The Effect of Aging on Visual Working Memory during Change Detection: Behavioral Data and Dynamic Neural Field Model

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Introduction

- Studies in change detection (CD) have revealed key limitations to visual working memory (VWM).
- Older adults have marked declines in CD search efficiency, although little is known on age group differences in the underlying search model.
- This study explores age-related differences CD with a behavioral task and a computational model designed to replicate age group performance.

Methods

Participants:
28 younger adults (18-30 yrs, 4 males) and 27 older adults (59-89 yrs, 12 males) who were neurologically intact and visually unimpaired participated in this experiment.

Experimental Procedure:
The change detection task had three variants (Shape changes, Color changes, Shape and Color Changes) in 3 set sizes (1, 3, 5 items). Subjects indicated whether the second display was different or same from the first.

Behavioral Task

ANALYSIS: Repeat-Measures ANOVA, with between-subjects factor of Age Group (Y/O) and within-subjects factors of Set Size (1, 3, 5), Type (Different, Same) and Task (Shape Change, Color Change, Shape & Color Change)

DNF Model

- The DNF model simulates the real-time neural dynamics of VWM by specifying the processes of encoding, WM consolidation and maintenance, and decision making (c.f., Spencer, Austin & Schutte (2012)).
- To capture our age group differences in the behavioral task, we increased the strength of global throughout WM consolidation and maintenance, and decision making (c.f., Spencer, Austin & Schutte (2012)).
- This is consistent with the limited neural resources theory of aging (i.e., CRUNCH; Reuter-Lorenz & Cappell, 2008).

Conclusions

- Behavioral result indicate that older adults operate with a ‘same’ bias, an effect mediated by increasing task difficulty.
- DNF modeling accurately capture the behavioral age group differences, and suggest a potential neurophysiological explanation in the HDR explanation.
- Our results provide a way for thinking about the neural changes that occur over aging, allowing us to compare predictions with both behavioral and neural data.