# Aging and the Role of Prior Knowledge in Neural Discrimination of Scene Images

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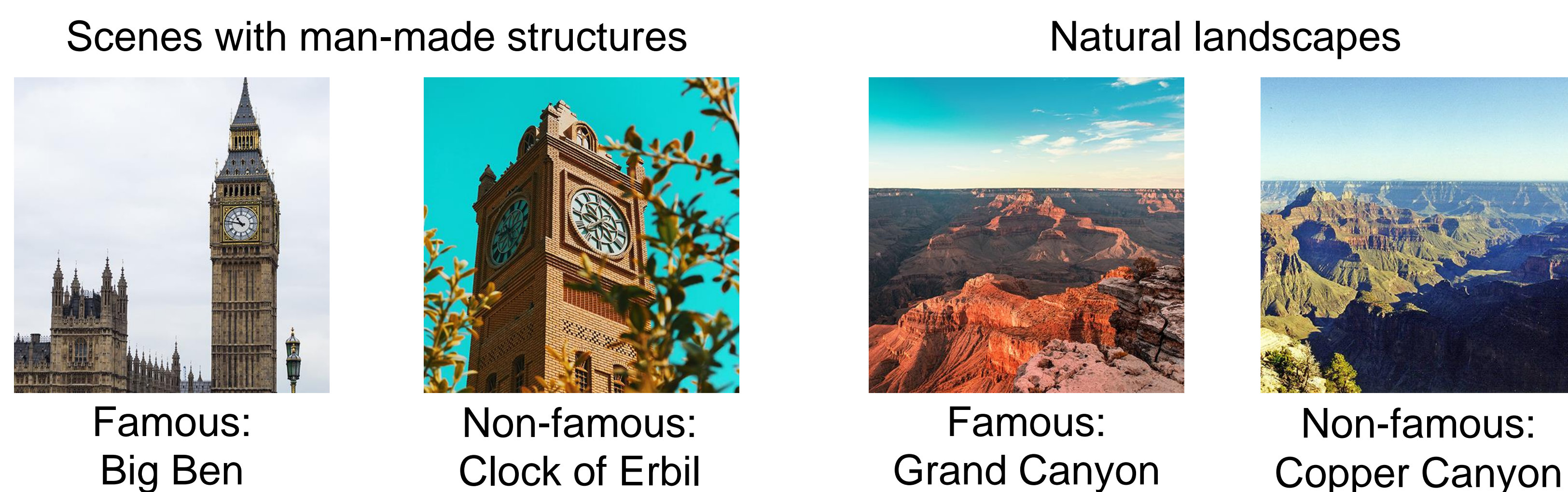Department of Psychology, University of Wisconsin-Milwaukee

## Background

- Detail and specificity of episodic memory declines with age[1].
- Older adults sometimes benefit from relying on prior knowledge[2], but it can also lead to false memories[3].
- Neural pattern analyses have been used to index memory content[4], and neural patterns can be less distinct in older adults[5].

How does prior knowledge affect the distinctiveness of neural patterns during perception and memory in young and older adults?
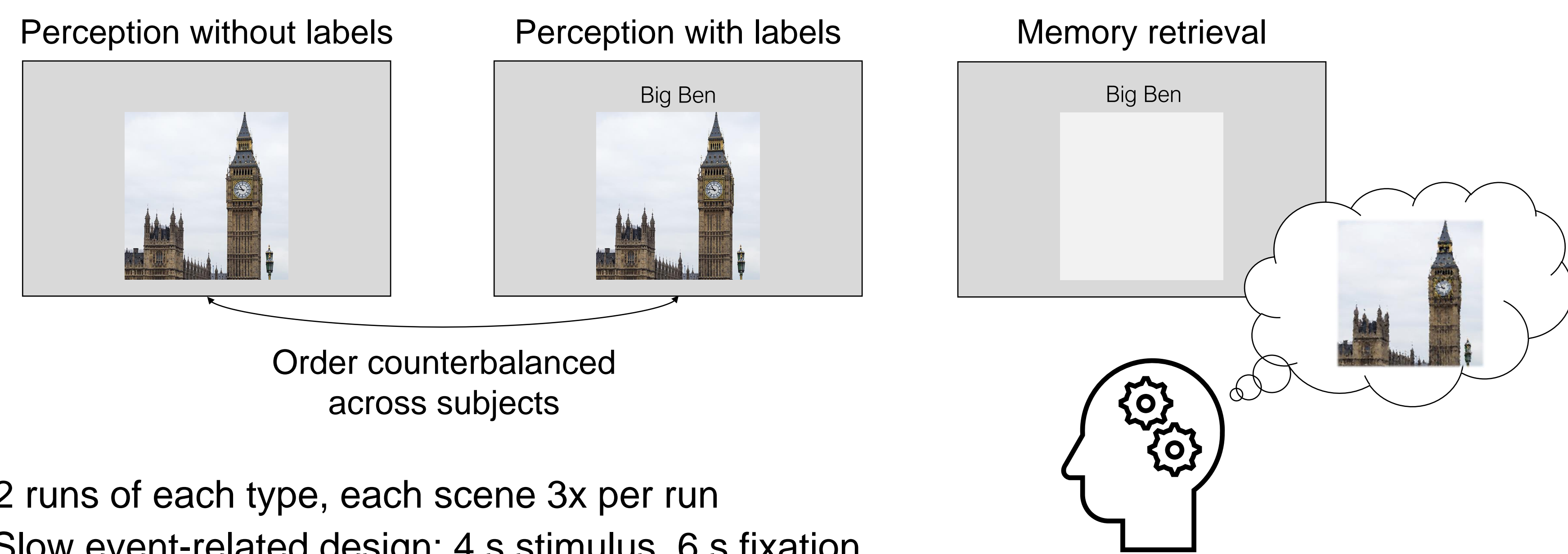
## Methods and behavioral results

Participants: 5 young (18-30) and 6 older (60-80) adults from Milwaukee area
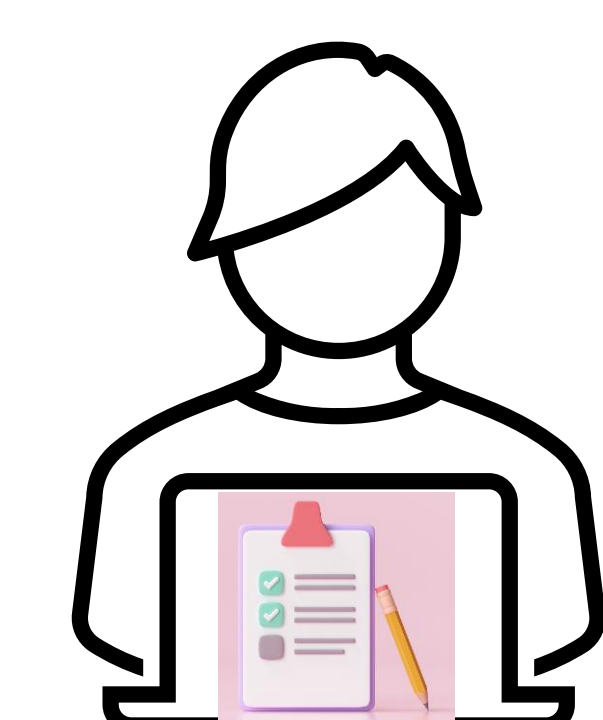
### Prior knowledge evoked by images of famous locations

Scenes with man-made structures



Famous: Big Ben

Non-famous: Clock of Erbil

Natural landscapes



Famous: Grand Canyon

Non-famous: Copper Canyon

Total of 16 scenes (4 per condition)

### fMRI scanning during scene perception and memory retrieval

Perception without labels

Perception with labels

Big Ben

Memory retrieval

Big Ben



Order counterbalanced across subjects

2 runs of each type, each scene 3x per run
Slow event-related design: 4 s stimulus, 6 s fixation

### Post-scan evaluation of scene memory

Scene descriptions

Forced-choice Recognition Task
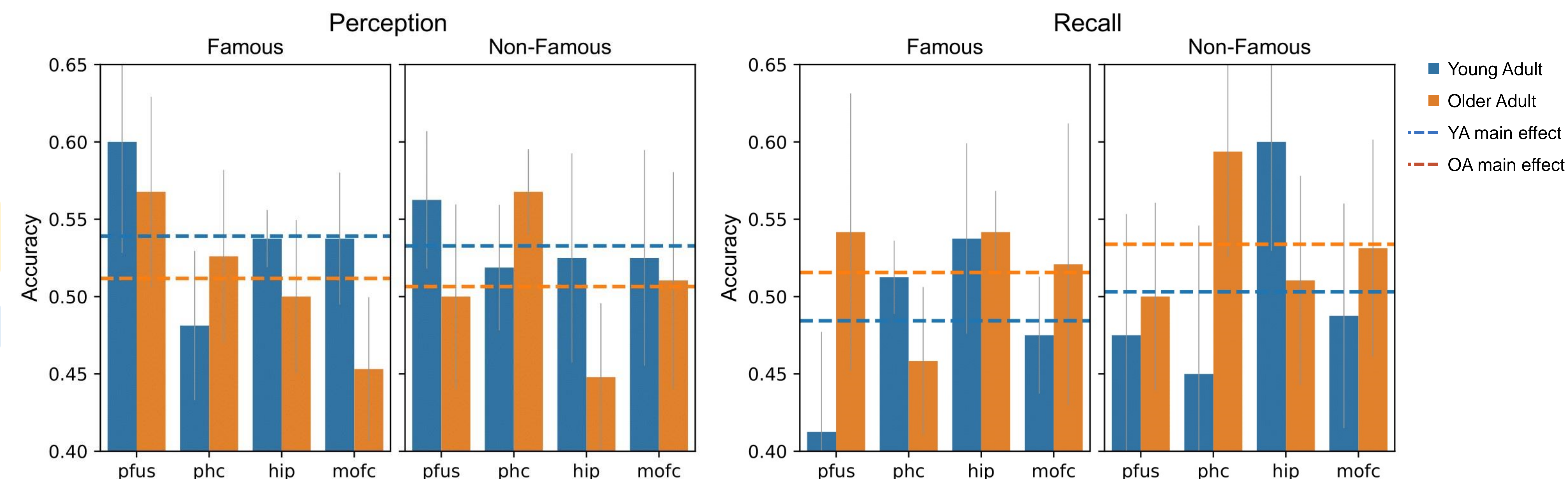


Knowledge of locations:
- Where is it located?
- Have you been there?

Memory of scene images:
- Describe the image.
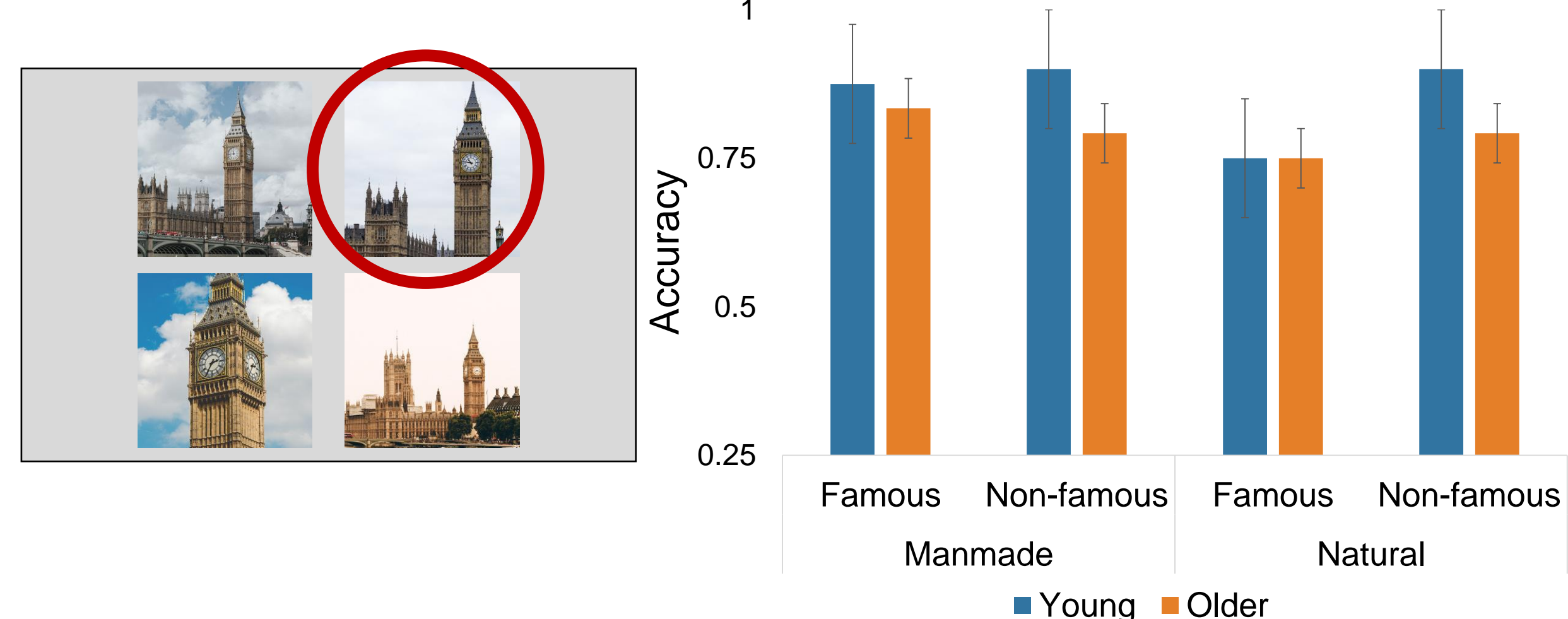
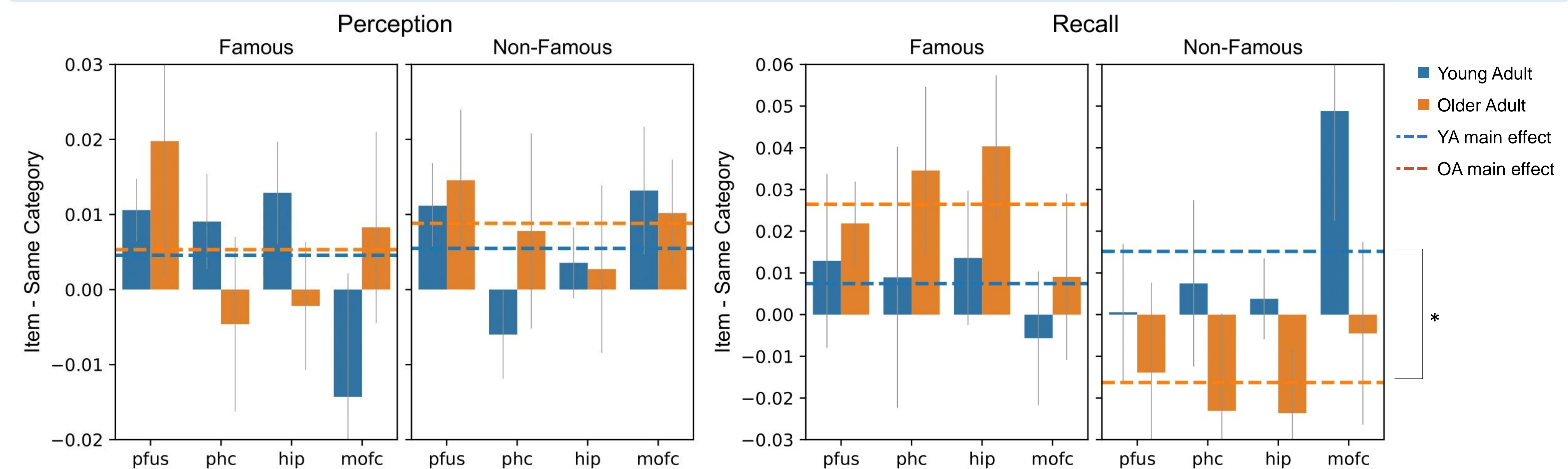- Higher accuracy for YA compared to OA for non-famous scenes

## Pattern Classification: Decoding Manmade vs. Natural Scenes



*Note.* pfus = posterior fusiform; phc = parahippocampal cortex; hip = hippocampus; mofc = medial orbitofrontal cortex

- Better classification accuracy for YA compared to OA for perception tasks.
- Better classification accuracy for OA compared to YA for memory retrieval task.
- Comparable overall classification regardless of whether famous or non-famous scenes were used.

## Representational Similarity Analysis: Representing Individual Scenes



*Note.* pfus = posterior fusiform; phc = parahippocampal cortex; hip = hippocampus; mofc = medial orbitofrontal cortex

- Perception: comparable representations of individual famous and non-famous scenes across age groups.
- Recall: Benefit of prior knowledge for older adults, comparable item representations for famous and non-famous scenes in YA.

## Conclusions and future directions

- Preliminary data (YA = 5, OA = 6) show...
  - …YA performed better on non-famous scenes for recognition tasks compared to OA.
  - …YA advantage in category-level decoding (manmade vs. natural) for perception, older adult advantage in recall.
  - …benefit of prior knowledge for OA for representing individual scenes
- Future directions: role of preprocessing pipelines and modeling choices, relationship between neural pattern distinctiveness and post-scan memory measures (recognition, detail of scene descriptions).

### References
1. Greene & Naveh-Benjamin. (2023) *Psychology and Aging.*
2. Ryan et al. (2015) *Hippocampus*
3. Koutstall & Schacter. (1997) *Journal of Memory and Language*
4. Polyn et al. (2005) *Science*
5. Koen & Rugg (2019) *Trends in Cognitive Science*

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