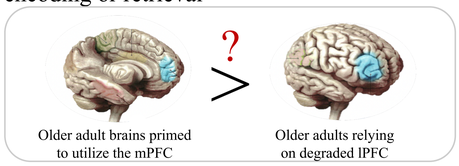
Utilizing socioemotional processing to alter older adults' memory: Implications for individual differences in cognition

Rachel Van Boxtel, Jaclyn H. Ford[1], & Elizabeth A. Kensinger[1]

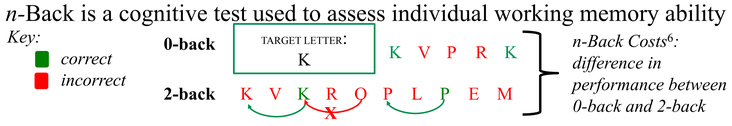
[1]Department of Psychology and Neuroscience, Boston College

INTRODUCTION

- Healthy aging is associated with a characteristic decline in working memory and ability to learn new information, possibly due to age-related degradation of the prefrontal cortex[1]
  - Younger adults engage the lateral PFC when engaging in successful recall, this may become less efficacious with age[2]
  - These regions might be able to be *bypassed* by engaging the medial PFC[3]
- The medial PFC is associated with memories in both socioemotional relevance and music[4,5]
  - Therefore, it may be able to be primed utilizing socioemotional tasks prior to encoding or retrieval



- *n*-Back is a cognitive test used to assess individual working memory ability



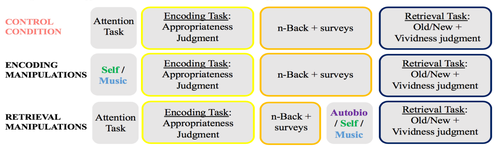
- ***Do individual cognitive differences influence the extent to which manipulations prior to encoding or retrieval affect performance on a memory task?***

METHODS

Participants: 522 (M_{age}=64.02, *SD*=5.95, 55-94 years; 336 female) recruited via Amazon Mechanical Turk

Task Procedure:

- Participants shown 80 title-image pairs of neutral valence and asked to rate appropriateness of titles; they were later asked to retrieve these titles
- Randomly assigned to an encoding or retrieval manipulation



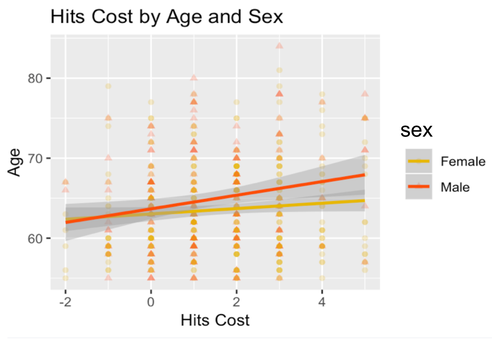
Analysis:

- ***n*-Back:**
  - Response Time Cost – 2-back minus 0-back response times
  - Hits Cost – 0-back minus 2-back hits
  - How is *n*-back costs related to demographics (age, biological sex, education)?
- **ANCOVA:**
  - Effect of manipulation condition on participant's memory accuracy and vividness
  - Interactions of *n*-back costs with condition on memory performance

RESULTS

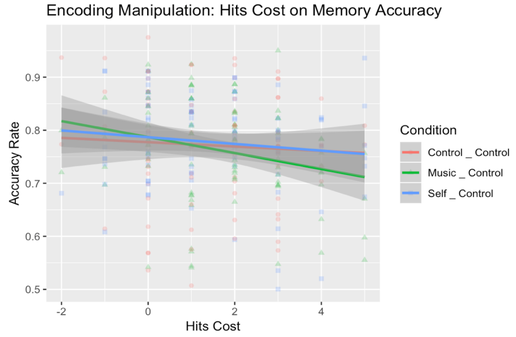
n-Back: Correlations with Demographic Variables

- Performance on *n*-back associated with
  - age (p=0.003)
    - Significant correlation between age and *n*-back hits cost (r=0.119, p=0.006).
  - sex (p=0.022)
    - A smaller mean for Hits Cost for males compared to females
- Performance on *n*-back was not correlated with education level

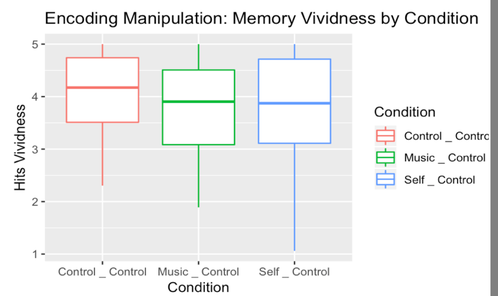


ENCODING MANIPULATIONS: Memory Performance & Individual Cognitive Differences

- Accuracy Rate:
  - Main effect of *n*-back performance measures
    - Hits Cost (df = 1, F = 5.46, p = 0.02)
    - Response Time Cost (df = 1, F = 8.96, p = 0.003)
  - No main effect of condition
  - No interactions between memory task accuracy rate and individual differences in working memory ability *(n*-back costs)



- Hits vividness:
  - Main effect of condition, but in unexpected direction
    - means = 4.05 (control), 3.76 (music), 3.79 (self-reference)
  - No interactions with vividness ratings on hits and individual working memory ability



CONCLUSIONS

- *n*-Back performance has reliable demographic differences, with decreased performance with increasing age, along with sex differences.
- **Effect of Condition** only plays a role in the vividness of memory, and with mixed results for the effects of manipulations compared to controls
- **Timing of Manipulations** mattered in the significance of effects
  - Encoding Manipulations showed many more main effects effects of the following categories:
    - *n*-back costs (both Hits Cost and Response Time Cost) on Memory Accuracy Rate
    - Effect of condition on Memory Hits Vividness
  - No significant effects of condition were seen in the Retrieval Manipulation conditions
    - Response Time Cost on Memory Accuracy driven by opposite directionality between 2-back and 0-back response times
- Future work will utilize in-person behavioral and fMRI testing to examine these learning strategies in older adults
  - **Are older adults able to access an online study less representative of memory performance of the general older adult population?**
  - **What structural or mechanistic individual differences characterize these individuals' memory?**

REFERENCES

1. Raz, N., Gunning, F.M., Head, D., Dupuis, J.H., McQuain, J., Briggs, S.D. (1997). Selective aging of the human cerebral cortex observed in vivo: differential vulnerability of the prefrontal gray matter. Cerebr. Cortex, 7 (3) (1997), pp. 268-282 **2.** Grady, C.L. (2008) Cognitive neuroscience of aging. Ann NY Acad Sci, 1124 (1)), pp. 127-144 **3.** MacPherson, S.E., Phillips, L.H., Della Sala S. (2002). Age, executive function, and social decision making: a dorsolateral prefrontal theory of cognitive aging. Psychol Aging, 17(4): 598-609. **4.** Gutchess, A., & Kensinger, E. A. (2018). Shared Mechanisms May Support Mnemonic Benefits from Self-Referencing and Emotion. Trends in cognitive sciences, 22(8), 712–724. doi:10.1016/j.tics.2018.05.001 **5.** Janata, P. (2009). The neural architecture of music-evoked autobiographical memories. *Cerebral Cortex*, 19, 2579-2594. **6.** Bopp, K.L., & Verhaegen, P. (2020). Aging and n-Back Performance: A Meta-Analysis. *J Gerontol B Psychol Sci Soc Sci*, 2020, Vol. 75, No. 2, 229–240.

ACKNOWLEDGMENTS

The authors would like to thank Ryan Daley and Erin Welch for their help collecting and analyzing data for this project. This work was supported by funding from NSF SOL1823795.