

## INTRODUCTION

- Saccades are a form of rapid eye movement that function to bring an item of interest on to the fovea, which is the location of highest visual acuity in the human eye
- They are widely used in neuroscience as a tool to measure cognitive processes such as working memory<sup>1</sup>
- Previous studies have shown that when items have a familiar or regular structure, it can encourage chunking to increase working memory load<sup>2</sup>
- The spatiotemporal structure of a sequence can contribute to our ability to remember spatial locations however, ongoing research is needed to delineate how spatiotemporal structure is influenced by other experimental factors<sup>3</sup>

**Goal:** To determine the effect of spatiotemporal structure on performance in memory-guided saccade sequences and determine how it is influenced by set size and target order

## METHODS

### Apparatus:

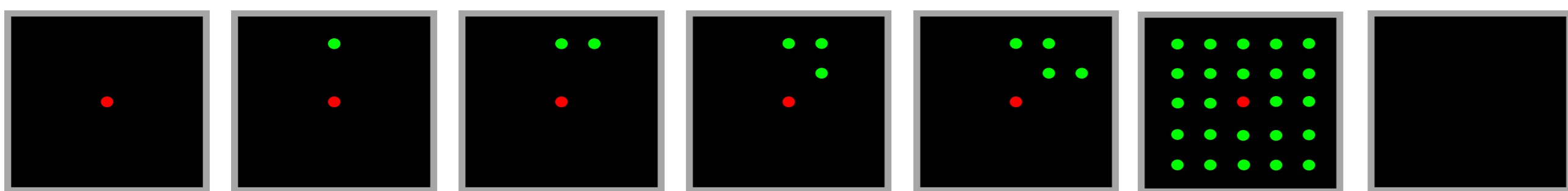
- 5x5 LED display encompassing 20°x20° of visual space
- Movements of the right eye were measured using *EyeLink II* (SR Research, Ontario, Canada)
- Participants were head-fixed using a personalized dental impression in a dark room

### Procedure:

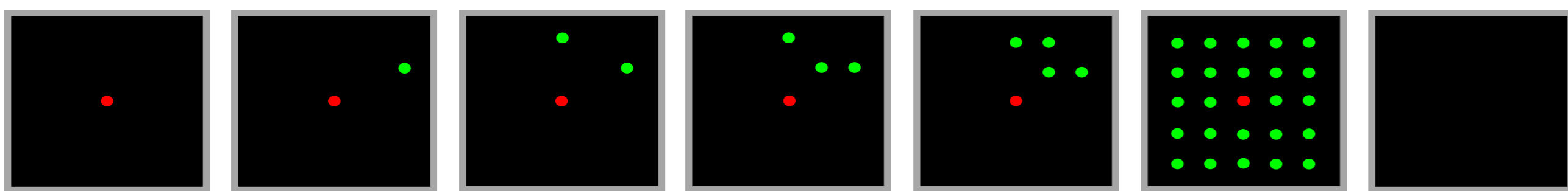
- Participants (N=6) were told to fixate a red central LED and memorize a sequence of three to six green target LEDs that appeared elsewhere on the panel
- Following presentation of the sequence, mask, and offset of the fixation light, participants were required to saccade toward the remembered target locations

### Three Path Types:

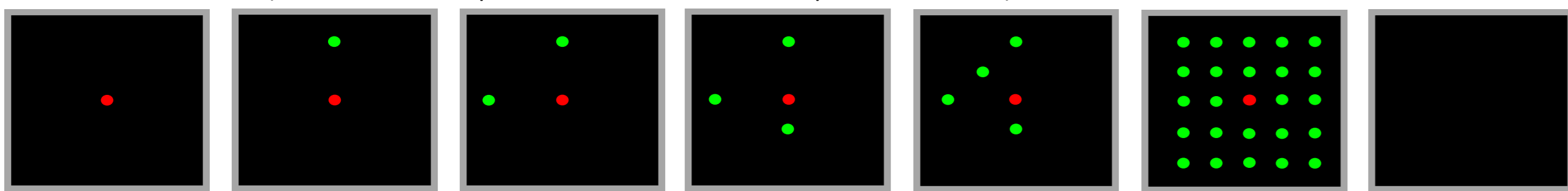
- Structured** (recognizable shape and spatiotemporal order)



- Semi-Structured** (recognizable shape with random temporal order)



- Unstructured** (random shape and random temporal order)

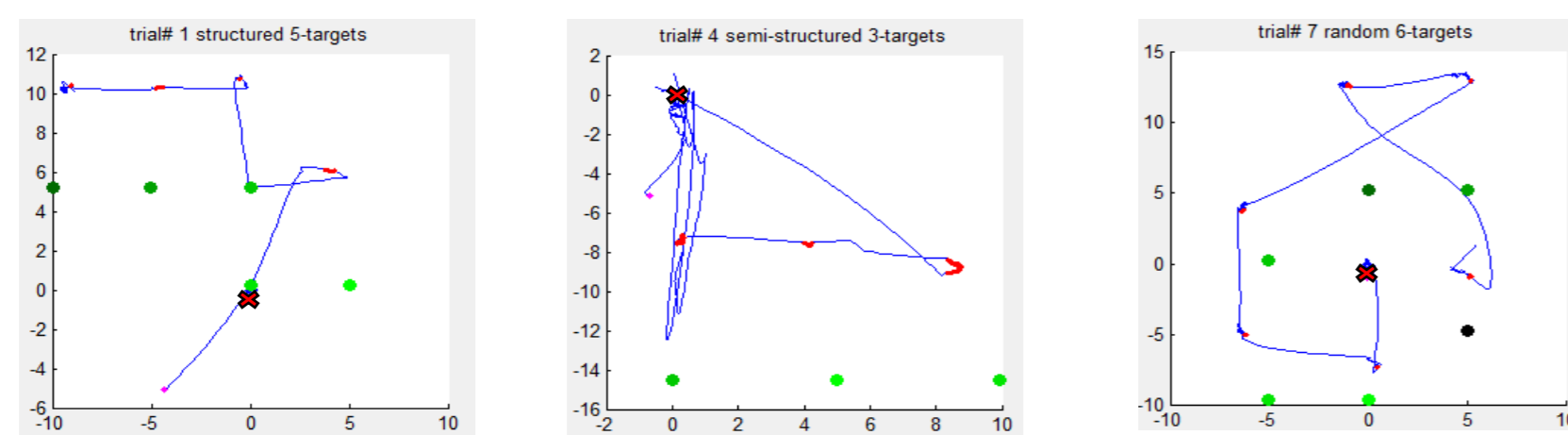


TIME 1s 2s 3s 4s 5-7s 8.5-9.5s 13-18s

### Sample Eye Movement Sequences:

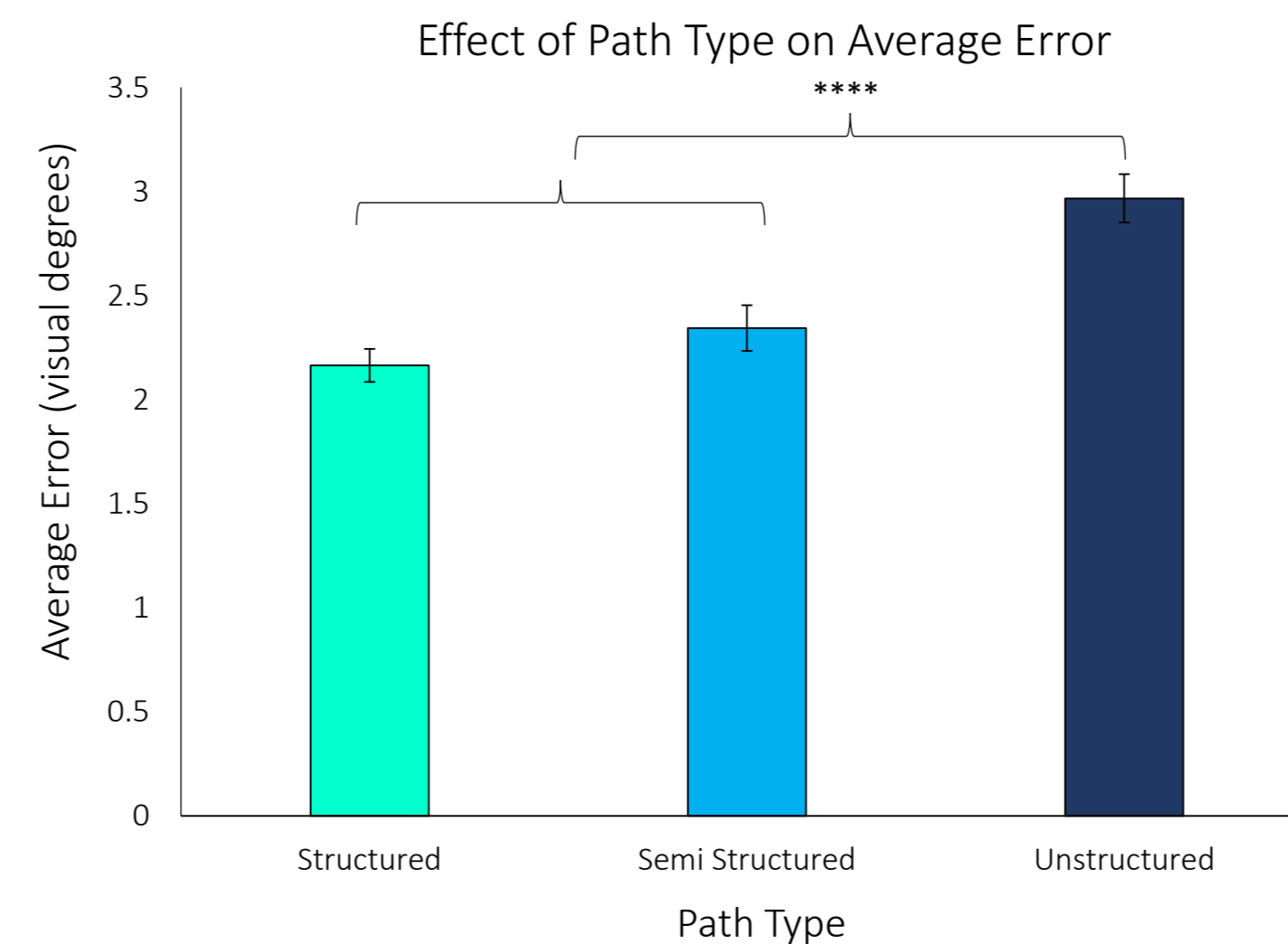
✖ = Fixation Point

\*Axes correspond to eye position in visual degrees



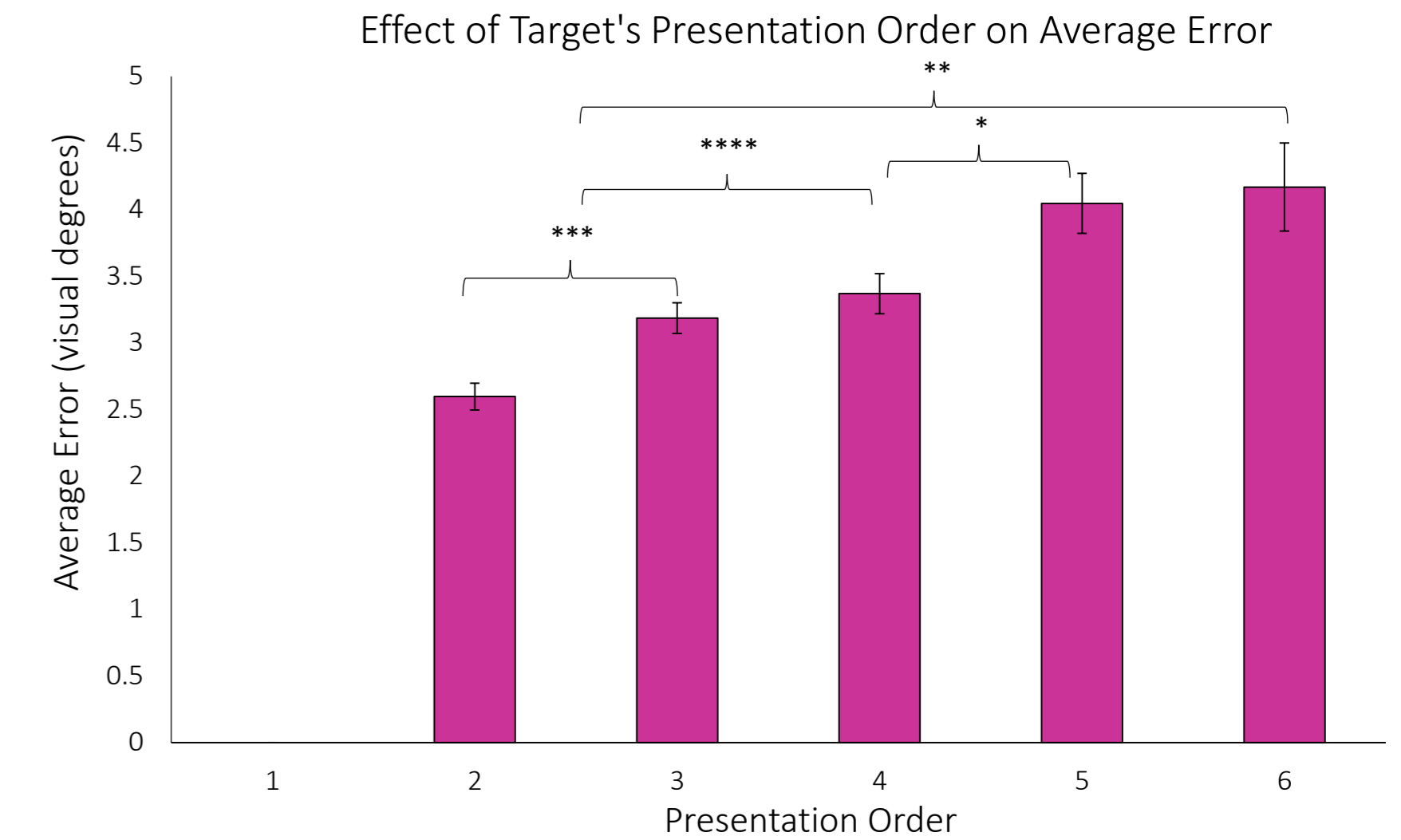
## RESULTS

### A How does the path type of a sequence influence recall ability?



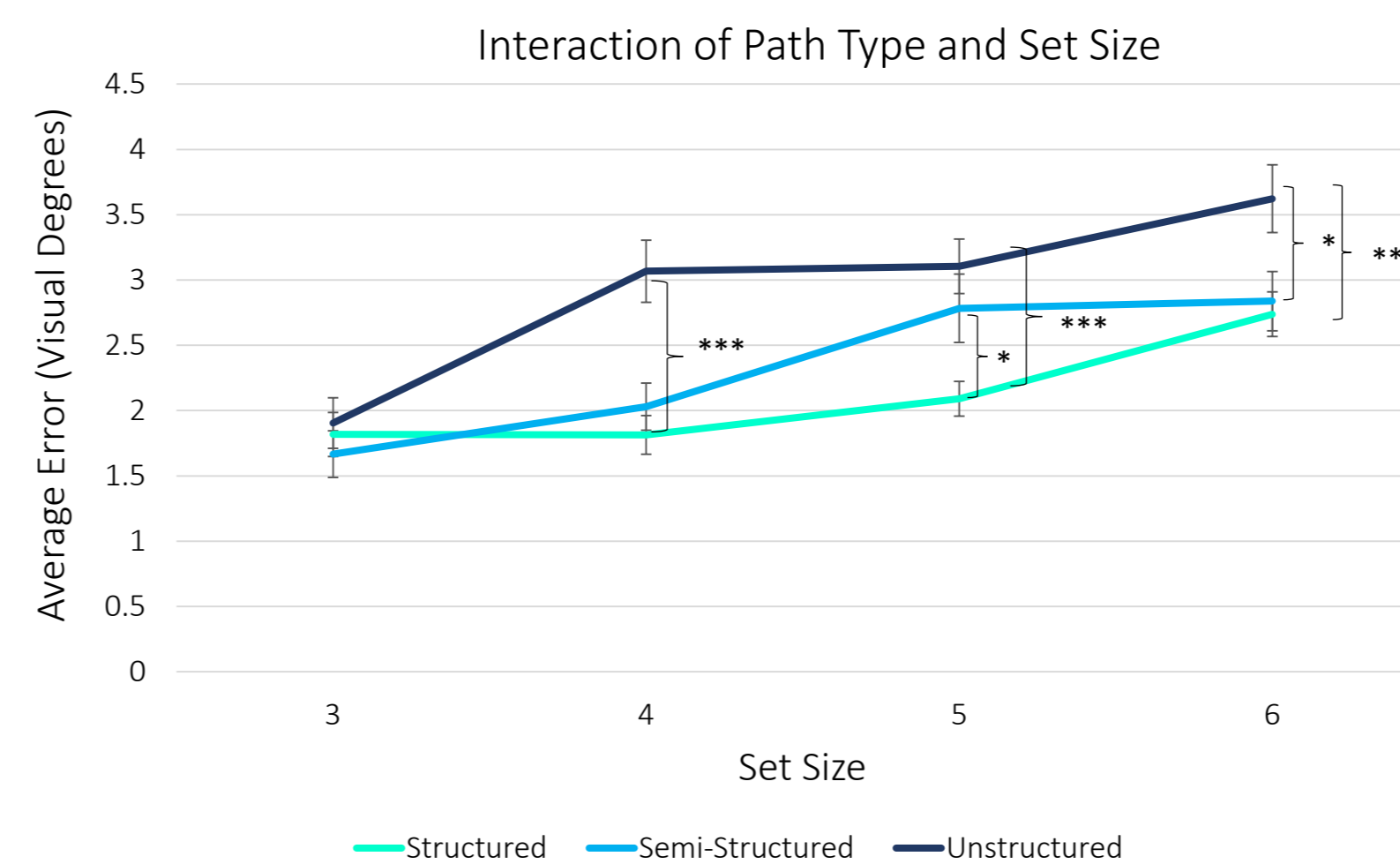
- Results showed that average error was lowest when the path type was structured and largest when it was unstructured

### B How does the presentation order of a target influence recall ability?



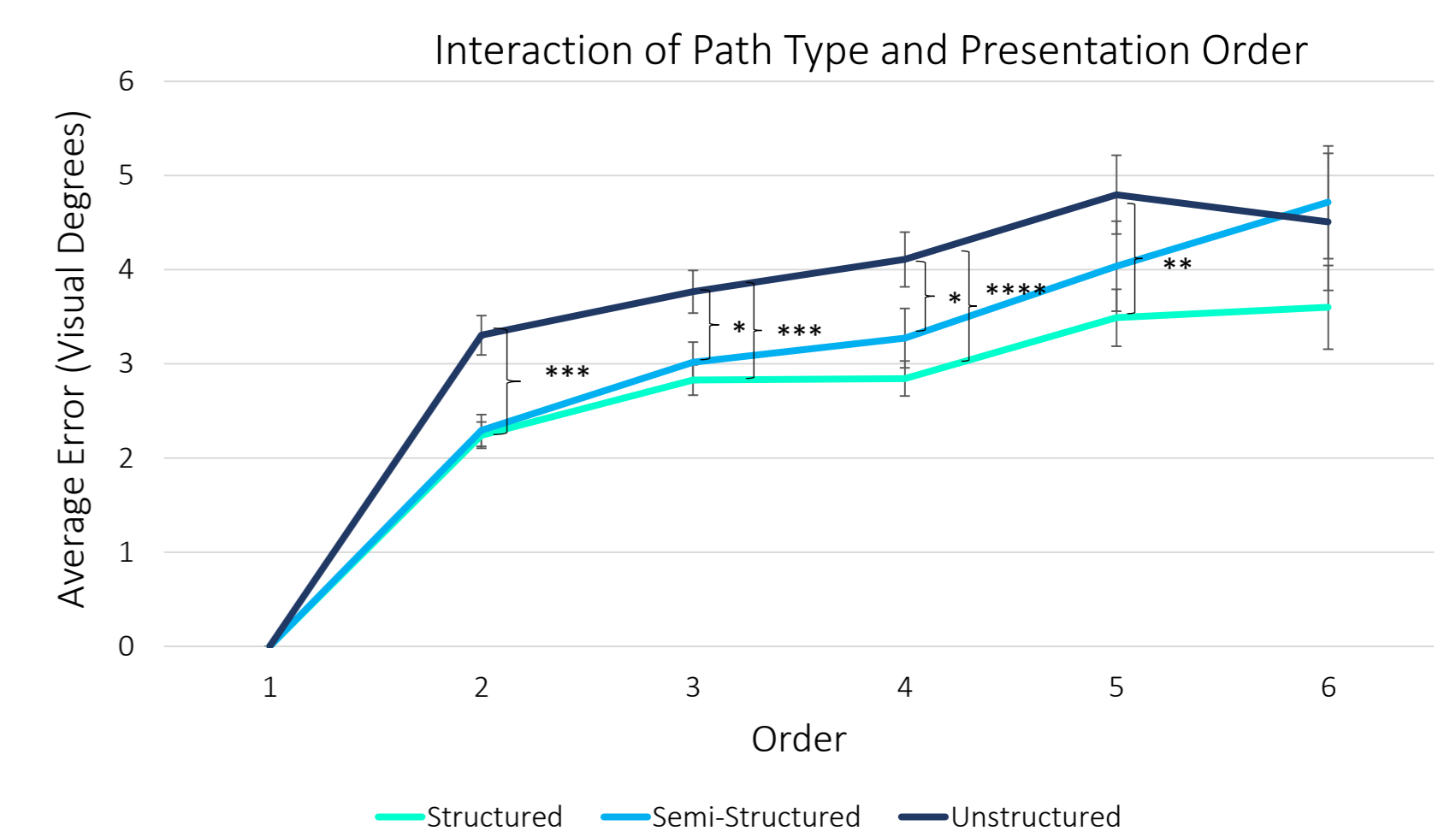
- Results showed that average error was lowest for targets presented early within the sequence, as opposed to ones presented later

### C How does the interaction of path type and set size influence recall ability?



- Results showed a significant effect of path type for set sizes of four, five or six targets

### D How does the interaction of path type and presentation order influence recall ability?



- Results showed that there was a significant effect of path type for targets presented in the second, third, fourth or fifth position in a sequence

## CONCLUSIONS

- The presence of spatiotemporal structure had a significant benefit to recall ability; with structured path types having the most benefit
- The benefit was significant for set sizes of 4-6 targets and targets presented 2<sup>nd</sup>-5<sup>th</sup> in order
- Overall, these results show that visual working memory capacity is improved by spatiotemporal structure but that this interacts with other factors
- Spatiotemporal structure, set sizes, ordering and other factors have to be studied in more detail to better understand how the brain chunks information

## REFERENCES

- Leigh RJ, Kennard C. 2004. Using saccades as a research tool in the clinical neurosciences. *Brain*. 127:460-477.
- Bor D, Duncan J, Wiseman RJ, Owen AM. 2003. Encoding strategies dissociate prefrontal activity from working memory demand. *Neuron*. 37:361-367.
- De Lillo C, Kirby M, Poole D. 2016. Spatio-temporal structure, path characteristics, and perceptual grouping in immediate serial spatial recall. *Front Psychol*. 7:1-18.

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