Perceptual stability in real-world scenes

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Background

Changes that occur during eye movements frequently go undetected. In simple stimuli, sensitivity to saccade target movements increase when the target is briefly absent after the saccade.[1,2,3] This effect is interpreted that perceptual stability relies on post-saccadic information[1,2,3] and object correspondence.[4,5,6] If the pre- and post-saccade views do not match, precise oculomotor data is accessed to detect the difference.[3]

We attempted to replicate this classic effect using scene stimuli, but found the opposite pattern of effects (Expt 1 and 2). Meanwhile, we were able to replicate the classic effect in simple stimuli (Expt 3).

Task

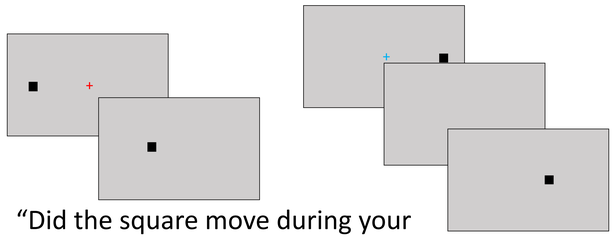
No post-saccade blank

Post-saccade blank (250ms)

"Did the scene move during your eye movement?"

Experiment 1 - 2° scene displacements

Experiment 2 - 2° and 4° scene displacements



"Did the square move during your eye movement?"

Experiment 3 – 1 and 2° displacements

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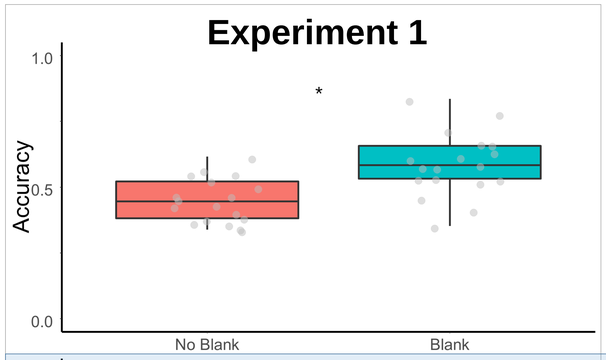
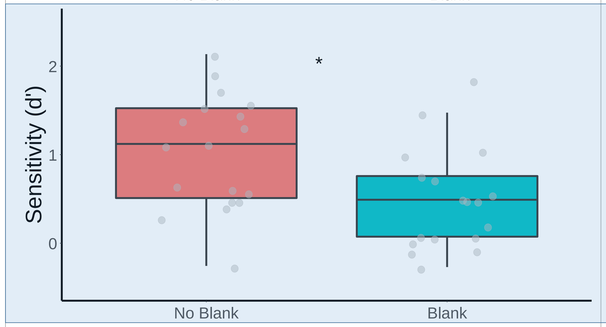
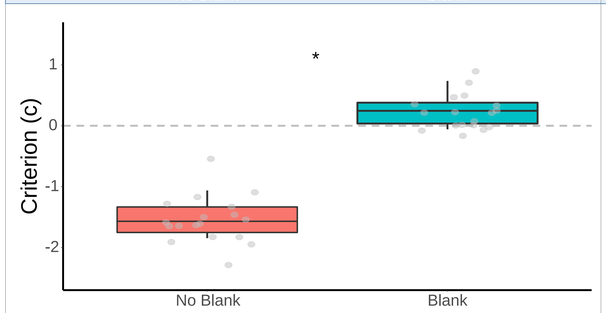
Experiment 1

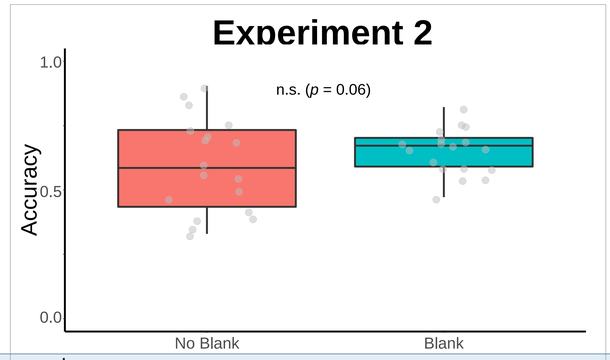


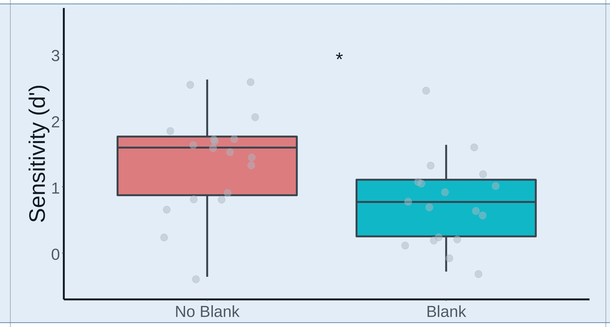


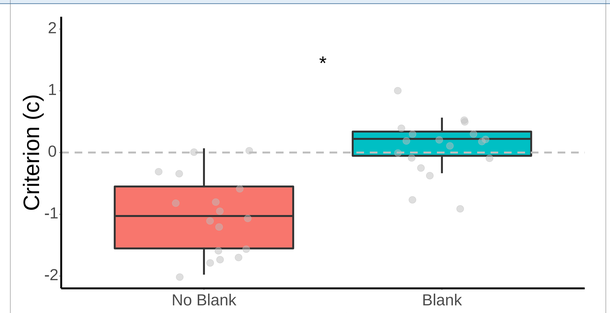


Participants were more sensitive to scene displacements in the no blank condition, despite being more accurate in the blank condition. The blank increased false alarms.

Experiment 2

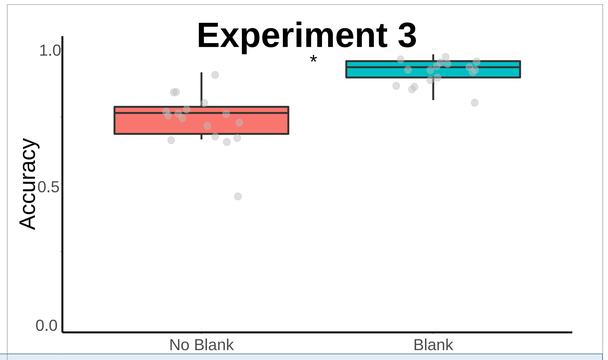


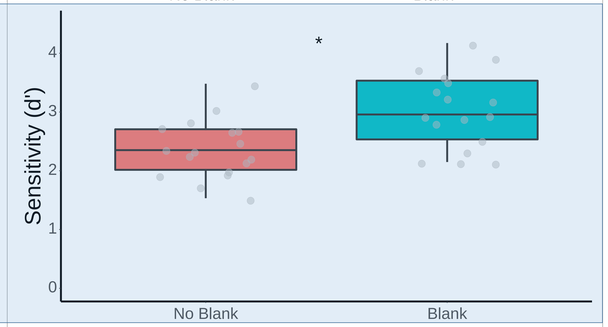


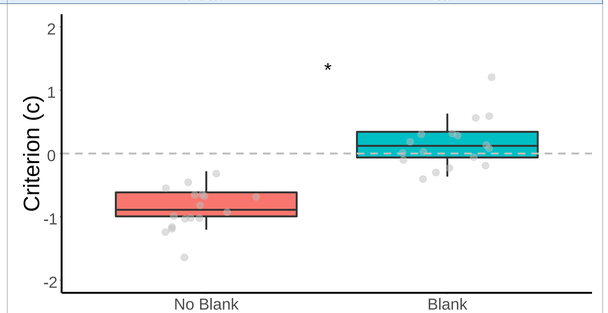


Even with a larger (easier to detect) displacement, participants were more sensitive to scene displacements in the no blank condition. The blank again increased false alarms.

Experiment 3







Replicating the classic effect, participants were more sensitive to simple stimulus displacements in the blank condition compared to the no-blank condition.

Conclusions

1. We did not replicate the classic effect of a post-saccade blank screen with scene stimuli, but did with simple stimuli.
2. Our results are consistent with accounts of limited-capacity VWM supporting displacement detection across eye movements: crowding at the saccade endpoint in scenes may lead to a poorer WM representation.
3. Our results are not consistent with the visual system relying on precise oculomotor information to identify transsaccadic displacements: participants were worse at detecting displacements with a post-saccade blank. A lack of post-saccade visual information should not impact the precision of oculomotor data.

References [1]Deubel, H. & Schneider, W.X. (1994). Perceptual stability and postsaccadic visual information: can man bridge a gap? *Behav. Brain Sci.* 17, 259-260. [2]Deubel, H., Schneider, W.X., & Bridgeman, B. (1996). Postsaccadic target blanking prevents saccadic suppression of image displacement. *Vision Res.* 36, 1827-1837. [3]Deubel, H., Bridgman, B., & Schneider, W.X. (1998). Immediate post-saccadic information mediates space constancy. *Vision Res.* 38, 3147-3159. [4]McConkie, G.W., & Currie, C.B. (1996). Visual stability across saccades while viewing complex pictures. *J. Exp. Psychol. Hum. Percept. Perform.* 22, 563-581. [5]Currie, C.B., et al. (2000). The role of the saccade target object in the perception of a visually stable world. *Percept. Psychophys.* 62, 673-683. [6]Hollingworth, A. Richard, A.M., & Luck, S.J. (2008). Understanding the function of VSTM: transsaccdaic memory, object correspondence and gaze correction. *J. Exp. Psychol. Gen. 137,163-181.*