Explicit Sequence Learning in Hybrid Visual Search in Younger and Older Age

Erica Westenberg[1], Jeremy M Wolfe[2], Iris Wiegand[2,3]

[1] Department of Neuro-Cognitive Psychology, Ludwig-Maximilians-Universität, Munich
[2] Brigham and Women's Hospital and Harvard University, Cambridge, MA
[3] Max Planck UCL Centre for Computational Psychiatry and Ageing Research, Berlin

In "hybrid search", observers search visual displays for memorized target items. Studies have found that reaction times (RTs) in these tasks grow linearly with the number of items in the visual display and logarithmically with the memory set size. In a recent study, we demonstrated that if target items appeared in a predictable sequence that was not explicitly mentioned, a subset of younger adults was able to learn the sequence. These "learners" had faster RTs and shallower RT x memory set size slopes in sequence conditions compared to when items appeared in random order. Post-experimental tests showed that observers whose performance improved in sequence conditions acquired explicit knowledge about the sequence. This suggests that learners used explicit sequence knowledge to improve search. However, none of our older adult observers learned the sequences. In a second study, we told observers about the sequence prior to the search task to examine if explicit knowledge would allow all observers to facilitate hybrid search. 12 participants aged 18-35 and 9 participants aged 65-85 completed four blocks of a target localization task. After memorizing 4 or 16 target items, they searched for the targets among 3 or 15 distractors. They were informed when targets would appear in either a fixed sequence over trials or in random order. Younger participants showed significantly faster RTs in sequence blocks than random blocks, particularly with memory sets of 16. Older participants also showed significantly faster RTs in sequence blocks, but only in blocks with 4 memorized targets. Post-experimental testing proved that participants had explicit knowledge of the sequence. This indicates that explicit sequence knowledge allows younger people to predict the next target and restrict their effective memory set size, especially when memory load is high, but that older adults may only benefit with smaller target sets.