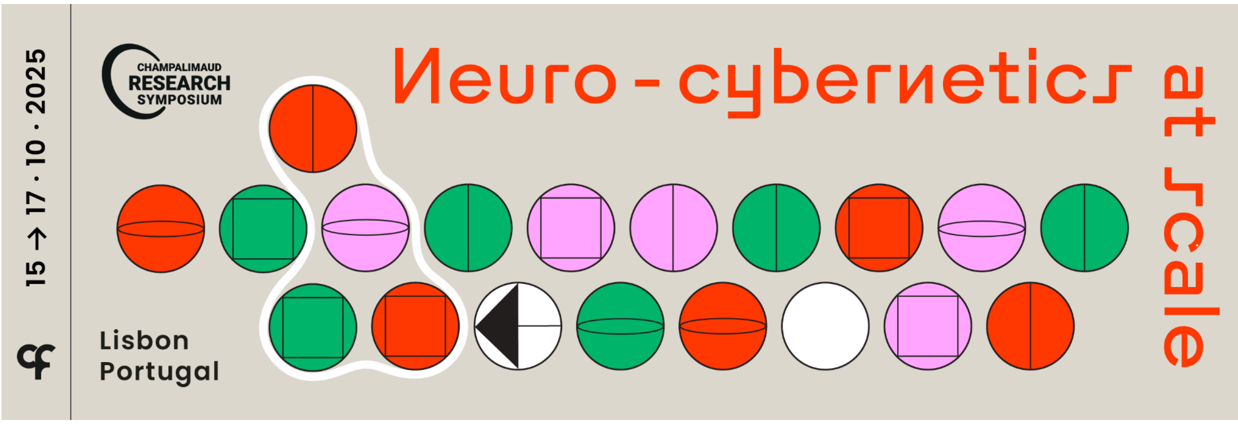

Angular Self-Motion Estimation Guides Evasive Turning Decisions in Walking Drosophila

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During navigation, animals continuously monitor their movements relative to internal goals and past actions to detect and correct deviations from their intended trajectory. Estimation of self-motion from visual cues as well as vestibular and proprioceptive signals enables movement correction, planning, and execution of new actions [1]. While the role of self-motion in continuous movement adjustments is well studied [2,3,4,5], its influence on discrete, punctuated actions remains poorly understood.
To address this, we leveraged the structure of Drosophila exploratory behavior, where walking trajectories consist of relatively straight runs interrupted by rapid turns, or body saccades [6, 7]. We developed a paradigm in which a brief, non-directional infrared laser pulse—delivered in darkness—transiently increases body temperature and triggers evasive, rapid turns. This approach enables precise temporal control over the transitions between running and turning. In absence of directional cues, we found that angular self-motion, estimated during the preceding run, predicts the direction of the evasive turn (e.g., leftward-drifting runs lead to rightward turns, and vice versa). This "drift-to-contraversive evasive turn" rule mirrors patterns observed in spontaneous body saccades, suggesting that information accumulated about angular drift, during runs, modulates both spontaneous and stimulus-evoked rapid turns.
We are currently investigating the circuits underlying evasive turns. Our goal is to understand how angular drift estimates, emerging through feedback loops involving the ventral nerve cord (the insect analogue of the spinal cord), the central complex (the fly’s navigational center), and the lateral accessory lobe (a higher premotor brain region) influence the direction of triggered evasive saccades.

self-motion estimation, decision making, sensorimotor transformation, behaviour, drosophila