Hand and eye movements during object categorization discriminate between younger and older adults

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Introduction

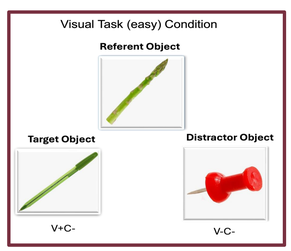
- In Alzheimer's disease, changes in the brain may manifest long before any noticeable shifts in behavior or cognitive function are observed[1].
- Motion-tracking and eye-tracking technology have been recognized as valuable tools for identifying early signs of cognitive decline[2,3].

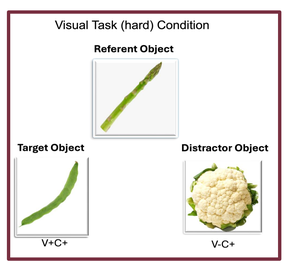
HYPOTHESES:

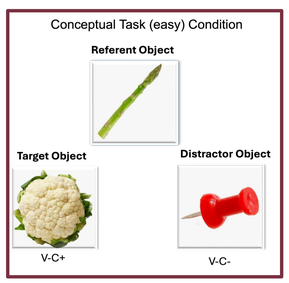
- Younger adults (YA) will perform better than older adults (OA) on object categorization task.
- Mild cognitively impaired (MCI) groups will have higher reach trajectories in motion tracking task when compared to healthy older and younger adults
- MCI groups will spend more time fixating on trials than healthy older and younger adults.

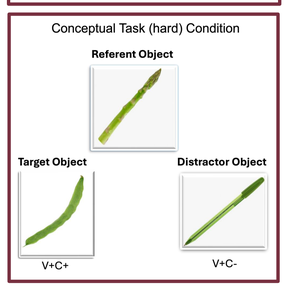
Methods: Object Categorization Tasks

Which of the two bottom images is **visually/conceptually** similar to the top image









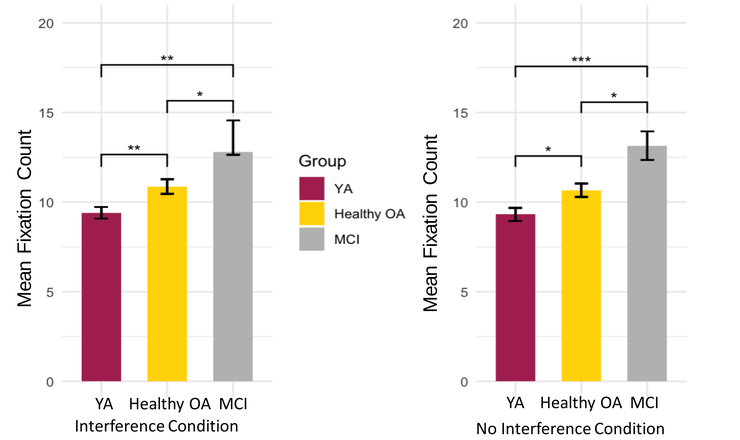
- **V+ = Visually similar to referent**
- **V- = Visually dissimilar to referent**
- **C+= Conceptually similar to referent**
- **C- = Conceptually dissimilar to referent**

Participants and Experimental Conditions

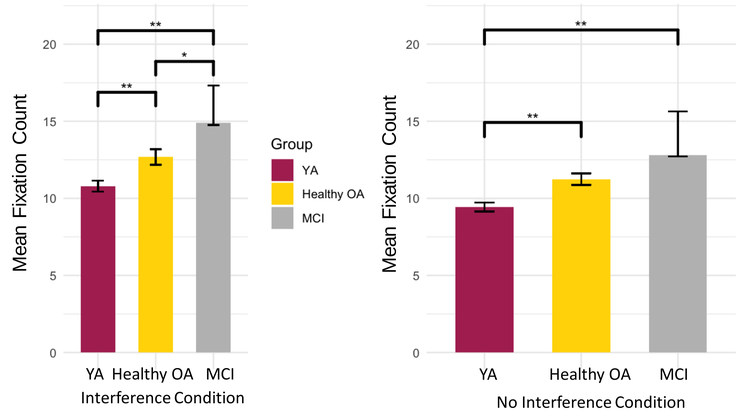
- Participants (N = 31 YA, 37 Healthy OA ,10 MCI) completed 320 trials, with 40 trials per 8 conditions
- Participants completed task over two sessions, one motion-tracking session, and one eye-tracking session.
- During motion tracking session participants were to select target image based upon audio cue.
- During eye-tracking session, participants were to select target image based upon being presented with either V (i.e., Visual) or C (i.e., Conceptual).

MCI Demonstrates Longer Fixation for Eye-Tracking Task

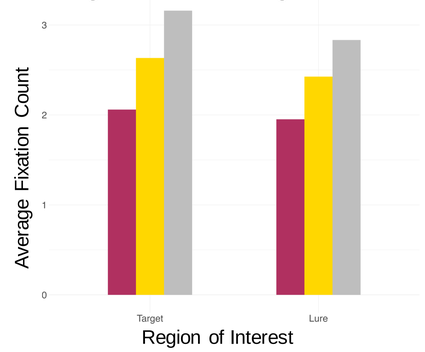
Fixation Bias for Visual Conditions With Interference vs No Interference



Fixation Bias for Conceptual Conditions With Interference vs No Interference



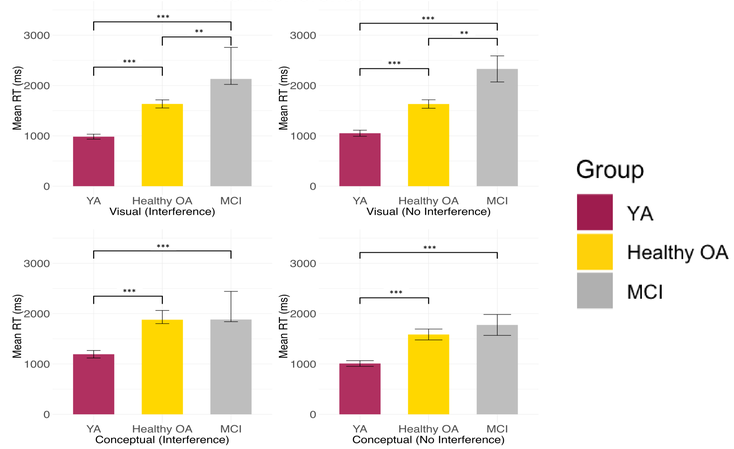
Average Fixations on Target and Lure



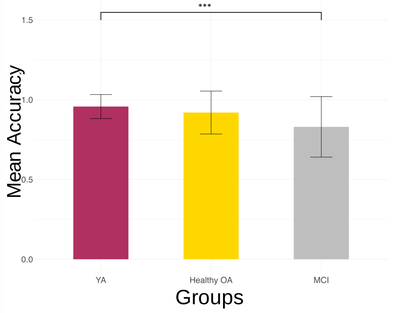
- MCI participants differed from both young adults and healthy older adults by exhibiting significantly longer fixation times, both when facing visual tasks with and without interferences, as well as during conceptual tasks with interferences. And in all cases, fixate longer on both target and lure than younger adults

Motion-Tracking Discriminates Between Age and Cognitive Status

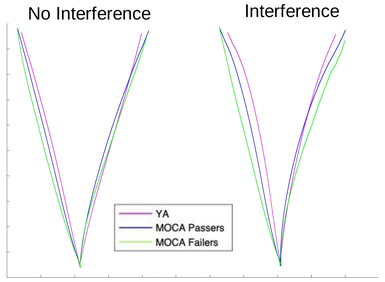
Reaction Time for Visual Conditions with Interference vs No Interference



Average Accuracy for Reach Task



Average Reach Trajectories



- MCI participants revealed longer reaction times when performing object categorization tasks using motion tracking across both visual and conceptual conditions.
- MCI participants showed a higher reach trajectory/ area under the curve (AUC) when categorizing objects in the presence of interference.

Conclusions and Future Directions

- Eye tracking revealed differences between (young adults, healthy older adults, and MCI) there were significant effects in fixation, accuracy and reaction time.
- Motion tracking also revealed significant differences, in some cases we have differences in reach trajectories where there aren't differences in reaction time.
- Previous research has revealed Perirhinal Cortex (PRC) activation for both visual and conceptual categorization of objects[4]. As a future direction for this study, we would like to further explore the role of different regions in the medial temporal lobe (MTL) in object perception memory.

[1]Jack et al. (2010). *Neurology.* [2]Gallivan & Chapman (2014). *Frontiers in Neuroscience.* [3]Boucart et al. (2014). *Frontiers in Neuroscience.* [4]Martin et al. (2018). *eLife*