

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

20 young adults (mean age of 25.4 years) and 20 older adults (mean age of 67.8 years) performed an episodic recognition memory task in an event-related fMRI design. At encoding, participants were presented with pictures, either once (Hard condition) or twice (Easy condition). They were asked to decide whether the object depicted on the picture would fit into a shoebox. During the test phase, the instruction was to judge the status of the item by choosing between three possible answers: Remember (studied item associated with the recollection of some contextual details), Know (studied item recognized as old but without any contextual information), New (unstudied item).

Brain correlates of recollection in the Easy condition were isolated by contrasting brain activity for old items associated to remember vs. know responses. Then, the neural substrates of familiarity in the easy condition were obtained by comparing brain activity associated to

know responses and to correct rejections. We determined the common effects between the two age groups for recollection and familiarity separately, by inclusively masking the effects observed in the young group with those observed in the older group. Finally, we examined age-related differences through t-test comparisons. Statistical analyses were performed with SPM8 ($p < .001$ uncorrected).

Results

First, at a behavioral level, we observed similar level of performance for the two groups in the easy condition for recollection processes and in the hard condition for familiarity. We observed the classical recollection-related effect (increased activity in the left parietal and temporal gyri, left parahippocampus, left amygdala, bilateral frontal gyrus) and familiarity-related effect (increased activity in the left parietal gyrus and bilateral frontal gyri and decreased activity in the right parahippocampal gyrus and left post-central gyrus), common to young and older groups. In addition, for recollection, we observed age-related reduction of activity in left frontal, left temporal, left parietal cortex and left parahippocampus. Moreover, some right regions demonstrated recollection effects only in the older group and were related either positively (right precuneus) or negatively (right middle frontal region) to memory performance. With regard to the familiarity process, we observed that bilateral anterior cingulate, right frontal gyrus, left superior temporal gyrus, left insula were activated in the young but not the older group but these age-related reductions in brain activity were observed on a more restricted network of regions than for recollection.

Conclusion

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.

References

- Daselaar, S. M., Fleck, M. S., Dobbins, I. G., Madden, D. J., Cabeza, R. (2006). Effects of healthy aging on hippocampal and rhinal memory functions: an event-related fMRI study. *Cerebral Cortex*, *16*, 1771-1782.
- Davidson, P. S. R., & Glisky, E. L. (2002). Neuropsychological correlates of recollection and familiarity in normal aging. *Cognitive, Affective & Behavioral Neuroscience*, *2*, 174-186.

Morcom, A. M., Li, J., Rugg, M. D. (2007). Age effects on the neural correlates of episodic retrieval: increased cortical recruitment with matched performance. *Cerebral Cortex*, 17, 2491-2506.