Comparison of representational similarity of episodic memory traces at encoding and retrieval in young and older healthy adults

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INTRODUCTION

Healthy aging is classically associated with changes in episodic memory performance and related brain activity. Employing Multivariate Pattern Analyses (MVPA) -a voxel-by-voxel variability analysis-, we investigated here if lower performance in older is related to less similar neuronal traces between the stages of encoding and retrieval of information.
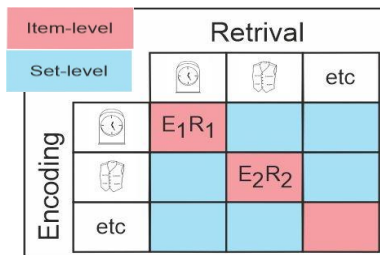
PARTICIPANTS & METHODS

Demographics

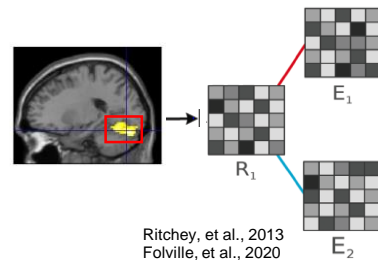|	Young (N=53)	Older (N=63)	t(114)
Age	23,6 (3,07) [19-31]	66,2 (4,42) [60-75]	***(t=-58.91; p<.001)
Gender	24F	34F	
Education	15.2 (1.77) [12-18] [1]	14,7 (2,75) [10-25] [2]	NS (t=-0.88; p=.38)
Mattis	-	140.98 (2,56) [135-144] [3]	-

Note. [1]N=46; [2]N=57; [3]N=54

Participants completed a recognition episodic memory task in an fMRI setting. Representational Similarity Analyses (RSA; a Multivariate Pattern Analyses approach) was employed to assess pattern similarity activity between age groups and encoding / recognition conditions. Encoding-Retrieval Similarity (ERS) maps were computed for each participant at item and set levels.

Ritchey, et al., 2013
Folville, et al., 2020

Item level: comparison of encoding and retrieval for a given item
Set level: comparison of each item to the average of all remaining items

ERS effects were localized by employing a voxel-vise searchlight procedure resulting in whole-brain maps.
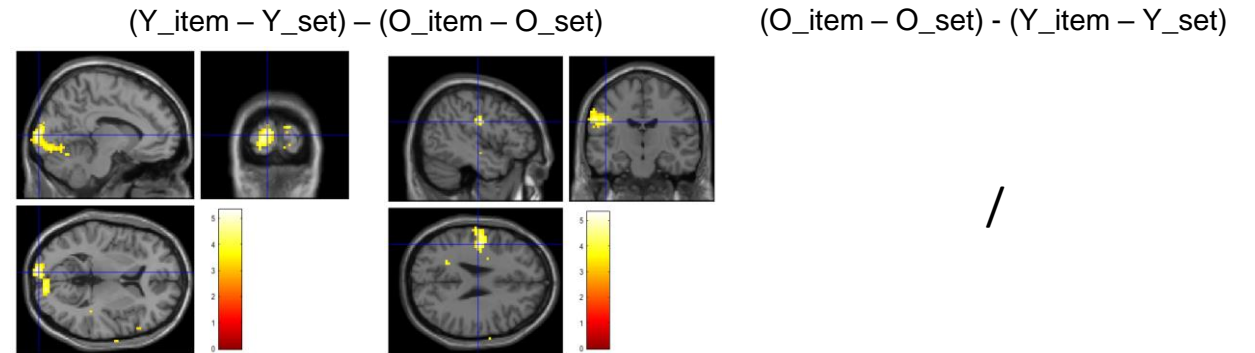Item and Set maps were Fisher-Transformed and sent to SPM12 for group analyses

SPM12 full factorial ANOVA 2 X (young vs. old) X 2 (item vs. set) analyses were conducted

RESULTS

Behavioral results

Indicate lower performance in the older group for accuracy (t=2.72; p<0.01) and reaction time (t=-3.65; p<.001)

Imaging results

(Y_item – Y_set) – (O_item – O_set)   (O_item – O_set) - (Y_item – Y_set)

At the brain level, larger encoding-retrieval similarity is observed in young by comparison to older in brain regions centered on the left occipital pole and left post-central (p<0.05 corrected at voxel level; figure displayed at p<0.001 uncorrected)

DISCUSSION

• Both behavioral and brain-level results indicate an age effect

• Lower ERS values in older indicate less specific reactivation of individual memory traces for pictures between encoding and recognition

•The localization of ERS changes were previously associated with:
- processing of visual characteristics of objects (occipital pole)
- embodied cognition (postcentral area)

• One possible explanation of the observed aging effect on recognition performance is that poor visual and sensorimotor encoding processes result in less distinctive memory traces

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