxels





Category Learning Performance



Early in learning: Similar performance for **exceptions**, **prototypes** and **rule followers**

Latent learning processes?

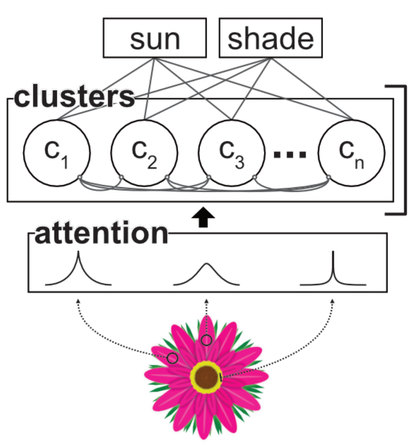
End of learning: Large individual differences in performance for **exceptions**: high (> 50%), medium (at 50%), & low (< 50%) learners

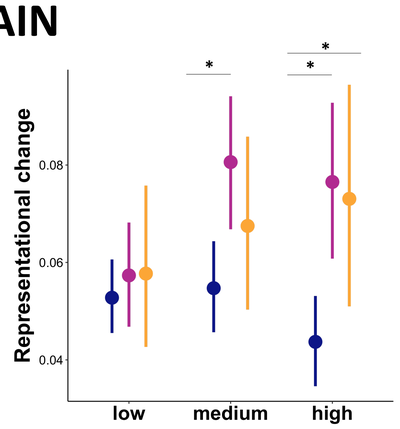
Computational Model of Learning: SUSTAIN

Trial-by-trial behavioural data fit to SUSTAIN.[9]

SUTAIN makes a category decision based on perceptual dimensions.

Updates the stored knowledge with new information.





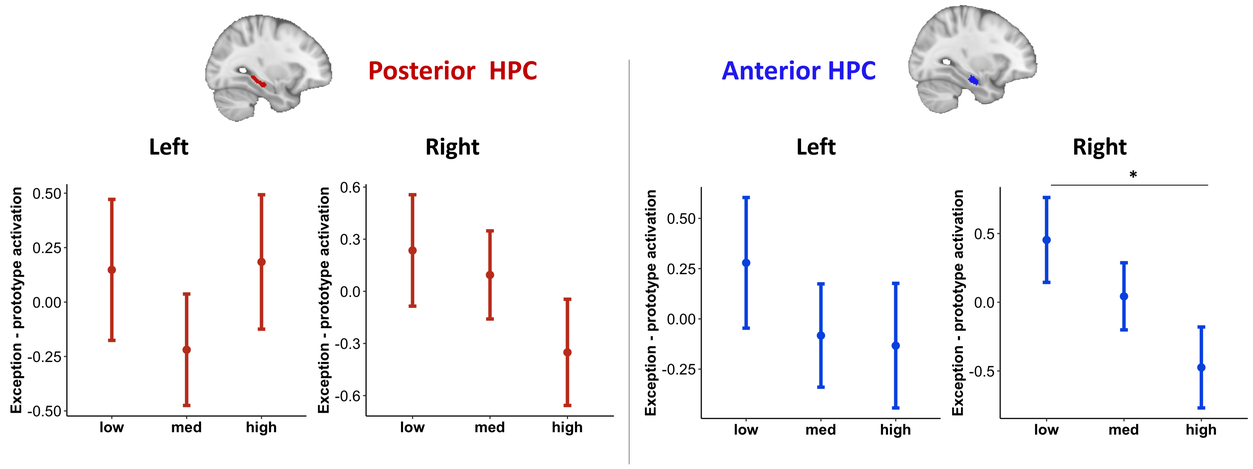
High learners rapidly encode distinct representations for **exceptions**

Early Learning Hippocampal Engagement

Univariate analyses based on feedback presentation during the first 3 learning blocks.

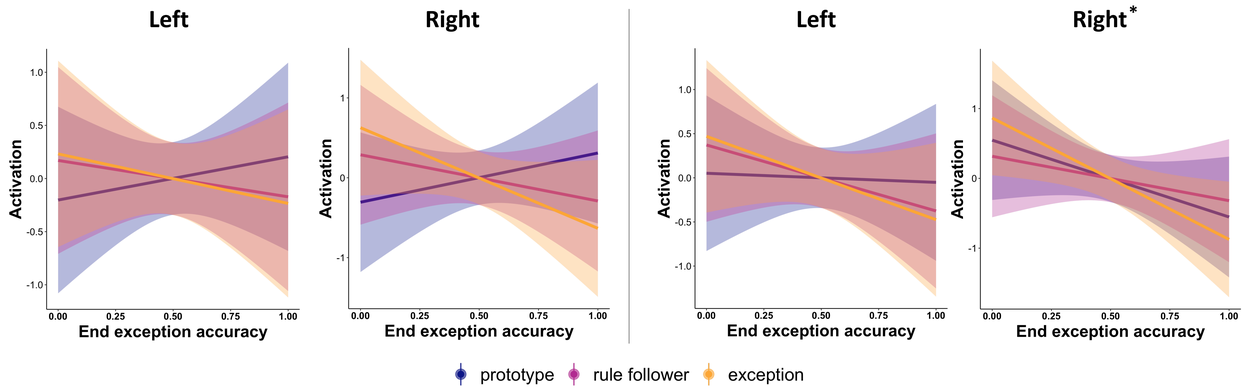
Right anterior HPC deactivation early in learning in high learners, p <0.05.

Linear model: ROI exception activation relative to prototype ~ learner type



Right anterior HPC deactivation early in learning predicts end of learning accuracy, specifically for categorizing exception items, p <0.05.

Linear model: ROI activation ~ stimulus type*end of exception learning accuracy



Conclusions

Distinct HPC long axis engagement in early learning supports flexible concept formation.

Model suggests greater representational change for exceptions, an index of flexible knowledge, early in learning for high learners.

High learners exhibit deactivation of anterior HPC early in learning, which could be the neural underpinning of sparse representations of exceptions.

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