



Differential Contributions of Hippocampal and Prefrontal Regions to Successful Associative Encoding in Young and Older Adults



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INTRODUCTION

- It is well established that older adults show declines in associative encoding.
- It remains unclear whether this deficit reflects
 - prefrontal dysfunction in regions such as the inferior frontal gyrus (IFG) and a reduced ability to generate associations between items^{1,2}
 - hippocampal (HC) dysfunction and an inability to successfully bind associations into a memory trace³.
- We presented word triads varying in the number of semantic associations between words.
 - Triads with fewer associations have higher generative load (i.e., associations have to be generated by the participant).
 - If age-related encoding deficits reflect prefrontal dysfunction and deficient generation of associations, the responsiveness of left IFG to generative load will be reduced with age.
 - Triads with more associations have higher relational load (i.e., the relations presented have to be bound into memory).
 - If age-related encoding deficits reflect HC dysfunction and impoverished binding of associations, older adults will show reduced responses to relational load in left HC.

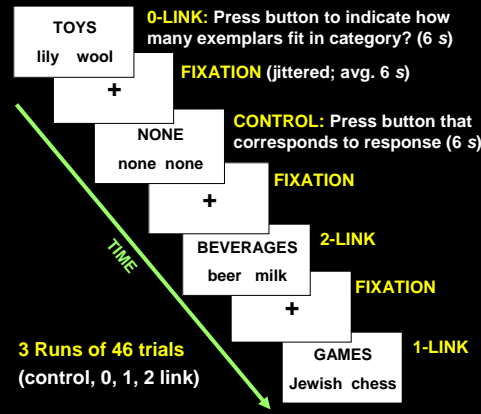
METHODS

Participants

- 15 young adults (mean age = 24 yrs; 7 males)
- 16 older adults (mean age = 73; 6 males)

Scanning Protocol

- 105 word triads: category and 2 exemplars
- Varied level of semantic relatedness (i.e., how many exemplars linked to category)



Post-scan Forced-Choice Recognition

- OLD and NEW triad (with 1 new exemplar)
- Task: Identify OLD triad
- Only subsequently recognized triads analyzed

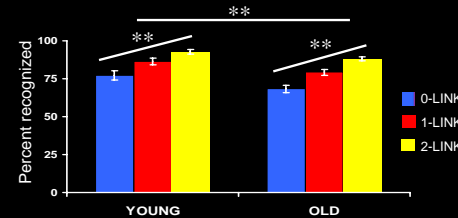
BEVERAGES	beer	tea
BEVERAGES	beer	milk

Analyses: SPM2

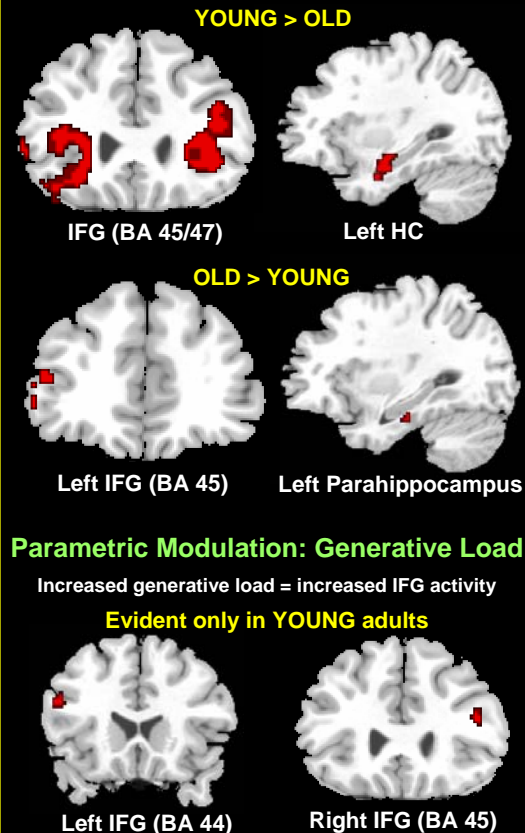
- Contrast: Successful encoding vs control task
- Parametric Modulation:
 - Increasing generative load (fewer links)
 - Increasing relational load (more links)

RESULTS

Behavioral results

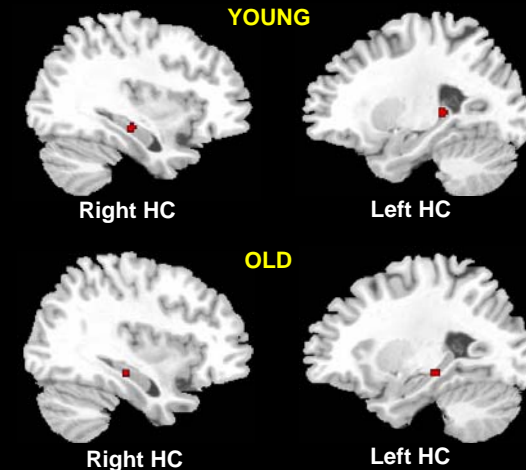


Successful Encoding vs. Control Task



Parametric Modulation: Relational Load

Increasing Relational Load = increasing HC activity
Evident in both YOUNG and OLDER adults



CONCLUSIONS

- In young adults, successful encoding engaged left HC and bilateral IFG. Older adults activated IFG only on the left and at reduced level, but did not activate left HC.
- Increasing generative load resulted in increased IFG activity, while increasing relational load resulted in increased HC activity.
- In older adults, generative load did not modulate IFG engagement. However, bilateral HC exhibited a significant response to relational load.
- These findings suggest age-related deficits in associative encoding likely reflect IFG dysfunction and reduced ability to generate associations between items.

REFERENCES

¹ Anderson, N. D. et al. (2000). The effects of divided attention on encoding- and retrieval-related brain activity: A PET study of younger and older adults. *JOCN*, 12, 775 – 792.

² Cabeza, R. et al. (1997) Age-related differences in neural activity during memory encoding and retrieval. *J Neurosci*, 17, 391 – 400.

³ Naveh-Benjamin, M. (2000). Adult age differences in memory performance: Tests of associative deficit hypothesis. *JEP: Learning Memory & Cognition*, 26, 1170 – 1187.

⁴ Addis, D. R. & McAndrews, M. P. (under review). Prefrontal and hippocampal contributions to the generation and binding of semantic associations during successful encoding. Submitted to *NeuroImage*.