

Age differences in Retrieval-related Anterior shift in the Parahippocampal Place Area

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Background

- Prior research suggests a posterior-anterior gradient within cortical regions: memory-based representations are localized more anterior to perceptual representations – **Retrieval-related Anterior shift**.^{1, 2, 3}
- Parahippocampal place area (PPA) has been proposed to be divided into two subregions with distinct functional roles.^{4, 5, 6}
 - **Posterior PPA:** perceptual processing of scenes
 - **Anterior PPA:** contextual and mnemonic processing of scenes
- It has been suggested that anterior shift may reflect a shift towards conceptual representations.^{1, 2}
 - **Is anterior shift sensitive to age?**
 - **Is anterior shift relevant to memory performance?**

Methods

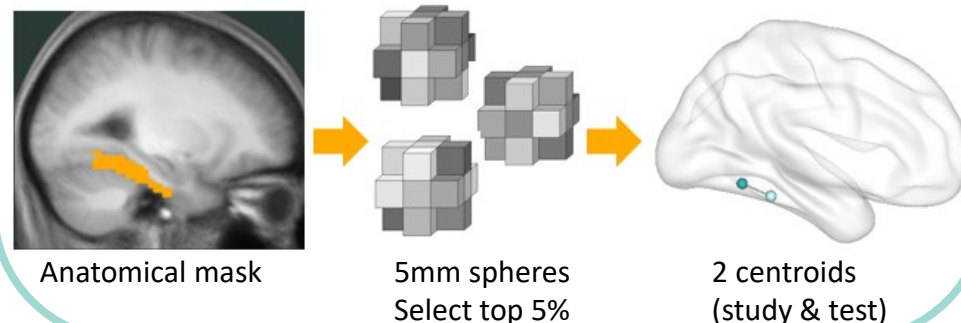
24 Younger (18 – 28 years) and 24 Older (65 – 75 years) adults underwent fMRI during encoding and retrieval tasks.

Encoding Task: Words paired with an image of a face or a scene; imagine a scenario where the object (word) is interacting with the face or scene.

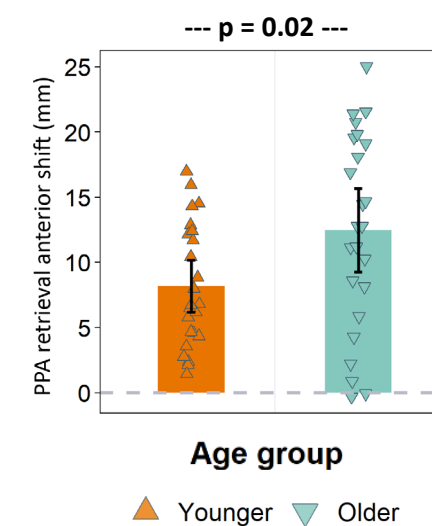
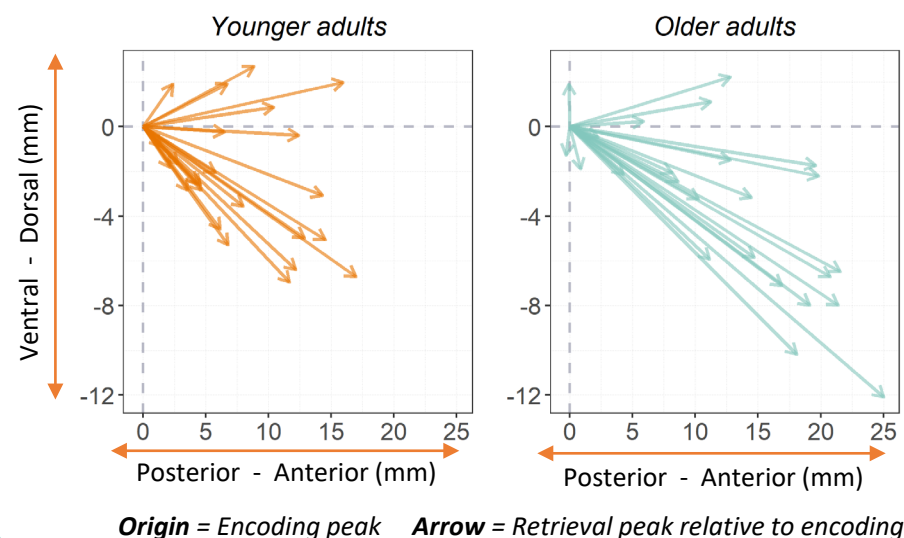
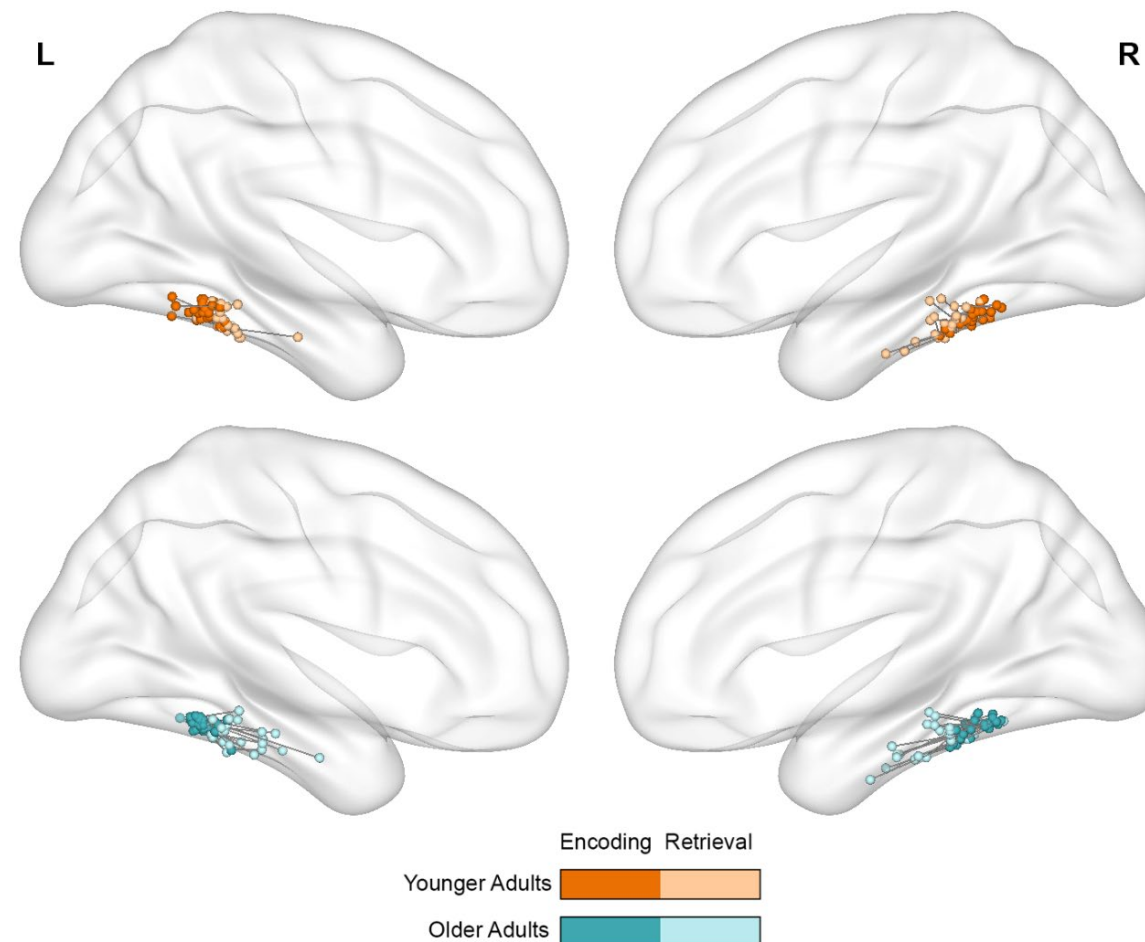
Retrieval Task: Presented with studied and new words; if word is judged old, indicate whether the word had been studied with a face or a scene.

Analysis approach:

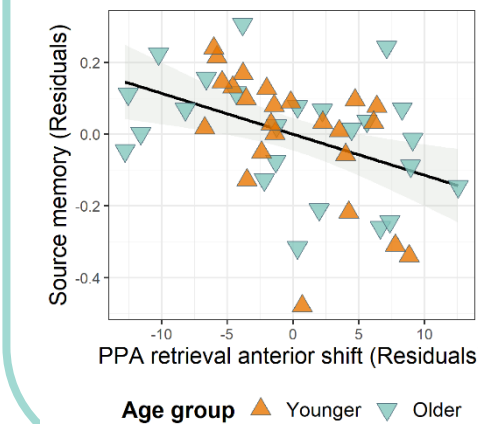
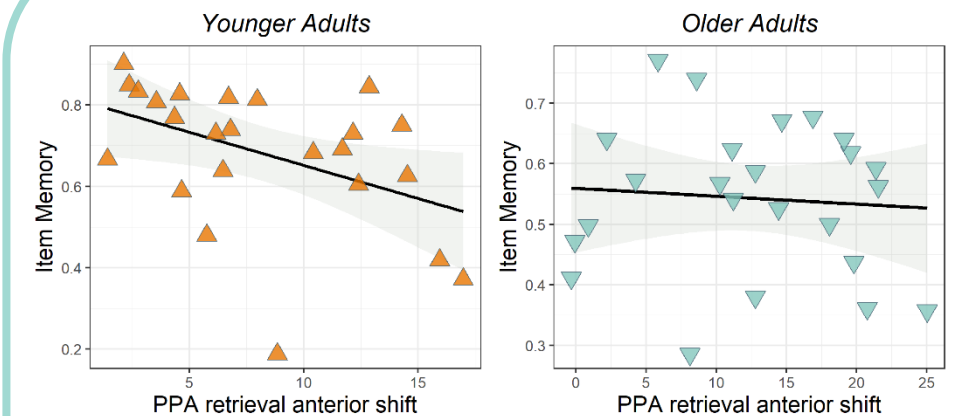
- Anatomical PPA mask using the Parahippocampal and Fusiform gyri.
- Scene > Face contrast for each subject, separately for study and test.
- 5mm spherical “searchlight” centered on every voxel of the mask.
- 5% of searchlights with highest scene-selectivity: MNI coordinates of the sphere centers were used to compute encoding and retrieval centroids (reflective of the areas with peak scene-selectivity)



Results



Results - continued



Relationship between PPA retrieval-related anterior shift and item memory
 Younger adults: $r = -0.44$, $p = 0.03$
 Older adults: $r = -0.08$, $p = 0.71$

Age-invariant relationship between PPA retrieval-related anterior shift and source memory
 $r_{\text{partial}} = -0.42$, $p = 0.003$

Conclusions

Older adults show greater PPA anterior shift relative to younger adults.

- Smaller anterior shift: retrieval of fine-grained perceptual information.
- Greater anterior shift: retrieval of higher-level conceptual information.
- Results suggest that older adults rely more on conceptual retrieval.
- **Greater anterior shift is associated with worse memory performance.**
- Retrieval of high-fidelity perceptual information appears to be beneficial to memory performance.

¹ Favilla et al., 2020, TINS

² Bainbridge et al., 2020, Cerebral Cortex

³ Steel et al., 2020, bioRxiv

⁴ Baldassano et al., 2016, eNeuro

⁵ Silson et al., 2016, Front. Hum. Neurosci

⁶ Epstein & Baker, 2019, Annu Rev Vis Sci.