THE NEURAL CORRELATES OF RECOLLECTION AND FAMILIARITY DURING AGING

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INTRODUCTION

Our ability to recognize previously encountered information depends upon two mechanisms: recollection and familiarity (Yonelinas, 2002). While familiarity-based recognition is relatively preserved, the ability to recollect spatio-temporal context is relatively impaired in healthy older adults (Davidson & Glisky, 2002).

Although several studies were interested in determining the brain correlates of age-related memory deficits, results are difficult to interpret (Daselaar et al., 2006). Indeed, performance is not similar between young and older subjects, so it is unclear if changes in brain activity are due to task difficulty or to changes in task-related cognitive processes.

Consequently, the present experiment aimed to investigate age differences in the neural correlates of familiarity and recollection processes during episodic retrieval, when performance is equated thanks to manipulation of task difficulty (Morcom et al., 2007).

METHODS

- **PARTICIPANTS:**

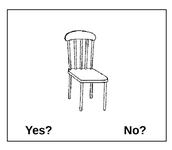
	Young (N=20)	Older (N=20)	t(38)
Age	25,4 (2.98)	67,8 (5,29)	***
Education	16,3 (2,45)	14,7 (2,99)	NS
Vocabulary (Mill Hill)	27,16 (3,00)	28,95 (4,19)	NS
Depression (BDI)	5,25 (3,95)	7,75 (5,9)	NS

*** p<.001; NS: not significant

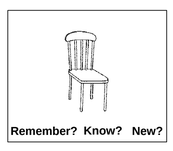
- **IMAGING METHOD:** event-related fMRI, 3T head-only Siemens scanner

- **PROCEDURE:** Episodic memory task

Incidental encoding of pictures of objects with a semantic judgment task (N=200)



Recognition memory task with the Remember/Know paradigm (N=300)



Hard condition: 1 presentation of each item
Easy condition: 2 presentations of each item

- **fMRI DATA ANALYSES:**

SPM8 voxel-wise analyses

Contrasts:

Recollection_Easy: Remember_Easy vs. Know_Easy
Recollection_Hard: Remember_Hard vs. Know_Hard

Familiarity_Easy: Know_Easy vs. Correct Rejection
Familiarity_Hard: Know_Hard vs Correct Rejection

Common effects between the two age groups:

↳ Effects of the young group inclusively masked (p< .001) with the effects of the older group, thresholded at p <.05 FWE

Age-related differences (when performance is equated)**:**

↳ T-test (Young vs. Older) on each contrast of interest, inclusively masked (p< .001) with the simple effects of each group, thresholded at p< .001 uncorrected

RESULTS

BEHAVIORAL DATA

	Young		Older	
	Easy condition	Hard condition	Easy condition	Hard condition
Discrimination index*				
Pr (Remember)	0.48 (0.15)	0.32 (0.14)	0.42 (0.14)	0.19 (0.10)
Pr (Know)	0.29 (0.19)	0.29 (0.15)	0.41 (0.16)	0.33 (0.15)

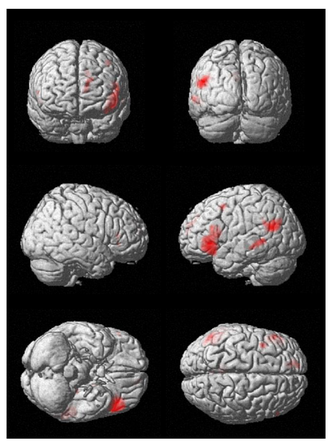
* % correctly recognized items minus % False alarms

↳Memory accuracy similar between young and older groups in the Easy condition for Remember responses and in the Hard condition for Know responses.

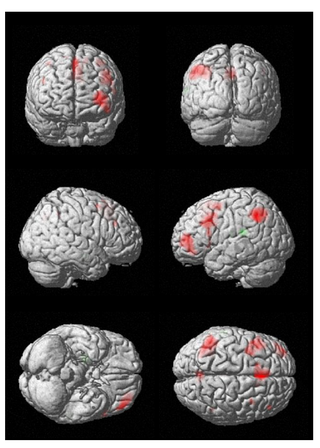
fMRI DATA

COMMON EFFECTS

Recollection (Easy+Hard)
Hits_R > Hits_K



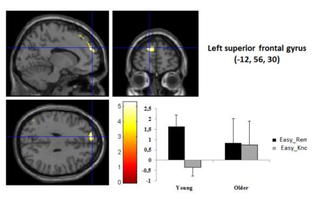
Familiarity (Easy+Hard)
Hits_K > Correct rejections (red)
Correct rejections > Hits_K (green)

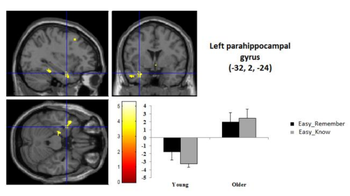


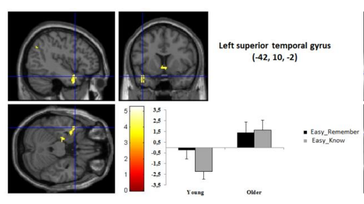
AGE-RELATED DIFFERENCES

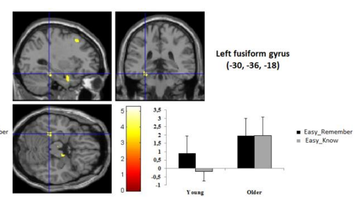
Recollection (Easy condition)

Young > Older

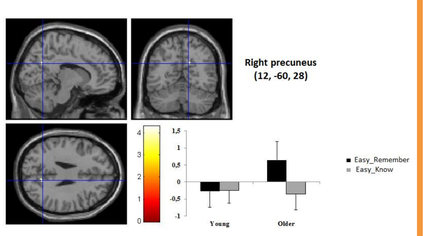


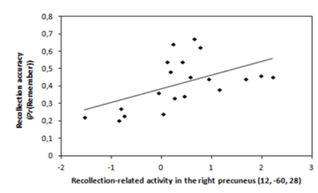






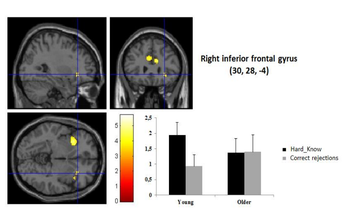
Older > Young

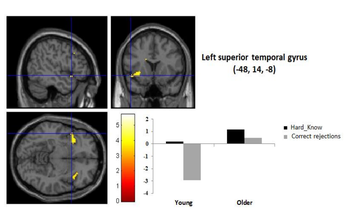


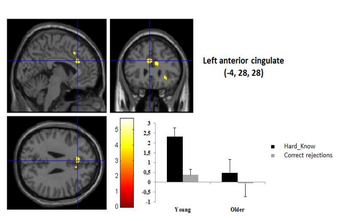


Familiarity (Hard condition)

Young > Older







DISCUSSION

Our findings revealed the classical network of regions associated with recollection (increased activity in the left parietal and temporal gyri, left parahippocampus, and bilateral frontal gyri) and familiarity processes (increased activity in the left parietal gyrus and bilateral frontal gyri and decreased activity in the right parahippocampal gyrus and left post-central gyrus) in both the young and the older groups.

Second, we observed reduced recollection-related (left frontal, left temporal, left parietal cortices and left parahippocampus) and familiarity-related activations (bilateral anterior cingulate, right frontal gyrus and left superior temporal gyrus) in older adults compared to young adults in several regions. Finally, for recollection processes only, older adults recruited an additional region (right precuneus), possibly to compensate for their difficulties.

In conclusion, this study showed that neural activity related to recollection and familiarity is reduced in older adults compared to young adults, even when the level of performance of each process is matched between groups. However, for recollection processes only, older adults recruit additional regions, possibly to compensate for their difficulties.

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