Integration of object motion across apertures during tracking eye movements: perceptual and oculomotor measures

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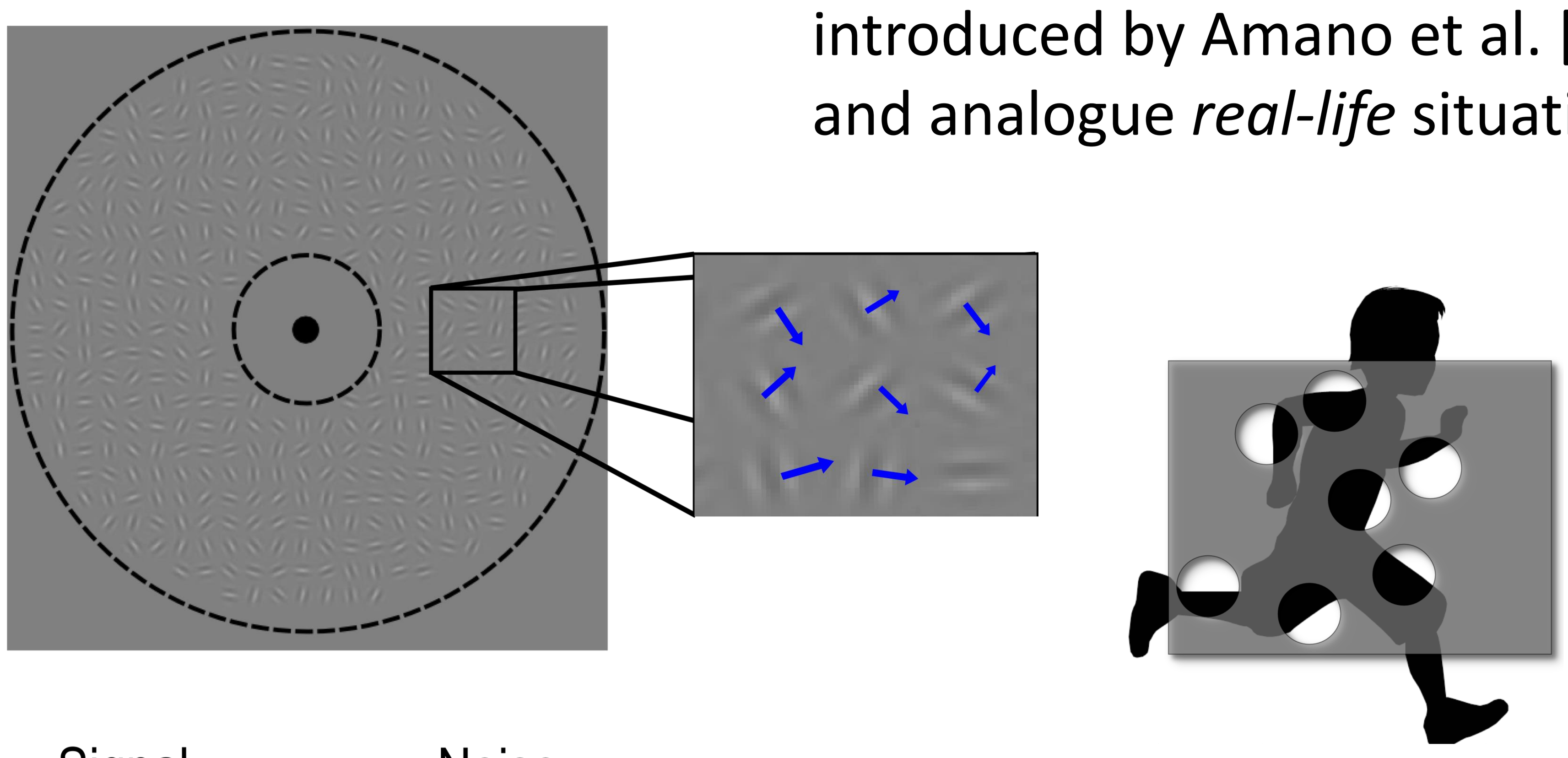
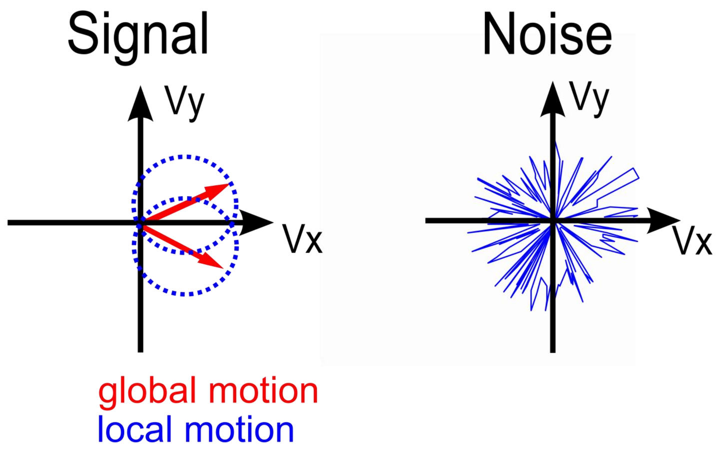
Background

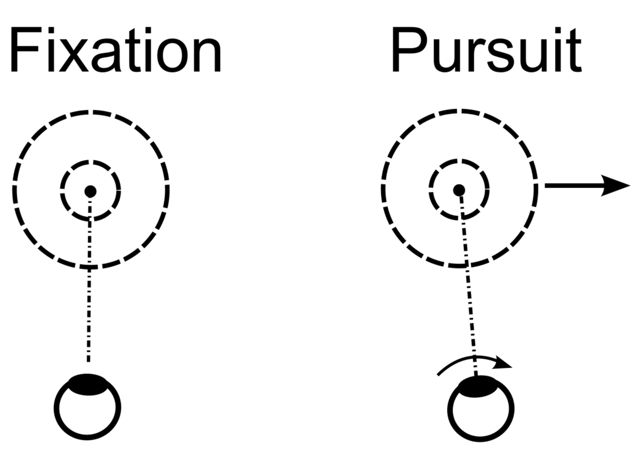
We showed previously that the integration of local motion signals leading to the perception of global motion is more effective during fixation than during pursuit eye movements [1]. Here, in a new experiment, we sought to relate psychophysical performance to ocular behavior as a way to exclude stabilization errors (retinal slip) as a determining factor.

Stimulus & task

Multiple-aperture display introduced by Amano et al. [2] and analogue *real-life* situation.







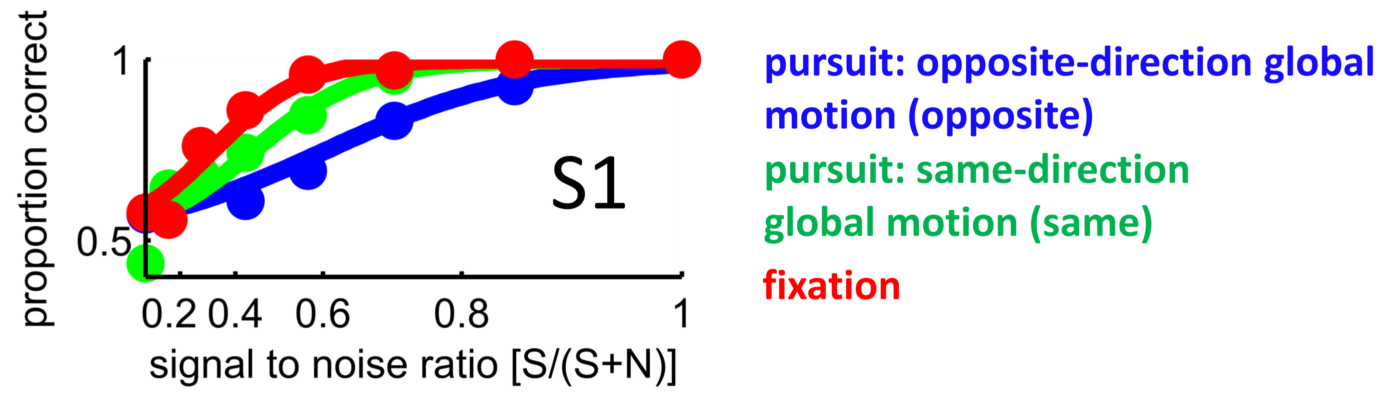
Perceptual task

- discriminate the direction of global motion: 10° up or down (2AFC)
- Motion duration: 200 ms

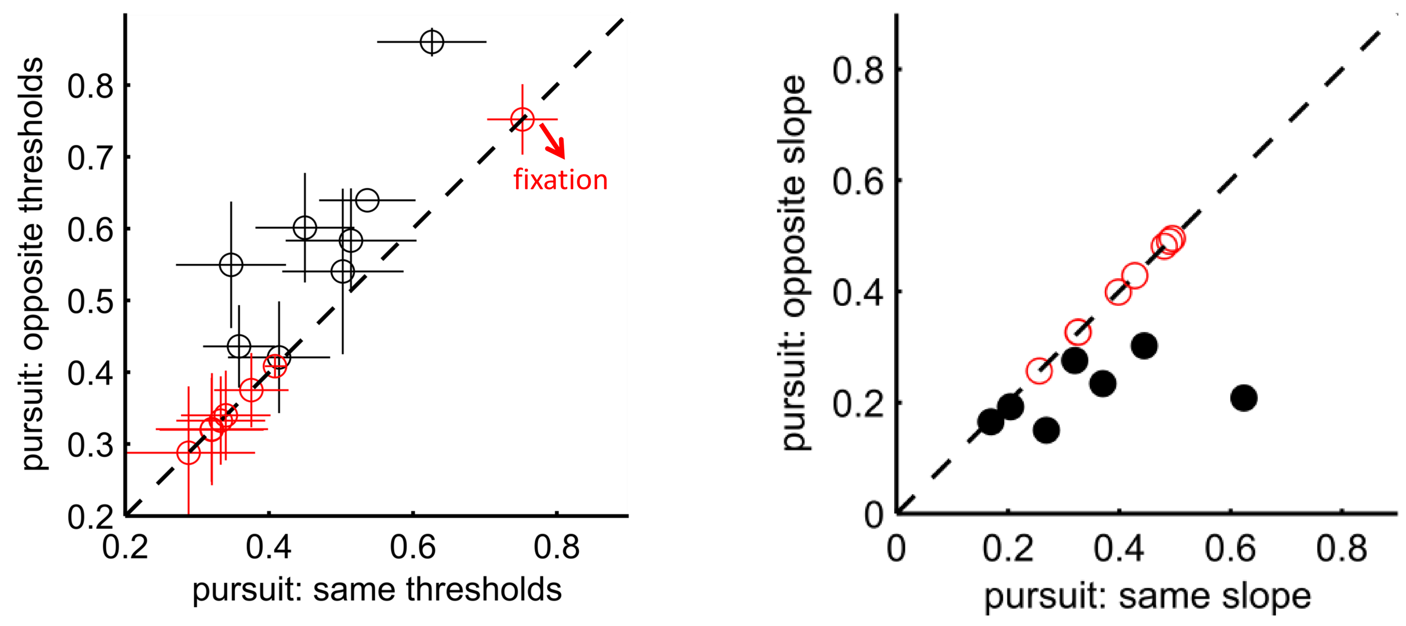
Oculomotor task

- Track or fixate the display during 2 s

Perception

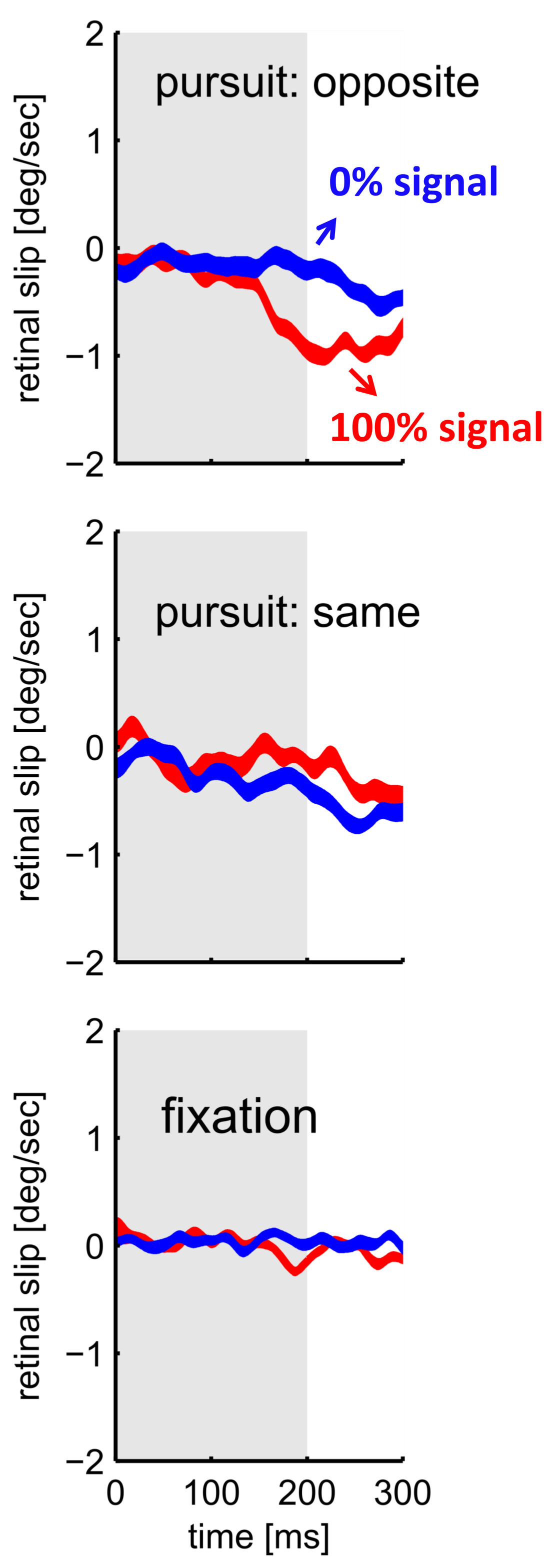


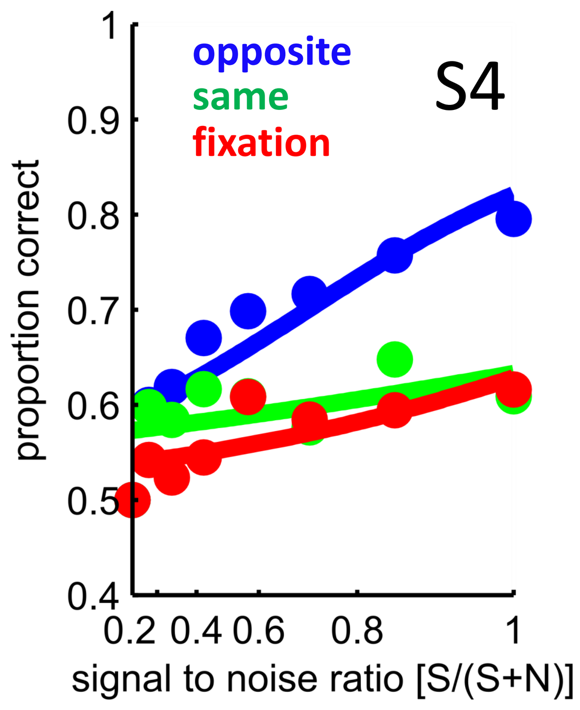
Group data



Retinal slip

horizontal retinal slip (S4)





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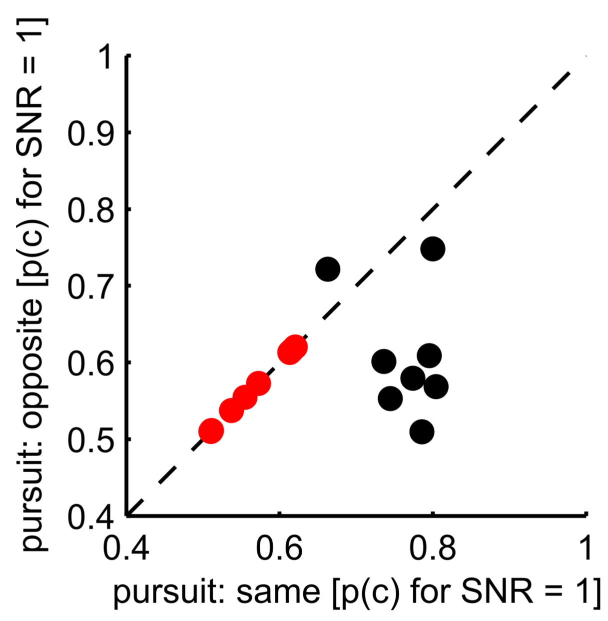
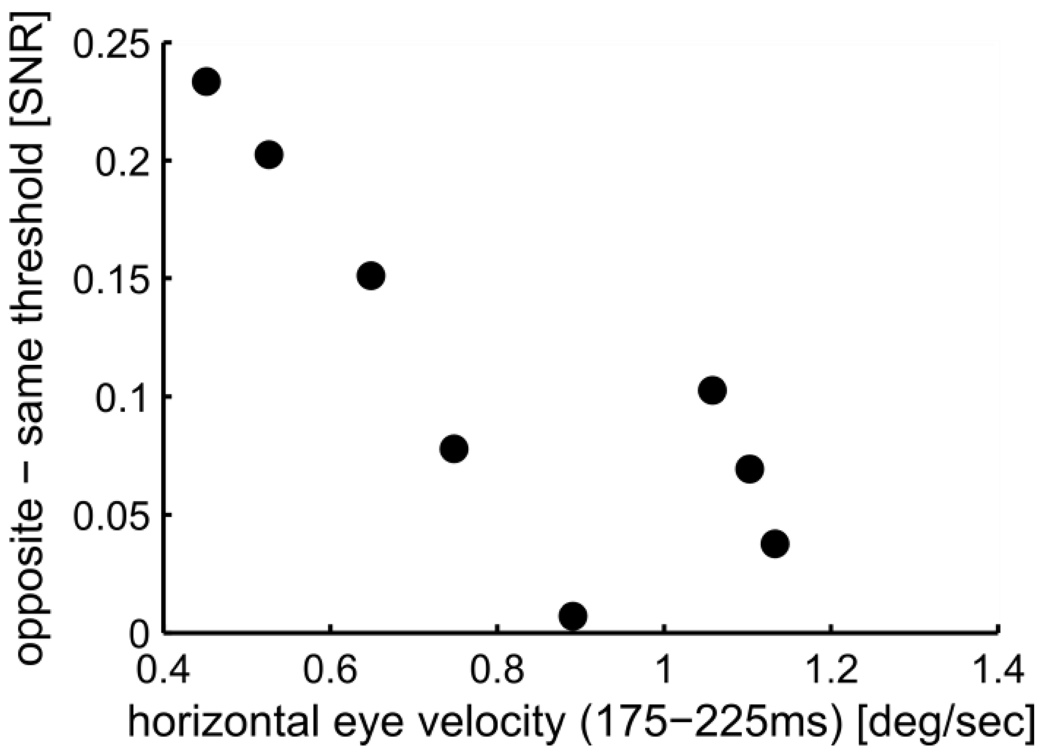


We calculated the ability to discriminate the signal horizontal direction based on horizontal retinal slip distributions (175-225 ms average) for a given signal level and the 100% noise baseline (oculometric ROC analysis [see 3]).

Vertical velocity could *not* solve the motion discrimination task.

Perception & retinal slip

Higher perceptual thresholds for opposite vs. same conditions are not a simple consequence of larger retinal slip. Tracking global motion may help direction discrimination [4].



Bottom line

Motion signals across apertures do not integrate as well for motion opposite to the pursuit direction as compared to same-direction motion (ECVP 2011). The reduced performance is not a simple consequence of higher retinal slip.

There is a systematically larger ocular drift (ocular following) in the opposite condition, contrary to what is found in the literature on the influence of background motion during pursuit [e.g. 5], suggesting that the segregation of object and background motion signals determines the strength of this response.

[1] Souto and Johnston (2011). *ECVP.* [2] Amano et al. (2009): *JoV.* [3] Gegenfurtner et al. (2003). *JoV.* [4] Spering et al. (2011). *J of Neurophysiol.* [5] Lindner & Ilg (2006) *Vis Res.*

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