

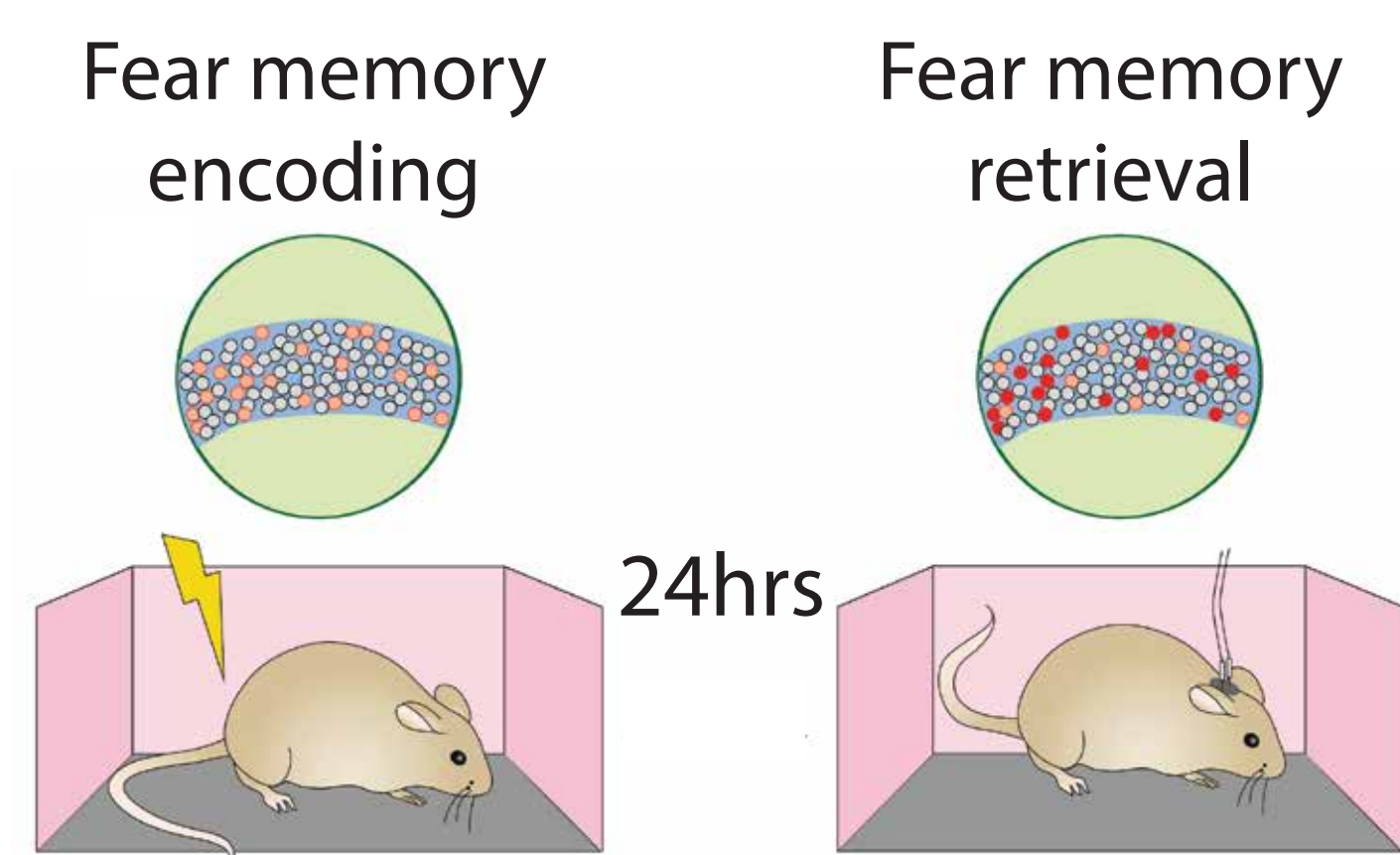
Augustin C. Hennings*, Mason McClay, Jarrod A. Lewis-Peacock, & Joseph E. Dunsmoor
Institute for Neuroscience, The University of Texas at Austin

1. INTRODUCTION

Background

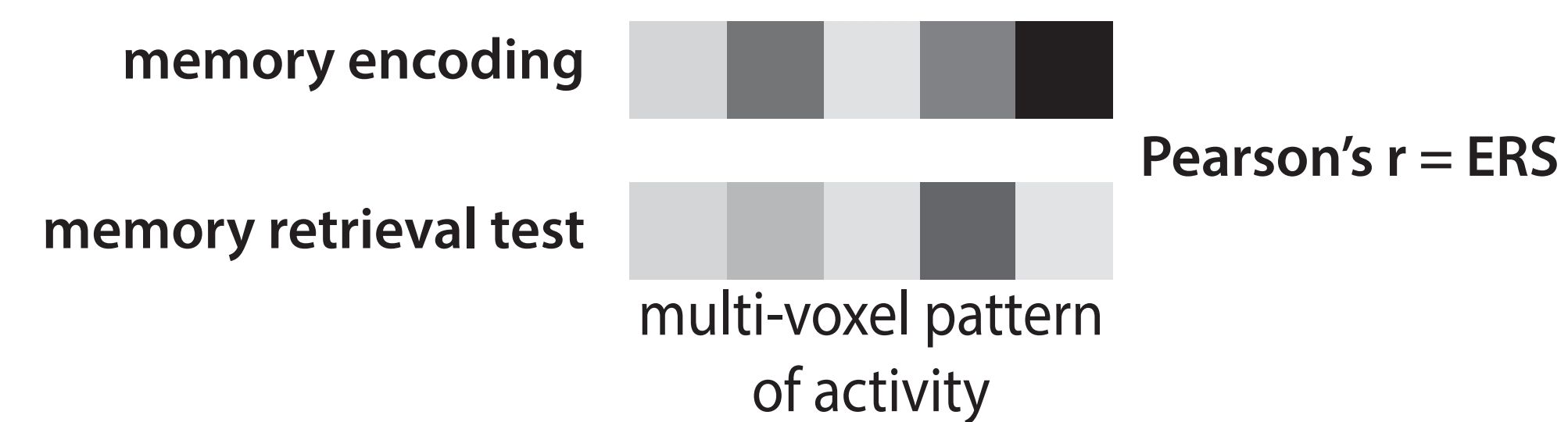
Specificity of neural coding

- The neural circuits which encode a memory reactivate during retrieval
- Fear and extinction engrams are stable and separable, in rodents
- Engram reactivation predicts behavior

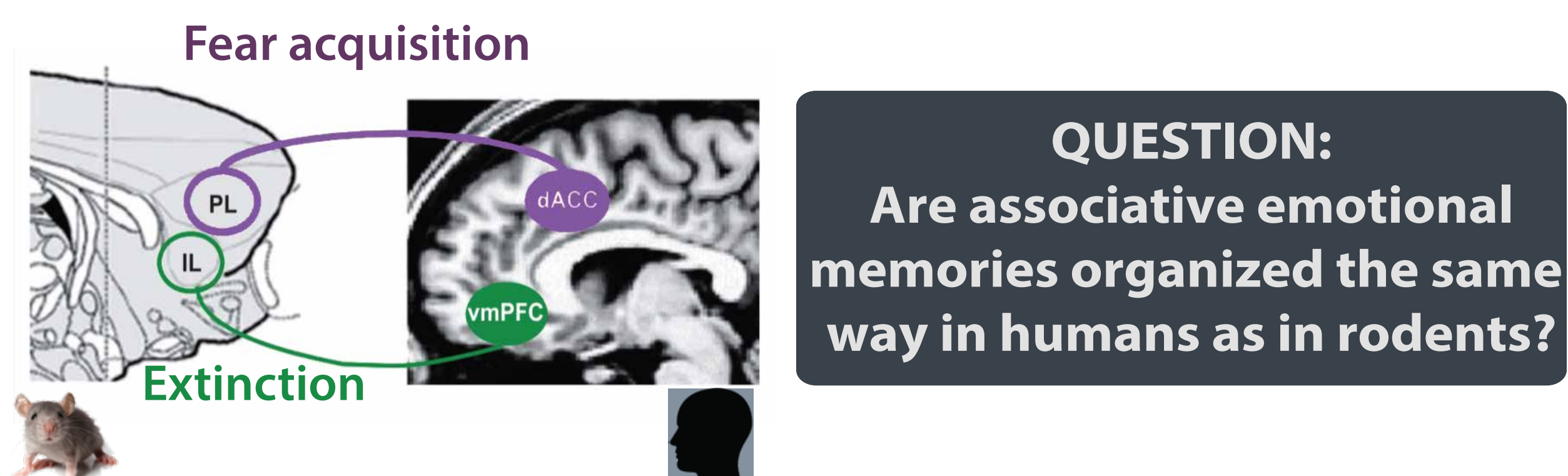


Reinstatement in the human brain

- Encoding-retrieval similarity (ERS) measures the overlap of neural activity from encoding to retrieval using functional MRI.



Dual role of PFC in emotional memory



Hypotheses

There will be a double dissociation of emotional memory reinstatement in the PFC

- We predict that fear acquisition memories are preferentially reinstated in the dACC, while extinction memories are preferentially reinstated in the vmPFC

Individuals with PTSD will display dysregulated reinstatement of emotional memories across these regions

- Specifically, individuals with PTSD should show less reinstatement of extinction memories in the vmPFC compared to healthy adults

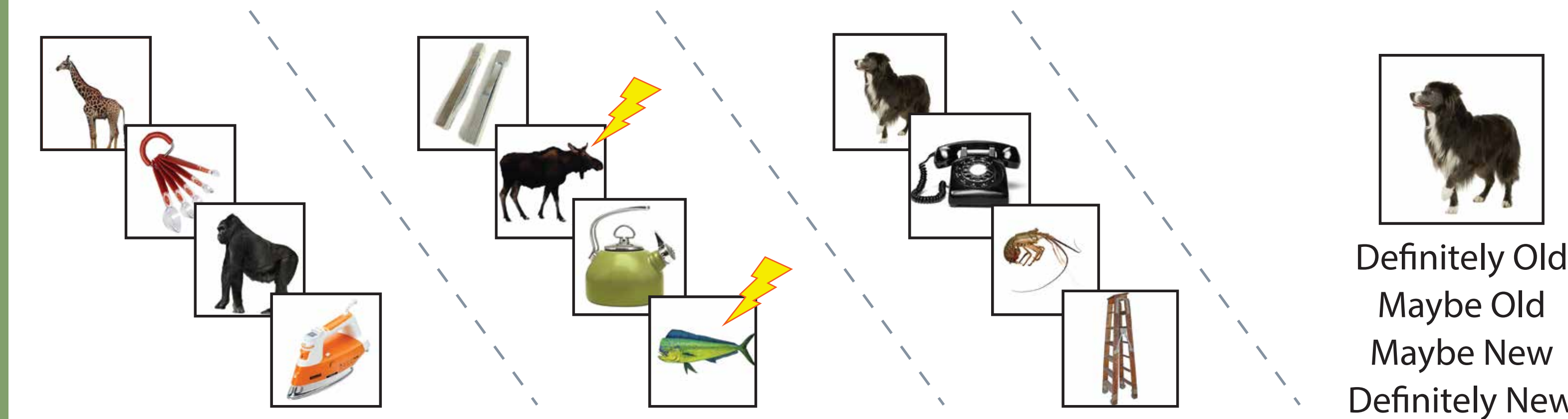
2. METHODS

N=24 Healthy adults, N=24 Individuals with PTSD

2-day fMRI study, TR = 2s, 3mm³ resolution. Imaging data preprocessed with fMRIPrep, cortical ROIs defined from meta-analyses, 10mm spheres restricted to grey matter. Freesurfer parcellations used for subcortical ROIs

Episodic-associative hybrid task

Baseline → Fear acquisition → Extinction → Surprise Recognition Memory Test
24hrs



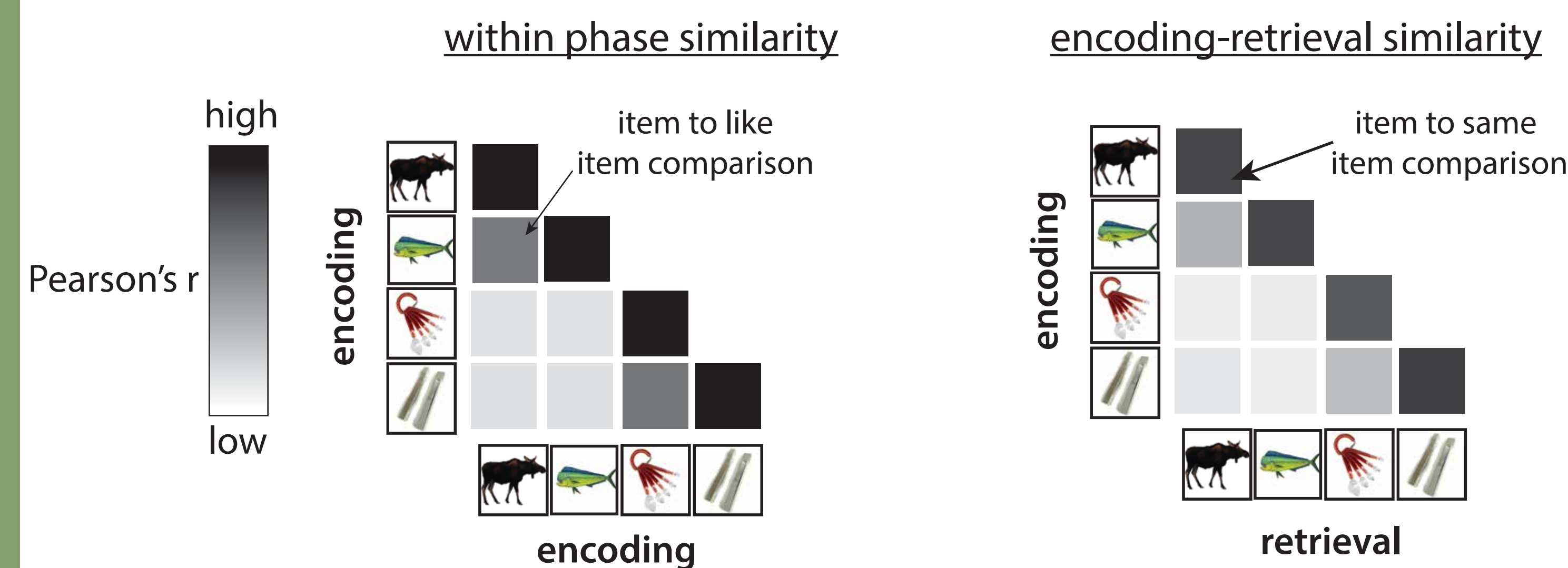
CS+ CS- = Animals, Tools ⚡ 50% CS+US reinforcement

Unique exemplars are encoded in distinct emotional contexts - "engram tag"

Each episodic memory has 1 emotional association (none, fear, or safety)

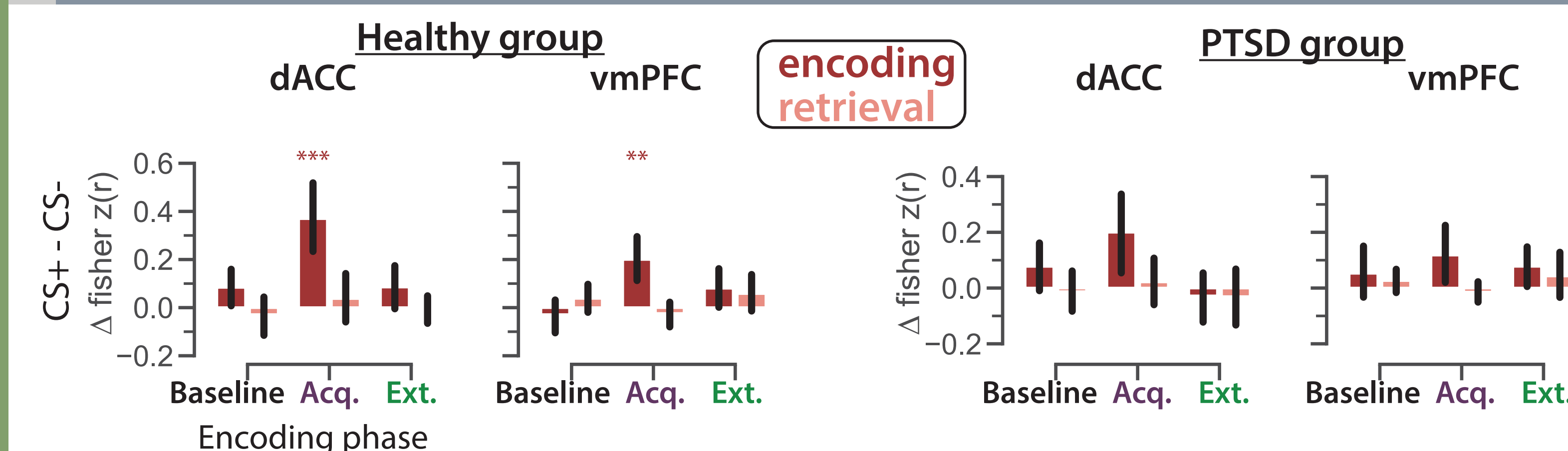
Memory is probed 24hrs later, with no threat of shock

Quantifying representational similarity



Emotional representation is quantified as the difference between CS+ and CS- items
 $\Delta \text{fisher } z(r) = \text{CS+} - \text{CS-}$

PFC is sensitive to emotional memories during encoding



CONCLUSIONS

Healthy adults exhibit a double dissociation of associative emotional memory reinstatement in the PFC

Individuals with PTSD display dysregulation of emotional memory reinstatement in the PFC

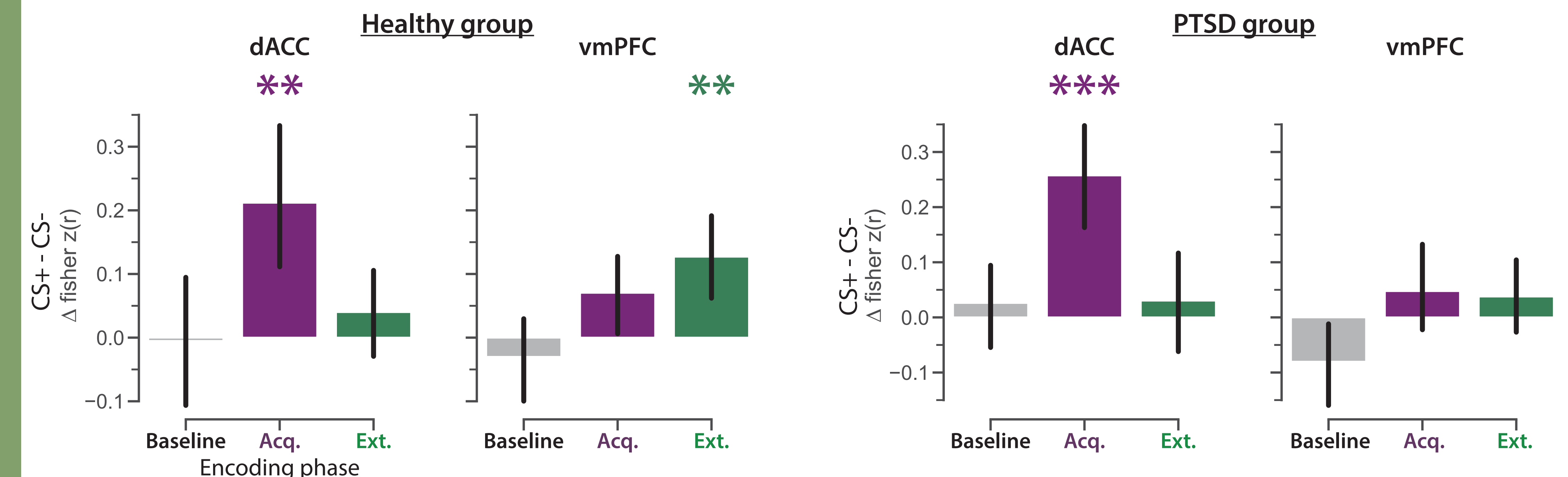
Distinct organization of opposing emotional memories in the PFC may be adaptive in healthy adults, may prevent memories from being overwritten

References

- Frankland, et al., (2019). Nature Neuroscience.
Quirk & Mueller (2008). Neuropsychopharmacology.
Ritchey, et al., (2013). Cerebral Cortex.
Dunsmoor & Kroes, (2019). Current Opinion in Behavioral Science
Funding: NIH/NIMH R00 MH106719

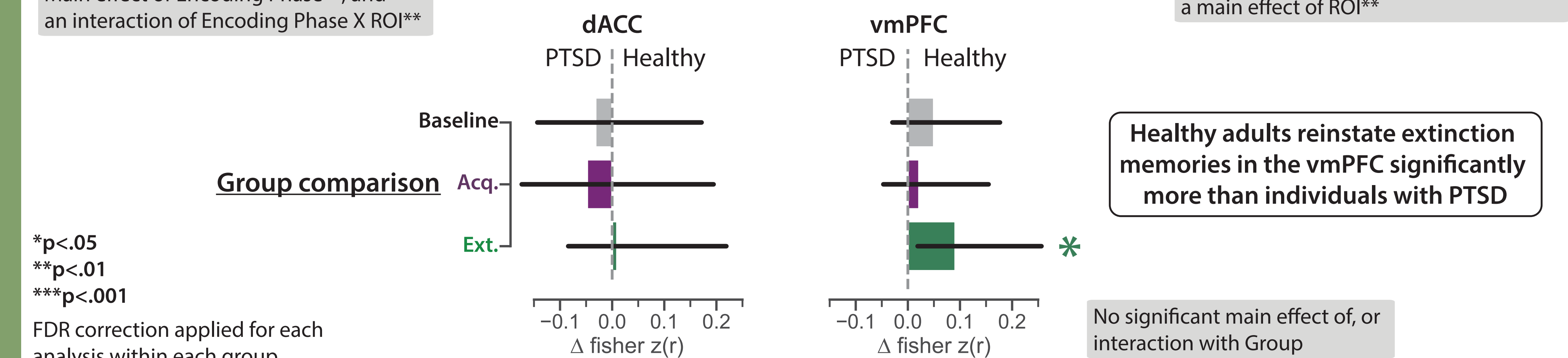
3. RESULTS

Double dissociation of emotional memory reinstatement in PFC



Main effect of Encoding Phase** and an interaction of Encoding Phase X ROI**

Main effect of Encoding Phase***, and a main effect of ROI**



* $p < .05$
** $p < .01$
*** $p < .001$

FDR correction applied for each analysis within each group

Healthy adults reinstate extinction memories in the vmPFC significantly more than individuals with PTSD

No significant main effect of, or interaction with Group

No emotional reinstatement observed in subcortical ROIs

