Flexible Object-Label Associations Following Rapid Perceptual Learning in Patients with Hippocampal Damage

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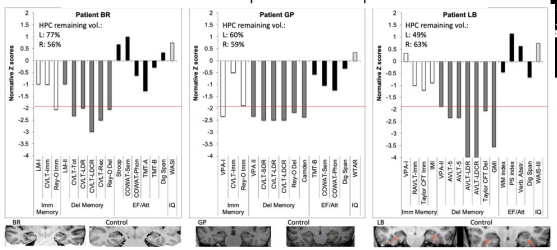
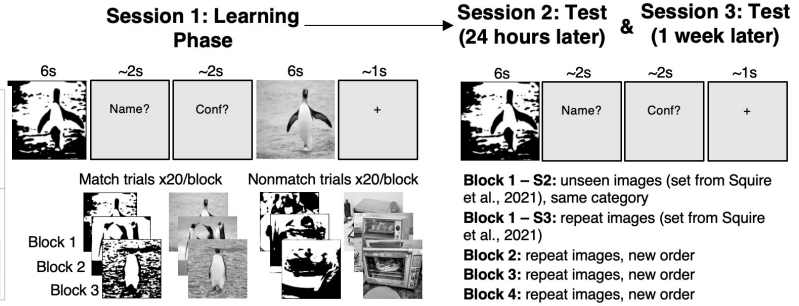
Background

- Hippocampal (HPC) damage → impaired conscious, flexible (declarative) memory, preserved non-conscious, inflexible (nondeclarative) memory[1]
- Squire et al., (PNAS, 2021) → HPC patients correctly named ambiguous images (Mooney figures), even months after learning
  - Reasoned a nondeclarative disambiguation mechanism[2]
- Given that participants learned so rapidly, and naming items is a declarative (semantic) process, **could these newly learned representations also be flexible?**

Methods

	HPC	Controls
N =	4	15
Mean age (SD)	42.25 (13.45)	48.20 (17.05)
Means years education (SD)	14.00 (1.83)	16.53 (2.48)

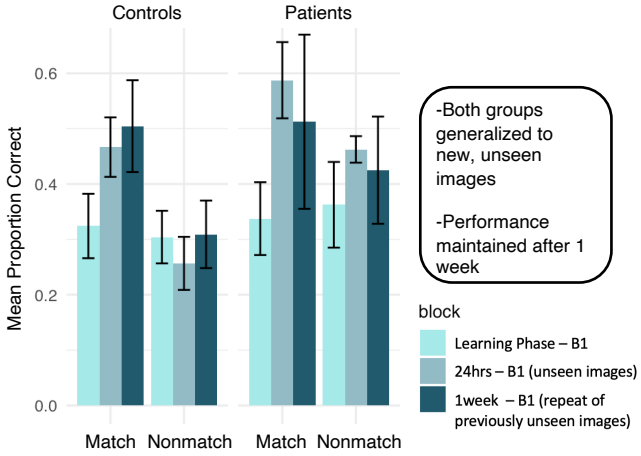




Block 1 – S2: unseen images (set from Squire et al., 2021), same category
Block 1 – S3: repeat images (set from Squire et al., 2021)
Block 2: repeat images, new order
Block 3: repeat images, new order
Block 4: repeat images, new order

Results

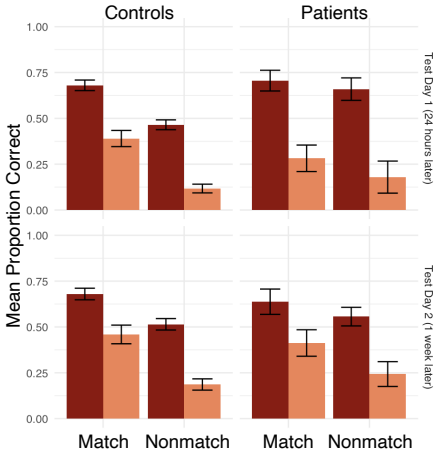
a) Naming Accuracy – LP, Block 1 vs. Test Sessions Block 1



-Both groups generalized to new, unseen images

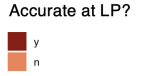
-Performance maintained after 1 week

b) Accuracy Based on LP Performance

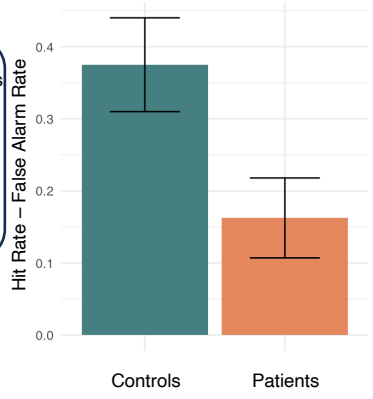


-Why did participants also improve on nonmatch trials?

-accurate naming at LP → improved performance



c) Recognition memory of grayscale images from the non-match condition



-Here, hits – false alarms is the proportion of "old" responses on old items minus the proportion of "old" responses on new items

-Although patients are significantly lower, both groups perform poorly

Conclusions

1. We replicated Squire et al.'s findings, showing that both HPC patients and controls correctly named previously ambiguous images

2. Both groups were able to generalize their learnings to new, unseen images, confirming our hypothesis that the acquired representations are flexible

- Naming was retained even 1-week later

3. Although to a lesser extent than matching trials, generalization sometimes occurred for nonmatching trials

- likely due to participant-driven disambiguation

Instead of purely nondeclarative processes, learning may be supported by hippocampally-independent, declarative mechanisms that promote the generalization of semantic representations → driven by rapid neocortical plasticity[3,4]

References

1. Squire & Zola-Morgan 1988, TINS; 2. Squire et al. 2021, PNAS; 3. Hebscher et al. 2019, TICS; 4. Merhav et al. 2015, Neuroimage