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Suppression of displacement detection in the presence and absence of eye movements: a neuro-computational perspective

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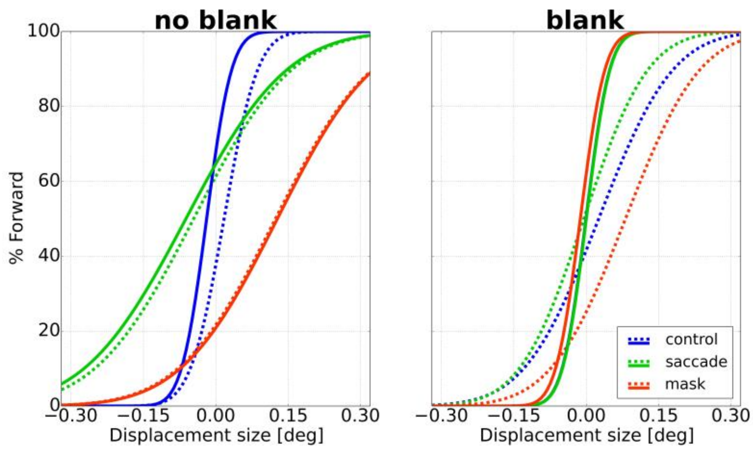
Understanding the subjective experience of a visually stable world during eye movements has been an important research topic for many years. Various studies were conducted to reveal fundamental mechanisms of this phenomenon. For example, in the paradigm saccadic suppression of displacement (SSD), it has been observed that a small displacement of a saccade target could not easily be reported if this displacement took place during a saccade. New results from Zimmermann et al. (2014) show that the effect of being oblivious to small displacements occurs not only during saccades, but also if a mask is introduced while the target is displaced. We address the question of how neurons in the parietal cortex may be connected to each other to account for the SSD effect in experiments involving a saccade and equally well in the absence of an eye movement while perception is disrupted by a mask.

Zimmermann et al. (2014) show that three phenomena, namely spatial and temporal compression as well as saccadic suppression of displacement (SSD) still occur if a mask is presented instead of executing a saccade. They conclude that these new data challenge the view that saccades cause those misperceptions and propose that interruptions in the visual input may have a more general underlying cause. In this article, we take a computational modeling perspective and discuss the challenges of these new data to existing computational models with the focus on saccadic suppression of displacement. For this purpose, we use the existing model of perisaccadic perception proposed by Ziesche and Hamker (2014), which already explains the phenomenon of SSD. We show that we can reproduce the findings of Zimmermann et al. (2014) without changing the model's dynamics and conclude that the mask induces similar effects as spatial updating, which are an increase in the threshold for motion perception, uncertainty and a bias toward backward displacements.



Original findings of Zimmermann et al. (2014) compared to model results: The fitted cumulative Gaussian decision curves for a "forward" response over displacement size for each task (control, saccade, and mask) with and without a blanking period. On the left, the results of the control (blue), saccade (green) and mask (red) task without a blanking period and on the right the tasks with a 200-ms blank are plotted. The fitted decision curves of the model are plotted with solid lines and those of the averaged experimental results with dashed lines.

References:

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