

THE RETRIEVAL-RELATED ANTERIOR SHIFT IS MODERATED BY AGE AND CORRELATES WITH MEMORY PERFORMANCE

Sabina Srokova, Paul F. Hill, Michael D. Rugg

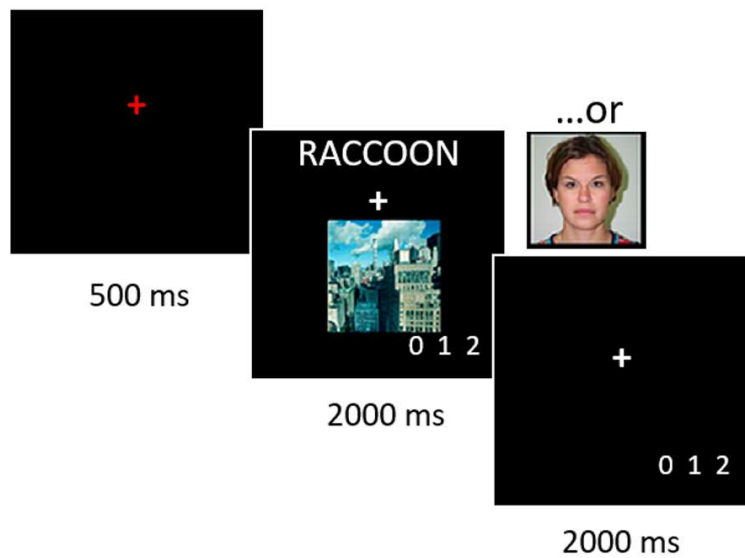
DAAMM 2021

Background & Aims

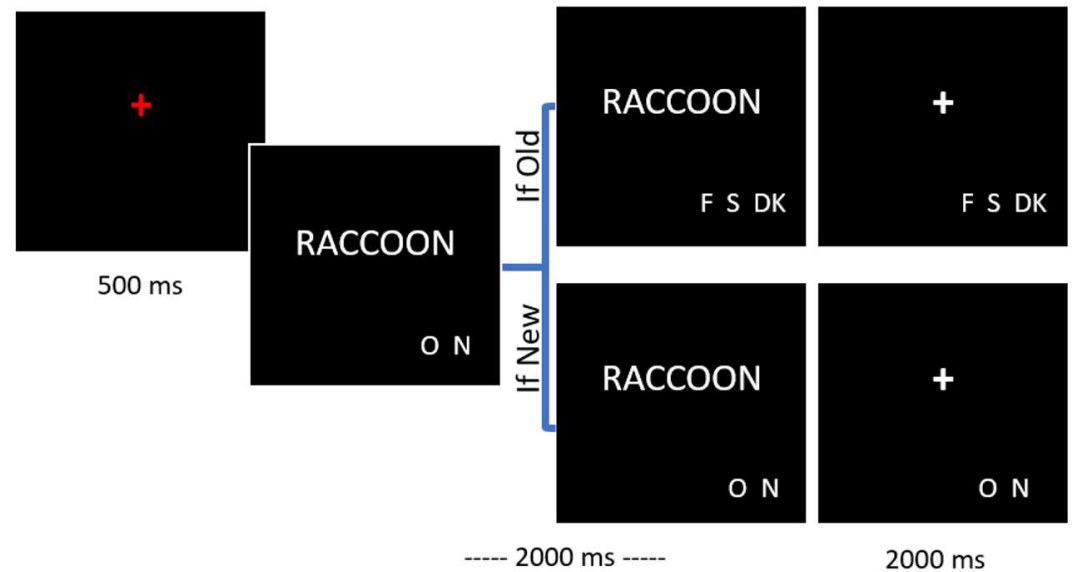
- **Cortical reinstatement** – retrieval-related reactivation of neural patterns observed at encoding
- **Anterior shift** – retrieval associated with peak neural activation in regions more anterior to the peak neural activity observed at encoding
- **Hierarchical organization along the posterior-anterior axis:**
[Posterior] Perceptual / High detail → [Anterior] Conceptual / Abstracted / Gist
Anterior shift = shift towards abstraction?
- **Two key questions:**
 - Age differences in anterior shift?
 - Relationship with memory performance?

Experimental Procedure

Encoding Phase



Retrieval Phase



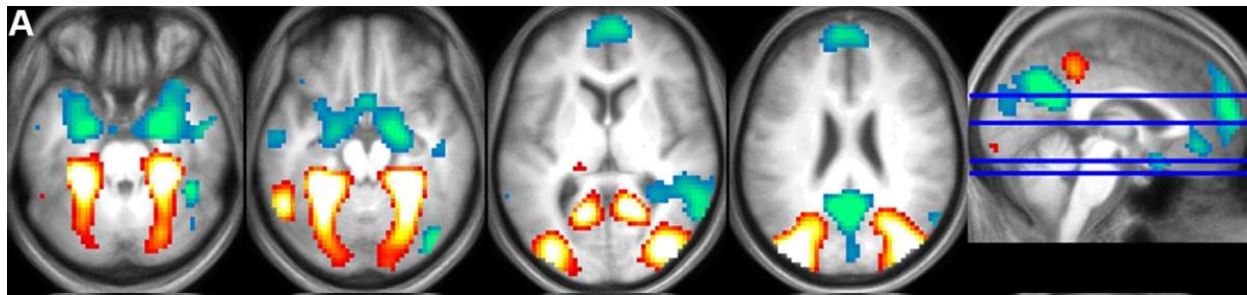
Behavioral Performance

$$Item Pr = \frac{Item Hit}{Old Trials} - \frac{False Alarms}{New Trials}$$

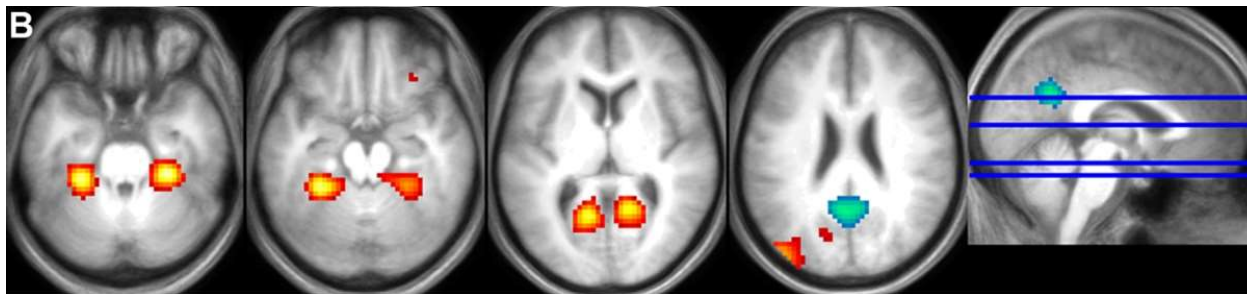
$$pSR = \frac{pSource Hit - 0.5 * (1 - pSource Don't Know)}{1 - 0.5 * (1 - pSource Don't know)}$$

	Younger Adults	Older adults	p-value
Item Memory (Pr)	0.68 (0.17)	0.54 (0.13)	0.003
Source Memory (pSR)	0.68 (0.18)	0.51 (0.16)	0.001

Whole-brain Univariate Analysis



Encoding:
Scene > Face
Face > Scene

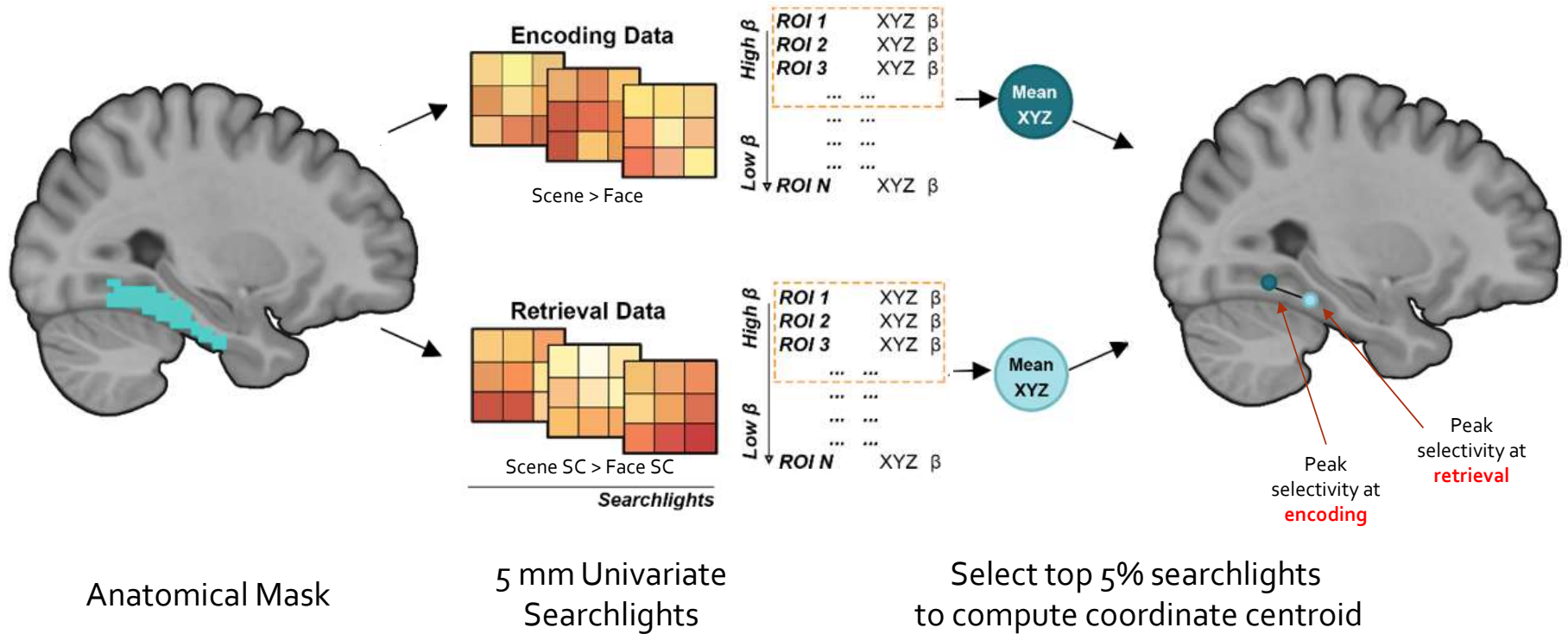


Retrieval:
Scene SC > Face SC
Face SC > Scene SC
SC = Source correct trials only

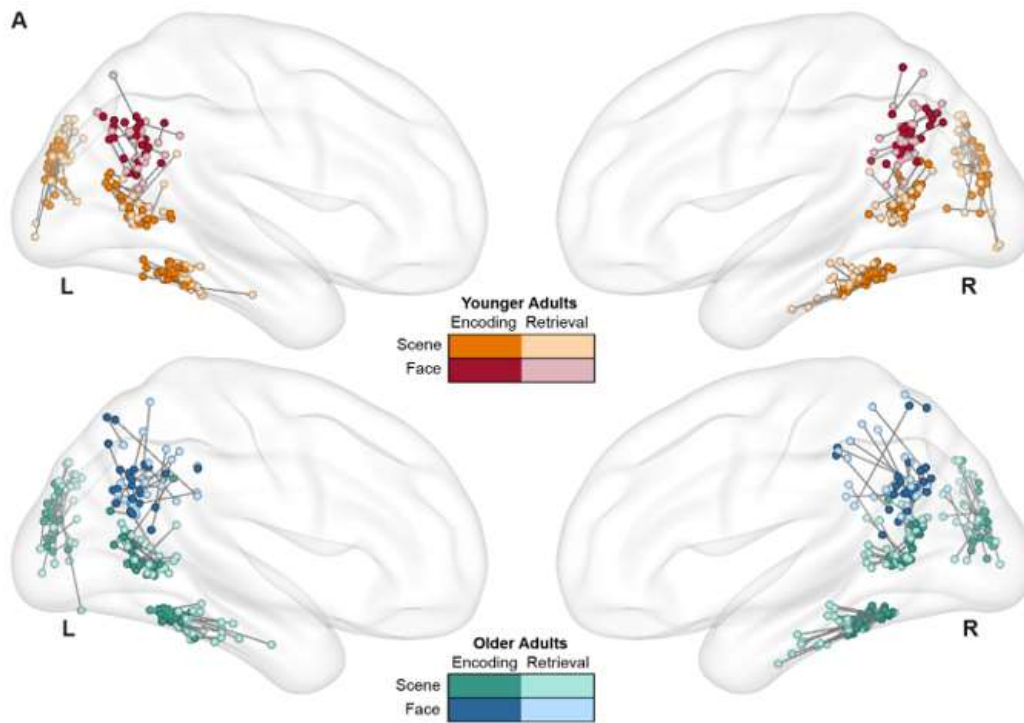
Four ROIs:

Parahippocampal place area (PPA), Medial place area (MPA), Occipital place area (OPA), Precuneus (PCU)

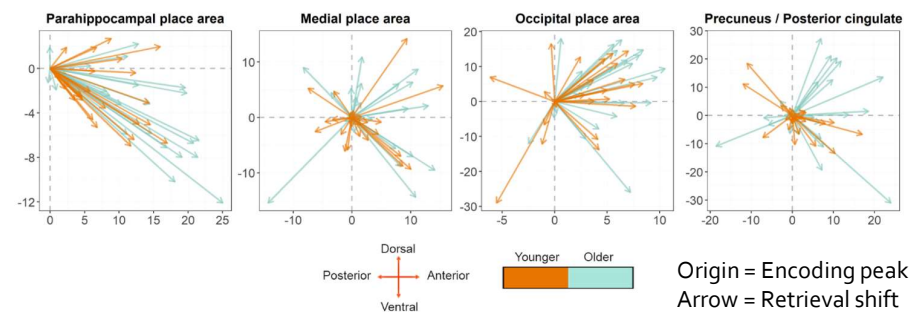
Anterior Shift - Analysis Approach

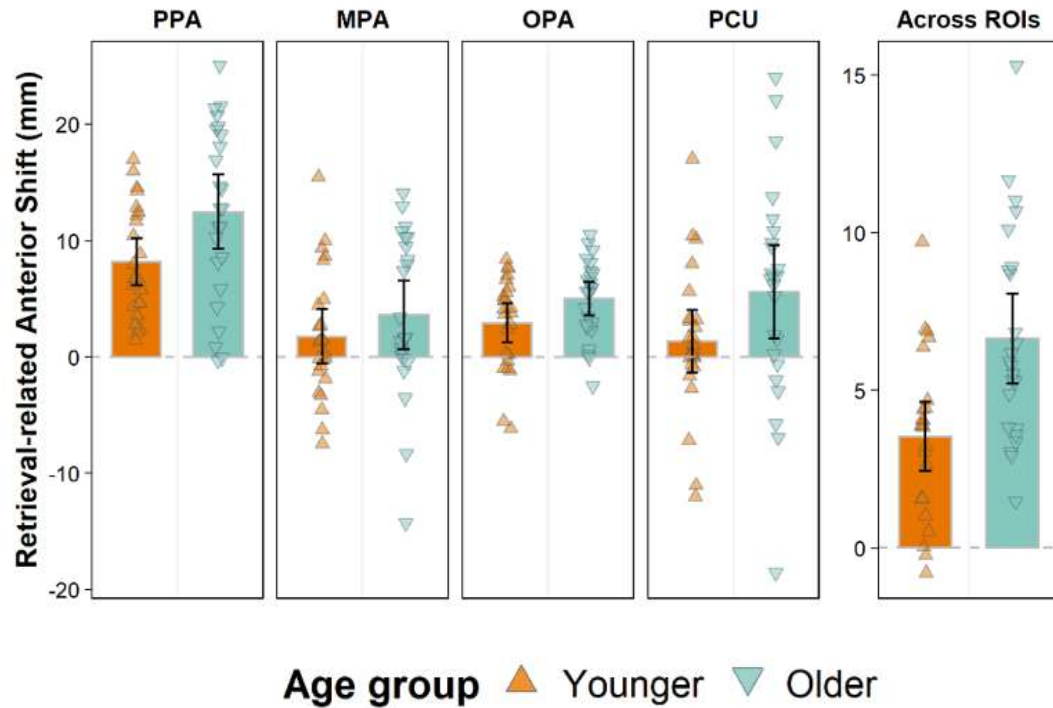


Anterior Shift - Results



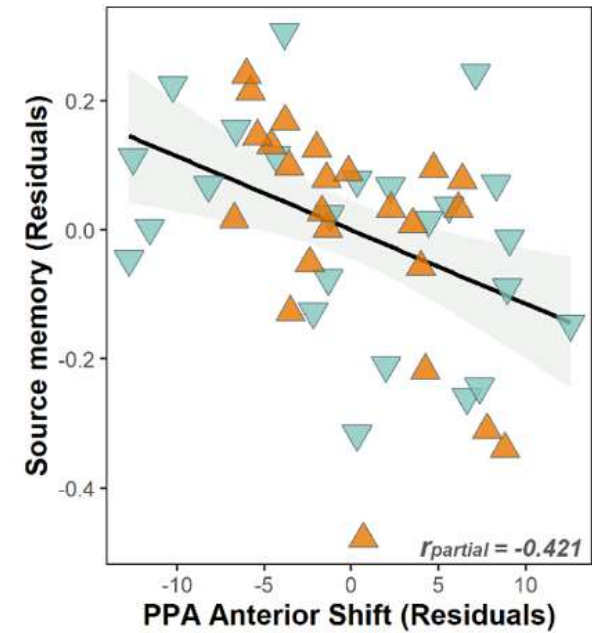
	Younger Adults	Older Adults
Left PPA	7.29 (5.79) $t = 6.169, p < 0.001 *$	11.09 (8.83) $t = 6.159, p < 0.001 *$
Right PPA	9.03 (6.40) $t = 6.906, p < 0.001 *$	13.82 (10.05) $t = 6.741, p < 0.001 *$
Left MPA	1.24 (6.69) $t = 0.907, p = 0.374$	3.45 (8.21) $t = 2.059, p = 0.051$
Right MPA	2.25 (5.51) $t = 2.005, p = 0.057$	3.70 (6.51) $t = 2.784, p = 0.011 *$
Left OPA	3.01 (4.21) $t = 3.503, p = 0.002 *$	4.34 (3.59) $t = 5.927, p < 0.001 *$
Right OPA	2.83 (5.55) $t = 2.504, p = 0.020 *$	5.65 (4.90) $t = 5.651, p < 0.001 *$
Left PCU	0.99 (5.83) $t = 0.833, p = 0.413$	5.83 (8.85) $t = 3.229, p = 0.004 *$
Right PCU	1.71 (7.31) $t = 1.146, p = 0.264$	5.33 (11.88) $t = 2.197, p = 0.038 *$





2 (Age group) x 4 (ROI) x (Hemisphere) ANOVA:
Main effect of age and no interactions

Greater shift in older relative to younger adults independently of ROI.



Age-invariant relationship
between PPA anterior shift and
source memory performance.

Summary & Conclusions

- Anterior shift covaries positively with age and negatively with memory:
 - Greater anterior shift in older relative to younger adults, independently of ROI.
 - PPA anterior shift negatively correlated with source memory, independently of age group.
- Anterior shift → mnemonic representations undergo a 'transformation' between encoding and retrieval.
 - Retrieved representations biased towards 'high-level' information that de-emphasizes 'low-level' perceptual detail
- Greater shift → shift towards abstracted and gist-based retrieval

Acknowledgements

Paul F. Hill, PhD
Michael D. Rugg, PhD

Special thanks to the members of the fNIM Lab and our research participants!

This work was supported by:
National Science Foundation Grant 1633873
National Institute of Aging Grant RF1AG039103.



fNIM laboratory
functional Neuroimaging of Memory

See also as a bioRxiv preprint! <https://doi.org/10.1101/2021.08.30.457871>