Similarity of Memory Representations Modulate Saccade Curvatures

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Introduction

Saccade trajectories are influenced by a variety of factors, including attention allocation[1] and the presence of distractors[2]. Two types of deviations are towards and away from specific locations within the visual scene. Deviating towards often occurs in competitive visual scenarios like double-step paradigms and visual searches, where multiple visual elements compete for attention.[3] In contrast, deviating away from a target is a consequence of distractor suppression.[4] The saccade trajectory can vary depending on stimuli manipulations, such as the target-distractor similarity[5], strength of distractor[6], and spatial proximity.[7]

Research Question:
Do spatial proximity and memory similarity affect saccade trajectories?

Prior studies found increased deviation in a mouse trajectory task when potential target locations were presented in closer spatial arrangements, and when those locations were associated with colors that were similar than dissimilar.[8] The present study tested whether this similarity effect can persist for memory representations for saccade trajectories.

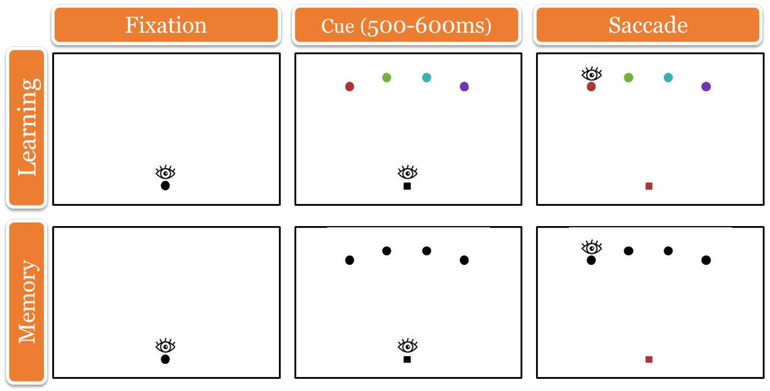
We hypothesized that similar memory representations would result in increased curvature compared to dissimilar memory representations.

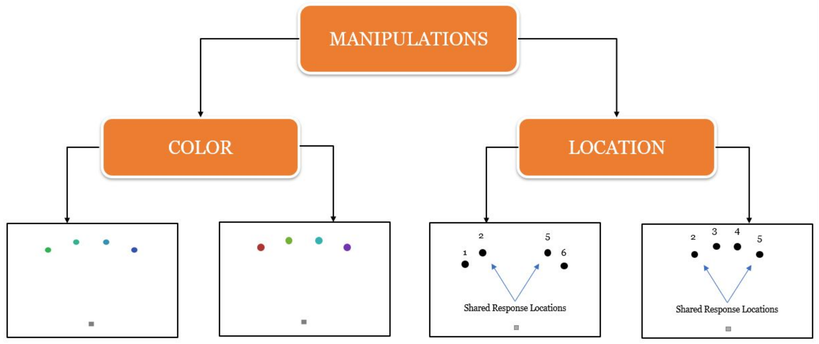
Method

Blocks:

Learning (24 trials): Participants completed a learning block where they were cued to execute a saccade to a colored circle. The same color was always associated with the same location, and participants were asked to learn the color-location associations.

Memory (500 trials): Participants then completed a memory block where all target locations were presented in grey, thus they had to rely on memory representations to execute a saccade to the correct location.

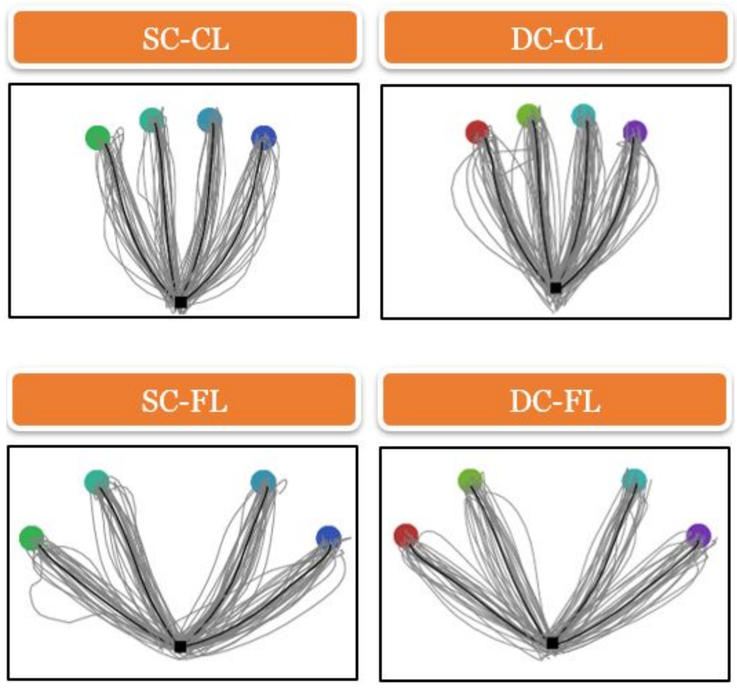




Manipulations:
Color:
Similar Color (SC): 30° apart
Dissimilar Color (DC): 90° apart
Location:
Close Location (CL): ~2.5 dva apart
Far Location (FL) ~7 dva apart

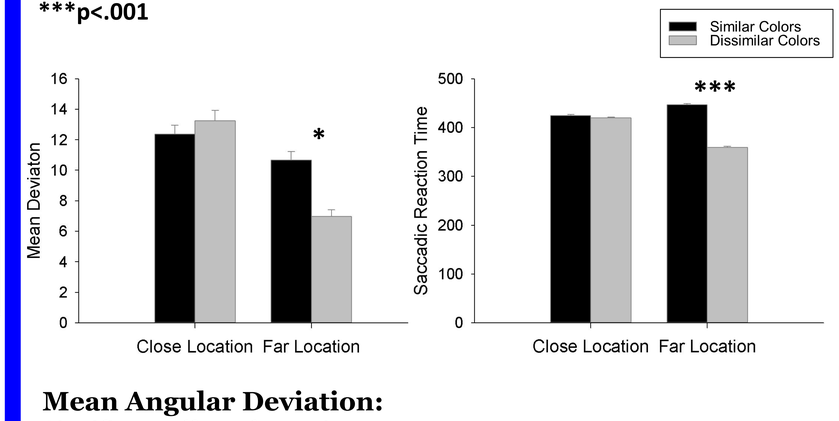
Conditions (between-subject):
SC-CL (17 participants)
SC-FL (13 participants)
DC-CL (20 participants)
DC-FL (19 participants)

Average Saccade Trajectories



*p<.05
**p<.01
***p<.001

Results



Mean Angular Deviation:
Significant effect of Location:
Larger deviations for close locations (*M*=12.8) than far locations (*M*=8.8)

Significant Color x Location interaction:
Larger deviations for similar colors (*M*=10.8) than dissimilar colors (*M*=7.0) for far locations, but not for close locations (*M*=12.4 and *M*=13.2, respectively).

Saccadic Reaction Time:
Significant effect of Color:
Slower SRTs for similar colors (*M*=435 ms) than dissimilar colors (*M*=389 ms)

Significant Color x Location interaction:
Slower SRTs for similar colors (*M*=447 ms) than dissimilar colors (*M*=360 ms) for far locations, but not for close locations (*M*=424 ms and *M*=420 ms, respectively).

Conclusion

The present study showed evidence that color memory representations can affect saccade trajectories.

These results suggest that oculomotor control can be modified by not only perceptual similarities but also similarities in memory representations.

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