Voluntary initiation of smooth pursuit eye movements

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Background

Humans do not naturally perform smooth pursuit eye movements in the absence of a moving target [e.g. 1]. But, can we learn to do it?

Here, a new gaze-contingent paradigm is introduced, in which cue-induced anticipatory smooth pursuit eye movements [2] can trigger motion of a dot (*Training Phase*). This was expected to lead to the ability to initiate pursuit in the absence of any external cue (*Test Phase*).

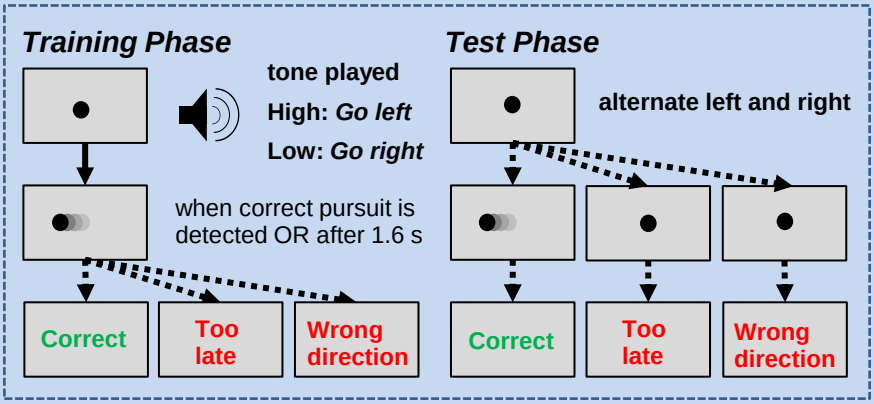
On-line pursuit detection

Eye movement velocity was filtered on-line by using iterative exponential smoothing.

Dot motion was launched when eye velocity was outside baseline velocity 99% CI, for 5 samples, and no saccade was detected.

Methods

Participants were psychology students from the University of Geneva. A dot motion was triggered by the detection of a smooth pursuit eye movement (eye position recorded at 1000Hz, Eyelink 1000).



In the Training Phase a dot direction of motion was **cued** by a tone. In the Test Phase, dot motion was dependent only on pursuit being detected in the required direction. Because an alternation was required, there could be no benefit of priming by the last pursuit. A random inter-trial waiting time was added (.6 to 2.1 s).

Six sessions were run on different days.

Session: Training (50) | Test (20) | Training | Test | Training | Test

All participants included in the analysis.

Results

Figure 1. Proportion of trials detected in the correct direction per session (n correct / n incorrect). Each shade of gray represents a participant.

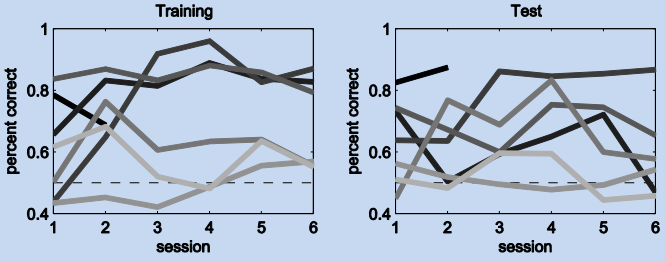
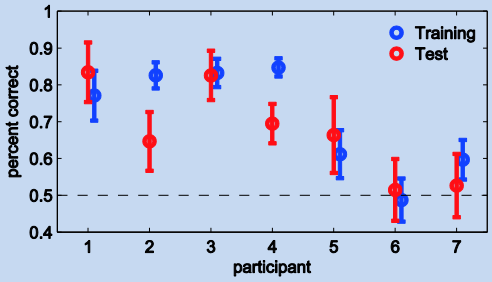


Fig 2. Proportion correct trials per participant



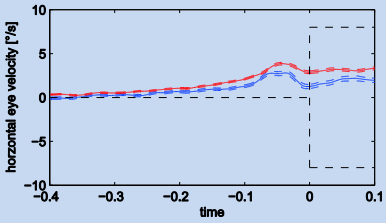
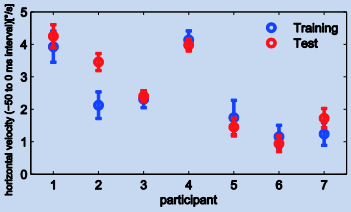


Fig 3. Subject 2. Average eye movement velocity in Training and Test correct trials. Leftward trials were mirrored.

Fig 4. Average eye movement velocity from 0 to 50 ms before dot movement onset in correct trials.



Conclusions

- Difficult task: pursuit not detected >50% of trials.
- Directional performance well above chance even when direction was not cued.
- Velocity profiles were not different in cued and non cued conditions.
- We must revise the idea that smooth pursuit initiation is impervious to **purely** top-down signals.

References

[1] Lorenceau 2012. *Current Biology, 22(16), 1506-150.*

[2] Barnes, G. & Collins, C (2008). *Prog Brain Res*, 171, 441-9.

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