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Perceiving motion in the world during pursuit eye movements: Directional and confidence judgements favor a re-calibration model

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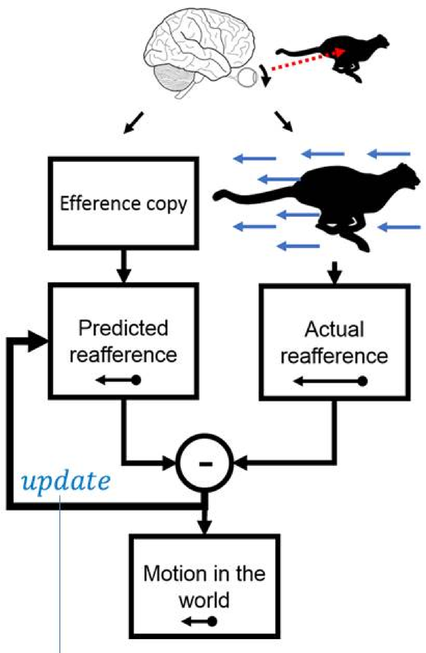
INTRODUCTION



To extract object motion during smooth pursuit eye movements, the visual system needs to tell apart reafferent retinal motion from motion in the world.

An efference copy signal can be used to predict the amount of reafference to subtract from the image. However, efference signals are subject to noise (e.g. same motor command may lead to different eye movements, due to, for example, fatigue).

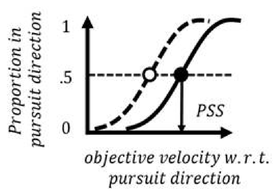
An image-based adaptive mechanism can ensure the continued accuracy of this computation: the predicted reafference is continuously being updated based on a prediction error (subtraction of the actual and predicted reafference).

*See **Haarmeir et al. 2001**: Repeatedly exposing observers to background motion with a fixed direction relative to that of the target that is pursued leads to a shift in their point of subjective stationarity (PSS)*

OBJECTIVES

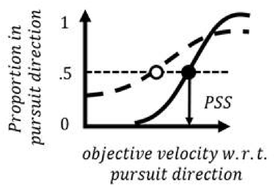
***Update** due to Re-calibration or Gaze-contingent adaptation?*

A Re-calibration



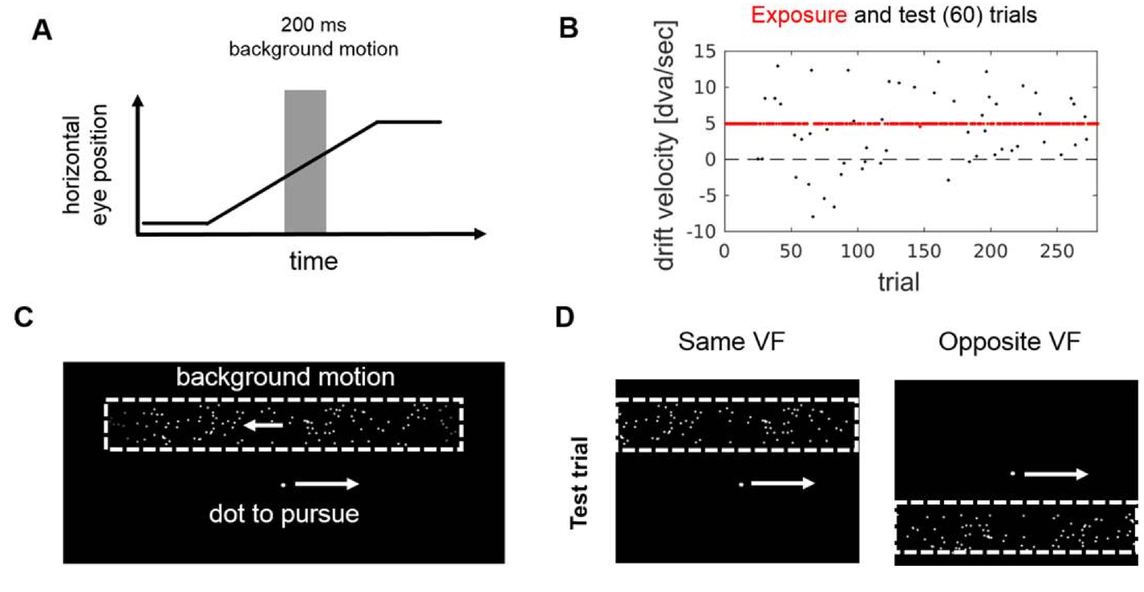
Point of subjective stationarity (PSS) is shifted to reduce the prediction error (dashed line). The discriminability of motion around the PSS remains the same to the previous state (solid line).

B Gaze-contingent adaptation



Motion detectors tuned to reafferent retinal motion relative to the pursuit direction reduce their response, resulting in reduced discriminability of dots velocity [shallower slope at the PSS (dashed line), compared to an unaffected state (solid line)].

METHOD



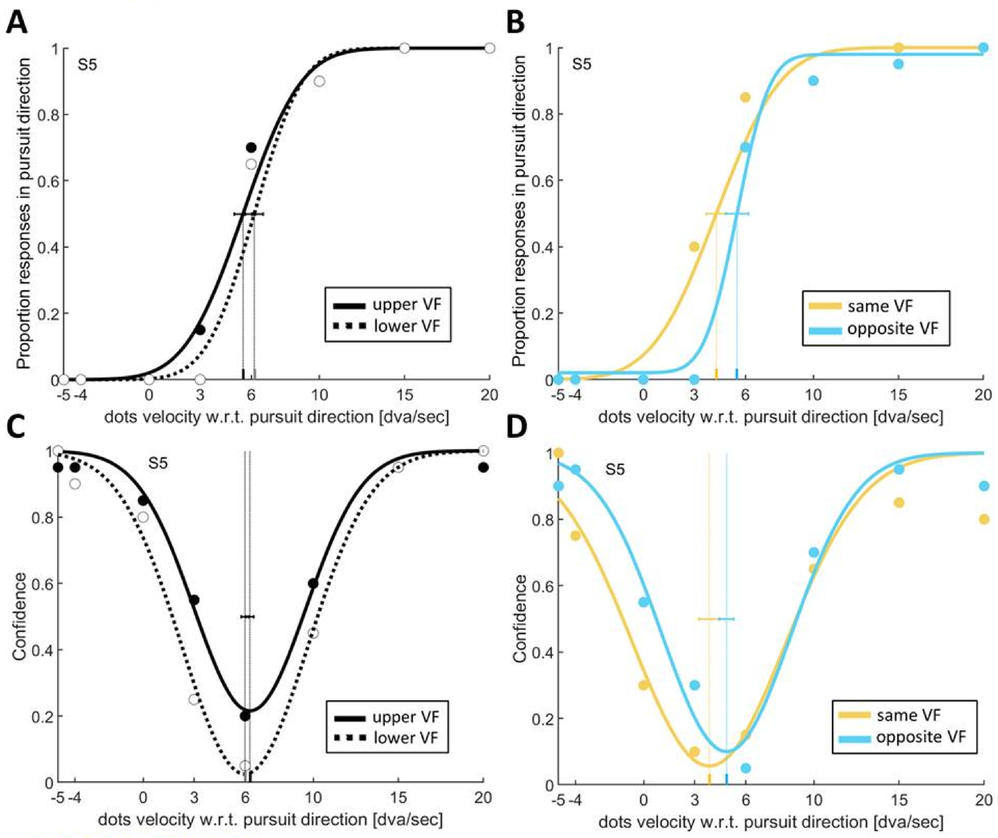
Control condition: In each trial, background dots with different drifting velocities appear while pursuing the dot. A response needs to be provided.

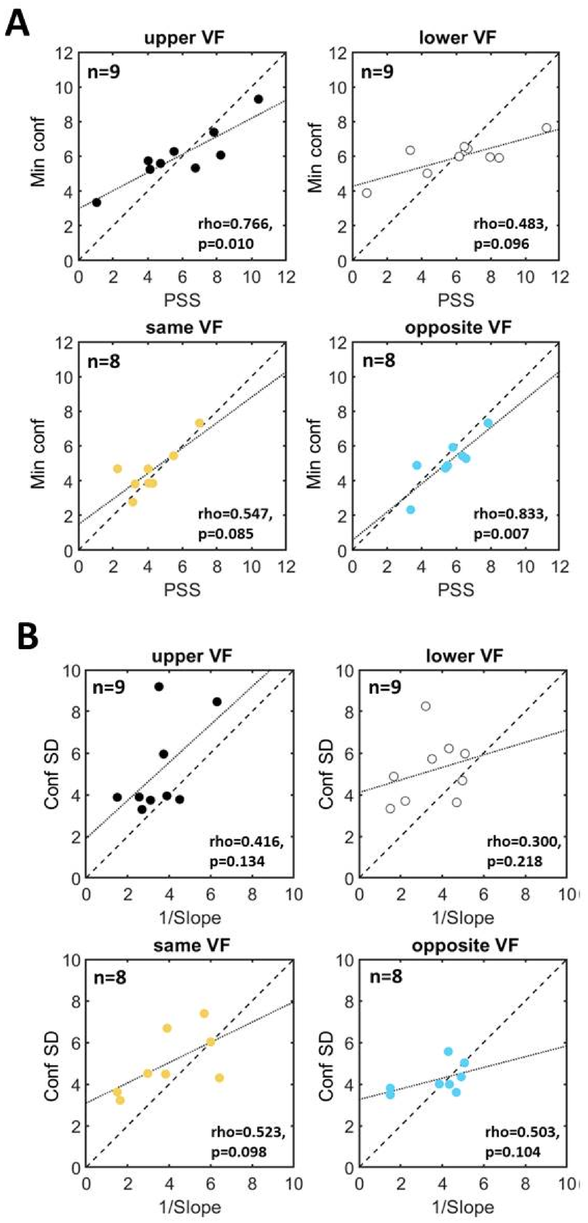
Exposure condition: Trials like those in the control condition (test trials) are interleaved with exposure trials. In these ones, background dots appear during pusuit, always moving at 5 dva/sec. No response is asked for these trials. They are just meant to achieve repeated exposure to a certain background motion.

Response:

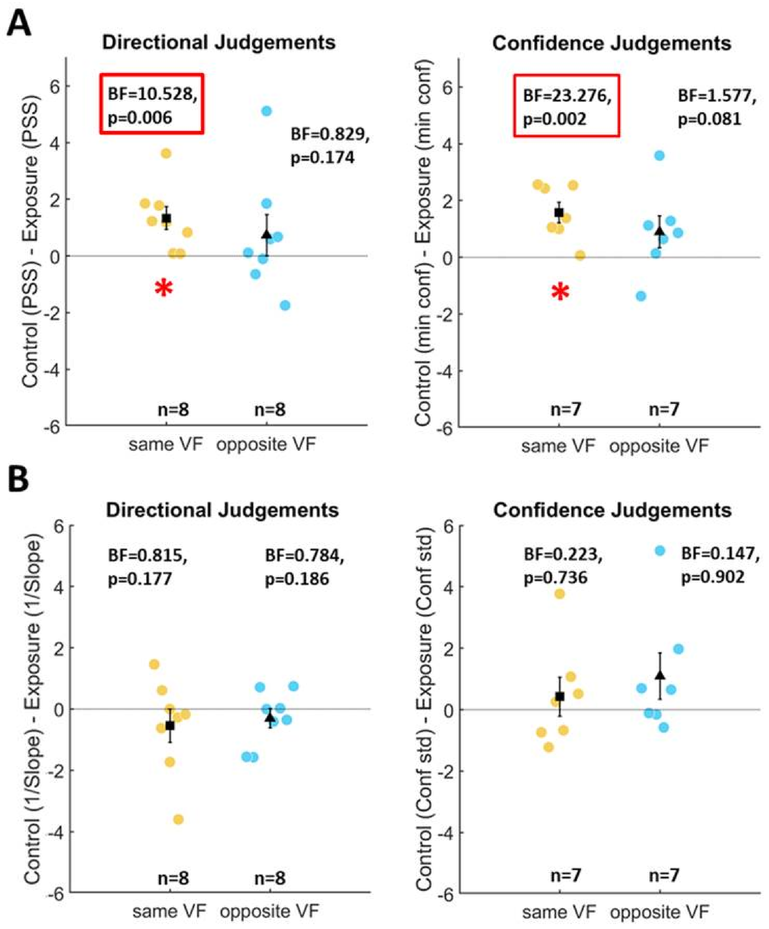
-Perceived **direction of motion** of the cloud of dots (rightward or leftward).
-**Confidence** about the directional judgement (high or low).

RESULTS





Confidence judgements are a good proxy for directional judgements. Sensory bias discarded (see Gallagher et al. 2019).



* p<0.05 Repeated-measures t-test. Significant effect of exposure to background motion only on the same VF.

(Consistent with Souto, Gegenfurtner & Schutz, 2016, VSS)

Bayesian t- test shows evidence favorable for a shift in PSS and point of minimal confidence in same VF. No shifts in the inverse of the slope or standard deviation of the confidence.

DISCUSSION

-An effect of exposure to background motion is confirmed specific to the exposed visual field.
-Recalibration is favored over gaze contingent adaptation to explain this exposure effect.

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