Using electrooculography to track closed-eye movements.

PRESENTER:
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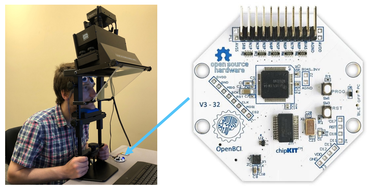
BACKGROUND

- Our eyes meaningfully change position during eyelid closure, e.g., while dreaming or imagining.
- Electrooculography (EOG) is a practical way to track closed-eye movements. EOG works by exploiting the eye's electric dipole, i.e. the corneo-retinal potential.

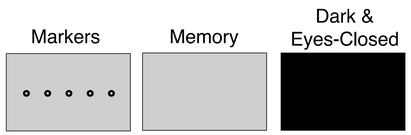
METHODS

- Ten healthy adults (8 female, 18–24 years) with normal or corrected visual acuity.
- Right eye simultaneously recorded at 250 Hz with an **EyeLink 1000** (**left**), and **EOG** acquired via **OpenBCI's Cyton Board (right)**:

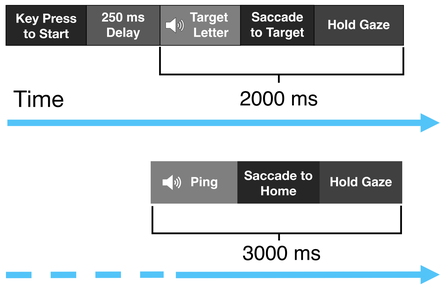


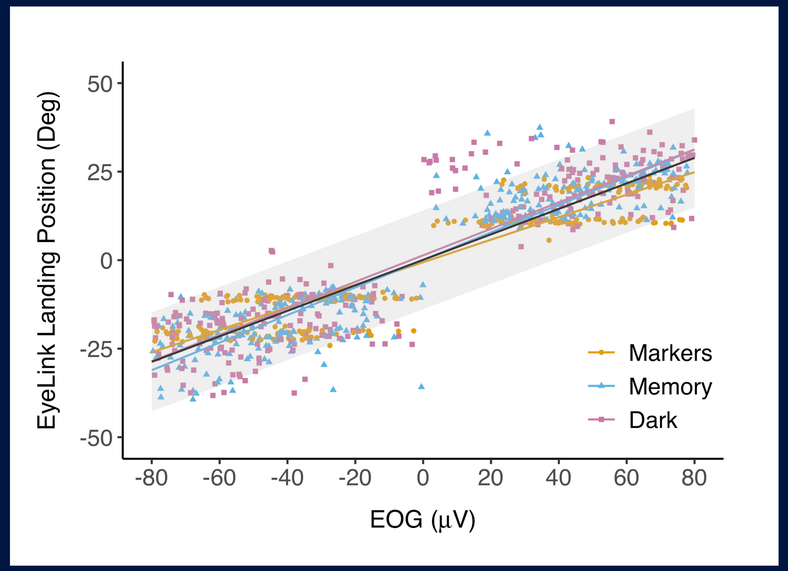
- An auditory signal ('A', 'B', 'C', or 'D') signaled participants to make a horizontal gaze shift to targets at –21°, –10.5°, 10.5° or 21° from centre, respectively.
- 160 self-paced trials per participant (10 to each of the 4 targets in 4 conditions):

Conditions



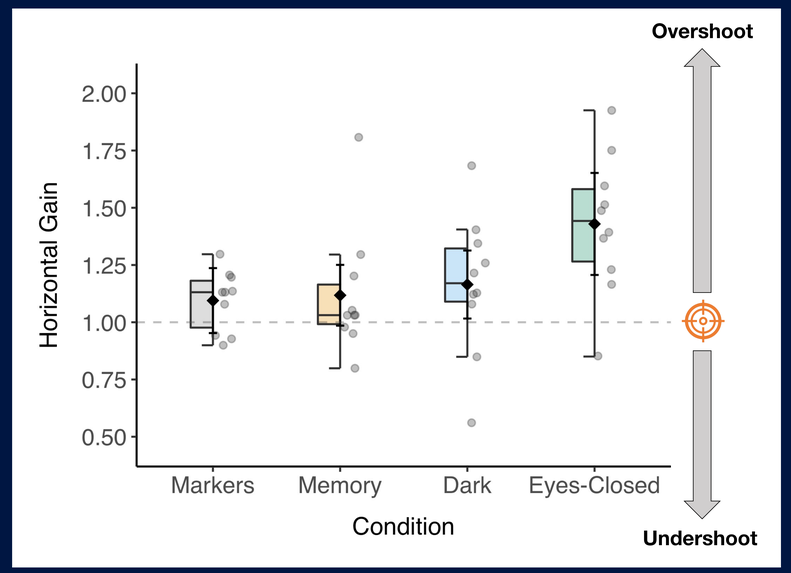
Procedure





We **trust EOG to determine gaze position** because we calibrate it with markers, memory, and even in the dark.

How do saccades differ with closed-eyes?



Note. Grey dots represent the aggregated means of individual participants (n = 10). Diamonds mark the mean. Error bars represent the within-subjects standard error.

Greater saccadic gain indicates more input from corollary discharge and proprioception.

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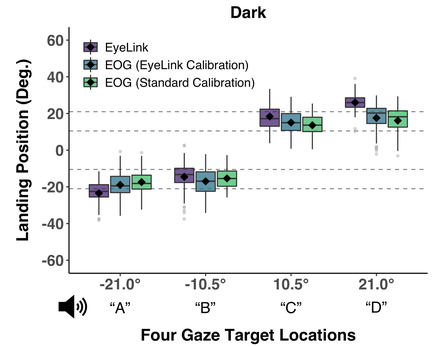
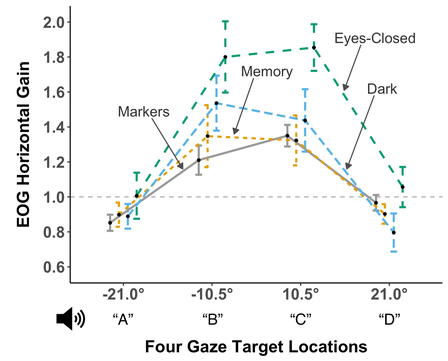
DETAILED RESULTS

- Model test in Dark condition: EOG calibrated with EyeLink was similar to the EyeLink signal alone, $t(9) = 2.56$, $p = .072$.
- Standard calibration of EOG, $t(9) = 2.73$, $p = .054$, was indistinguishable from the EyeLink-based model, $p = .998$.



- Main effect of condition on gain, $F(2.21, 19.88) = 4.47$, $p = .022$, $\eta^2 = .12$, and main effect of target on gain, $F(1.35,12.12) = 21.04$, $p < .001$, $\eta^2 = .37$.
- Closed-Eyes resulted in more gain than Markers, $t(9) = 2.78$, $p = .021$, and Memory, $t(9) = 2.50$, $p = .033$, but not Dark, $t(9) = 2.14$, $p = .06$.
- Horizontal gain greatest for the intermediate target locations (significant quadratic trends, with the greatest for Eyes-Closed).



Ethics Statement: All research presented here was carried out in accordance with Canada's *Tri-Council Policy Statement 2: Ethical Conduct for Research Involving Humans* and was approved by The University of British Columbia's research ethics board (H18-03792).

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