Forced-choice and old/new test formats reveal a stable age-related impairment of performance on the Mnemonic Similarity Task

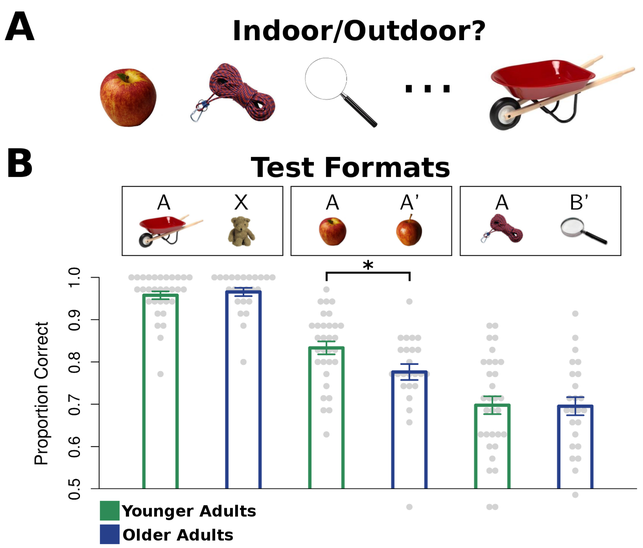
Derek J. Huffman[1,2] and Craig E.L. Stark[1]

[1]Department of Neurobiology and Behavior, Center for the Neurobiology of Learning and Memory, University of California, Irvine
[2]Center for Neuroscience, University of California, Davis

Motivating Questions

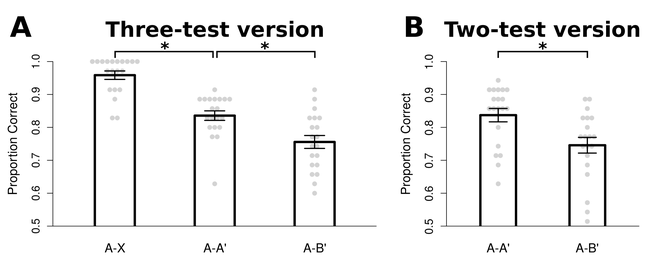
- Does the age-related impairment of performance on the Mnemonic Similarity Task (Stark et al., 2013, 2015) extend from old/new and old/similar/new test formats to the forced-choice test format?
- Does performance differ across forced-choice test formats?
- How does performance on old/new test formats relate to performance on forced-choice test formats?

Exp 1: The age-related impairment extends from the old/new test format to the A-A' test format



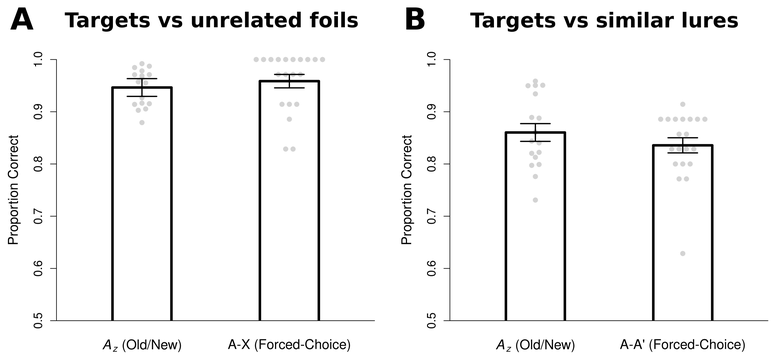
- Performance differs based on the test format in both age groups
- Healthy aging is accompanied by impaired performance on the Mnemonic Similarity Task using old/new (with confidence ratings), old/similar/new, and forced-choice (A-A') test formats (also see: Stark et al., 2015)

Exp 2: Replication of the test format effect in younger adults



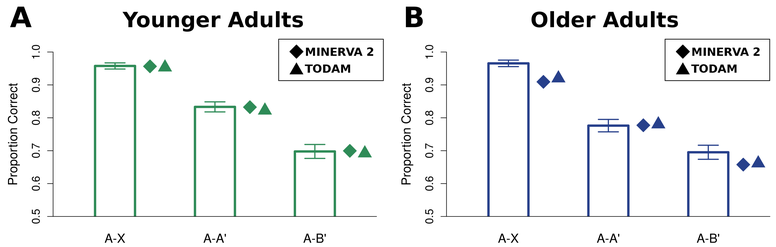
- These results suggest that the presence of the A-X test format did not artificially reduce performance on the A-B' test format

Exp 2: Performance is similar on old/new and forced-choice test formats in younger adults



- Performance was similar on old/new and forced-choice test formats for both targets vs unrelated foils ($t_{35} = -0.76$, $p = 0.45$) and targets vs similar lures ($t_{35} = 1.11$, $p = 0.28$)
  - In contrast, performance was better on the old/new test format with targets and similar lures than the A-B' test format ($t_{35} = 6.93$, $p < 0.001$)
- These results suggest that forced-choice test formats do not receive familiarity-related enhancements compared to old/new test formats
- Thus, old/new and forced-choice test formats likely rely on the same cognitive processes

What is leading to the test format effect? Can the age-related effects be explained by a decreased probability of successful feature encoding?



- Global matching models can account for the test format effect
  - MINERVA 2 predicts that the A-A' > A-B' effect is caused by both encoding variability and variability in inter-item similarity (also see: Hintzman, 1988)
- Decreasing the probability of successful feature encoding in the models resulted in the largest change in performance on the A-A' test format

Can global matching models account for other findings in the literature?

Repetition (3 vs 1 presentation) has been shown to increase the lure false alarm rate (Reagh and Yassa, 2014). However, an ROC analysis and the A-A' test format suggest that repetition enhances a participants' ability to discriminate between targets and similar lures (Loiotile and Courtney, 2015). Global matching models can account for all of these results.

Take Home Messages

- Stable age-related impairment on the Mnemonic Similarity Task
- Forced-choice performance depends on the nature of the distractor
- Encoding variability and variability in inter-item similarity likely contribute to the test format effect
- A diminished probability of encoding stimulus features is a candidate mechanism for memory changes in healthy aging

Methods

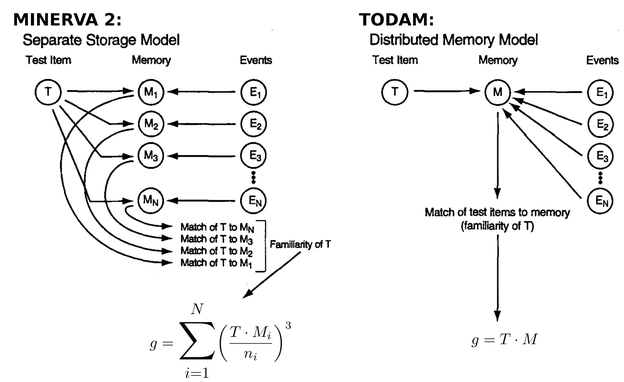
Experiment 1:

- 31 younger adults (18-27); 24 healthy older adults (64-85)
- Encoding: Indoor/Outdoor task (2 s trial, 0.5 s ISI, 140 trials)
- Testing: 3 forced-choice test formats (35 trials each; matched "lure bins")

Experiment 2:

- 20 younger adults (18-33)
- 2 counterbalanced rounds of encoding and testing
  - Separate stimulus sets for the three- and two-test versions (matched lure similarity)
- Encoding: Indoor/Outdoor task (2 s trial, 0.5 s ISI, 140 trials)
- Testing: Forced-choice test formats (35 trials each; matched "lure bins")
- We calculated the area under the ROC curve using maximum-likelihood estimation to fit the z-transformed ROC curve (A_z; rocfit in Stata). A_z does not assume equal variance of the target and distractor distributions (e.g., Stanislaw and Todorov, 1999). Old/new with confidence ratings data from Stark et al. (2015).

Global Matching Models:



Simulation of proportion correct:

$$Pr\{A > X\} = \frac{1}{L} \sum_{i=1}^{L} [I(g_{A_i} > g_{X_i}) + 0.5 \cdot I(g_{A_i} = g_{X_i})]$$

MINERVA 2 (Hintzman, 1984, 1988); TODAM (Murdock, 1982, 1995); Figure modified from Clark and Gronlund (1996)

Acknowledgements

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email: huffmand@uci.edu