

Differential contributions of hippocampal and prefrontal regions to successful associative encoding in young and older adults

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It remains unclear whether age-related declines in associative encoding reflect dysfunction of inferior frontal gyrus (IFG) and deficient generation of associations, and/or hippocampal dysfunction and impoverished binding of associations. To tease apart these contributions to encoding, we examined the parametric responses of these regions to varying amounts of generative and relational processing in young and older adults. Encoding trials involved presentation of word triads (one category and two exemplars) varying in the number of semantic associations amongst them. Participants judged the number of exemplar words associated with the category (none, one, all). Thus, triads with fewer associations had higher generative load while triads with more associations provided had higher relational load. Control triads were comprised of one word shown three times (either: none, one, all) and participants pressed the corresponding button (none, one, all). Participants then completed a forced-choice recognition test for encoding triads. In young adults, successful encoding (i.e., subsequently recognised items) activated left hippocampus and bilateral IFG, relative to the control task. Older adults engaged left IFG, albeit significantly less than young, but did not activate hippocampus or right IFG. Parametric modulation analyses in young adults demonstrated that increasing generative load resulted in increased activation of bilateral IFG while increasing relational load resulted in increased activity in bilateral hippocampus. In older adults, generative load did not modulate IFG engagement. However, bilateral hippocampus exhibited a significant response to relational load. This suggests that when provided with associations to bind, hippocampal activity in older adults is comparable to young, consistent with increased recognition accuracy under such conditions.