Abstract Submitted
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Low-dimensional stochastic dynamics underly the emergence of spontaneous movement in electric fish[1] ALEXANDRE MELANSON, Univ of Ottawa, JAMES J. JUN, Janelia Farm, JORGE F. MEJIAS, New York University, LEONARD MALER, ANDRE LONGTIN, Univ of Ottawa — Observing unconstrained animals can lead to simple descriptions of complex behaviours. We apply this principle here to infer the neural basis of spontaneous movements in electric fish. Long-term monitoring of fish in freely swimming, stimuli-free conditions has revealed a sequence of behavioural states that alternate randomly between periods of activity (movement, high active sensing rate) and inactivity (no movement, low active sensing rate). We show that key features of this sequence are well captured by a 1-D diffusion process in a double well energy landscape, where we assume the existence of a slow variable that modulates the relative depth of the wells. Model validation is two-fold: i) state duration distributions are well fitted by exponential mixtures, indicating non-stationary transition rates in the switching process. ii) Monte Carlo simulations with progressive tilting of the double well is consistent with the observed transition-triggered average. We interpret the stochastic variable of this dynamical model as a decision-like variable that, upon reaching a threshold, triggers the transition between states. We thus identify threshold crossing as a possible mechanism for spontaneous movement initiation and offer a dynamical explanation for slower behavioural changes.

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