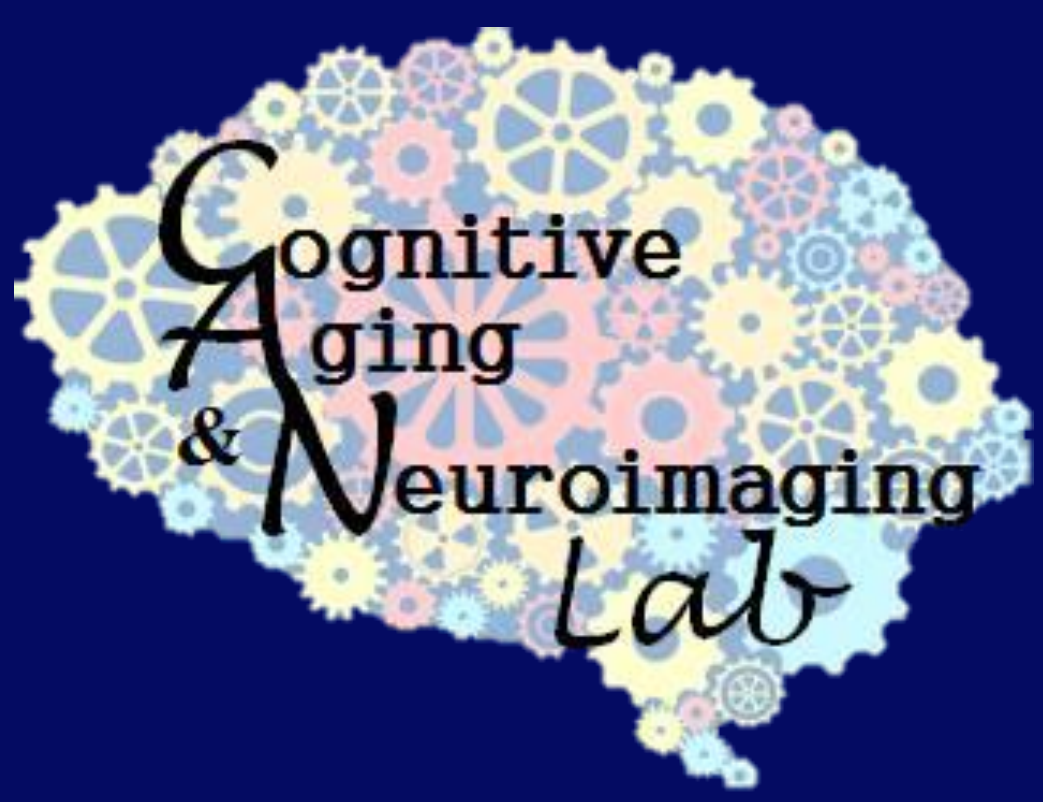# Encoding-Retrieval Similarity (ERS) of Perceptually Related Items and Their Relation to False Memories in Aging

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Introduction

- Greater age is associated with increased false memories, notably when perceptual details are similar across target and lure items (McCabe et al., 2009; Yassa et al., 2011)
- Few studies have deliberately controlled the perceptual similarity of visual stimuli and their relation to false memories
- Previous work from our group demonstrates increased activity in frontal and temporal regions associated with perceptual false memory processes (Dennis & Turney, 2018; Turney, & Dennis, 2017)
- Recent work suggests the similarity of neural patterns between encoding and retrieval in occipital and inferior temporal regions underlies false memory processing in younger adults (Ye et al., 2016)
- No work has examined such similarity of neural patterns when perceptual similarity is controlled

The purpose of the current study is to investigate age-related differences in the neural recapitulation of visual information associated with targets and highly similar lures

Method

Encoding
- 96 faces across 4 runs
- Participants made typical/atypical ratings of stimuli

Retrieval
- Participants viewed 4 runs of 112 faces including
  - 48 targets
  - 48 morphed lure faces
  - 16 unrelated lure faces
- Participants responded using old-high, old-low, new-low, and new-high memory decisions

Demographics
- 25 younger adults (M_{age} = 23, SD_{age} = 3.74)
- 25 older adults (M_{age} = 68.0, SD_{age} = 5.83)

Encoding   100/0

Retrieval   70/30   50/50   30/70   0/100

Related Lures   Unrelated Lure

Analyses

Behavioral:
- Repeated measures ANOVAs examining hit and false alarm rates across perceptual similarity

Encoding-Retrieval Similarity (ERS) Analysis:
- Calculated the similarity (Pearson's r) of neural patterns associated with target and lure items at retrieval with their corresponding items at encoding
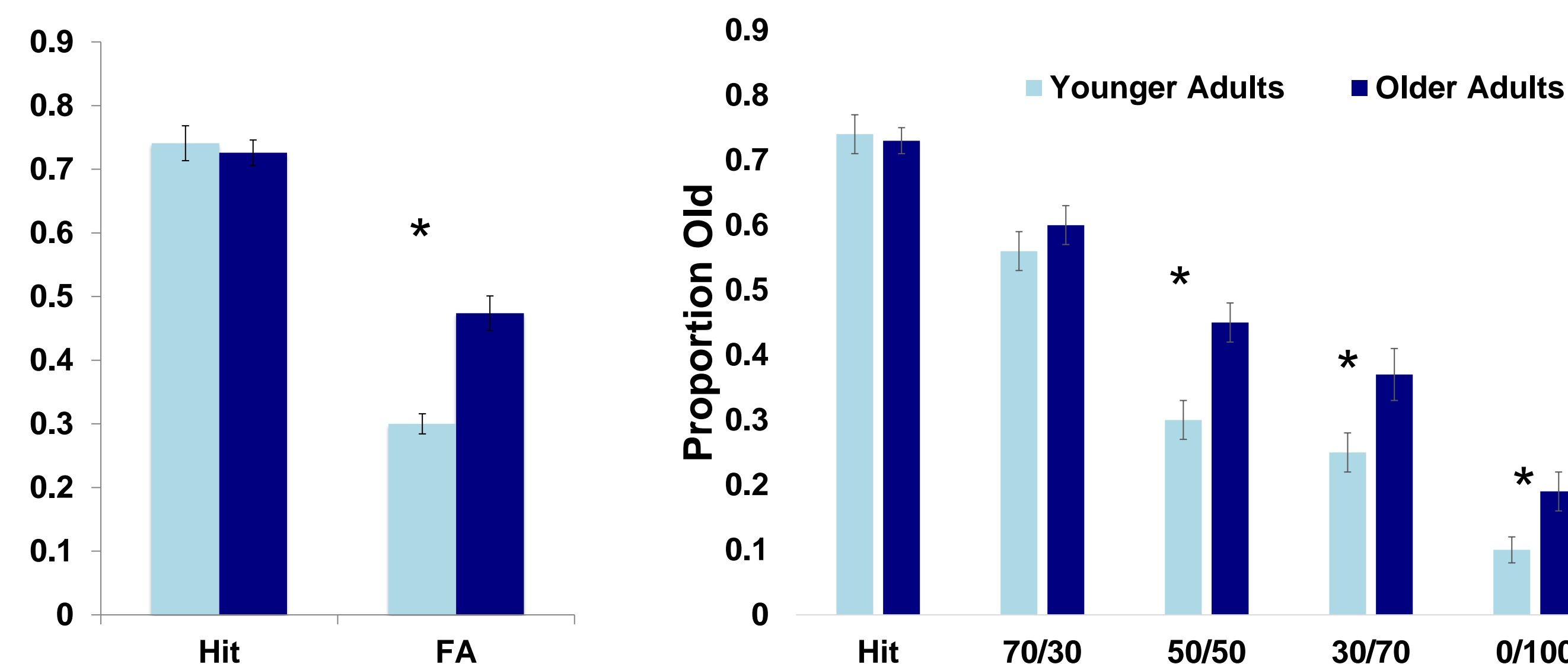- ERS analyses were conducted at the single-item level as well as the set level
- Data were kept in native space and minimally smoothed
- Bilateral ROIs selected anatomically using Freesurfer
- All analyses completed using the CoSMoMVPA toolbox

Behavioral Results

Conclusions:
- False memory rates were greater for older adults than younger adults, and false memory rates increased with perceptual similarity

ERS-Item Level

Bilateral Inferior Temporal

Bilateral Middle Occipital

Bilateral Hippocampus

Age Group: Older / Younger

* indicates $p < .05$

ROIs (created with Freesurfer):
Inferior Temporal Cortex
Middle Occipital Cortex
Hippocampus
Temporal Pole

Results
- In inferior temporal cortex, we observed an age-related reduction in ERS for targets, but not lures
- ERS was reduced for both targets and lures in the middle occipital cortex in older compared to younger adults
- We observed an age-related reduction in the hippocampus for targets, with negative ERS in older adults

ERS-Set Level

Bilateral Inferior Temporal

Bilateral Middle Occipital

Bilateral Temporal Pole

Results
- At the set level, we again observed reduced ERS for targets in the inferior temporal cortex, and replicated reductions in middle occipital cortex
- ERS *increased* for lures within the temporal pole of older compared to younger adults

Conclusions

ERS-Item Level
- Reduced ERS in the inferior temporal and occipital cortex for older adults suggests fewer perceptual details of target items are recapitulated during retrieval
- Negative target ERS in the hippocampus of older adults likely reflects a failure to process item-specific details

ERS-Set Level
- The similarity of neural patterns between encoding and retrieval was again reduced for visual regions, showing deficits at multiple levels
- Temporal pole increases suggest older adults may demonstrate a greater reliance on gist-information

Future Directions
- Examine the relationship between neural outcomes and behavioral measures (d', false alarm rates)
- Explore age-related differences in encoding-retrieval similarity for lure subtypes, and within functionally defined regions

References & Acknowledgements

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