INTER-REGIONAL NEURAL DYNAMICS UNDERLYING SELF-PACED ACTION DECISIONS

M. Elbaz[1], *K. Butterer*[1], *J. Glaser*[2], *A. Miri*[1]
[1]Northwestern university, Evanston, United States, [2]Northwestern university, Chicago, United States

Topic & Theme selection
Main Topic: I.1.h: Decision making
Secondary Topic: D.11.b: Voluntary movements

Abstract Body
Abstract body: Sixty years after the discovery of a slow monotonic drift in electroencephalographic recordings preceding voluntary self-paced actions ("the readiness potential"), its physiological underpinnings remain elusive. A classical interpretation holds that readiness potential onset reflects the decision to act, with the drift thereafter proceeding deterministically to movement onset. However, more recent analyses suggest that the readiness potential's monotonicity may be an artifact of trial averaging; rather than a slow, deterministic process, fast stochastic processes underlie self-paced decisions. In the absence of measurements resolving neural dynamics during single trials, these competing accounts have persisted. We have taken a comparative behavioral approach to address this, training mice to initiate an action in two contexts: in response to cues (instructed) and in their absence (self-paced). We can thus identify neuronal dynamics specific to self-paced decisions that are not motor-related. We used Neuropixels to simultaneously record activity in several brain regions implicated in self-paced decisions. The activity preceding movement enables above-chance classification of decision-making contexts. We parcellated this preparatory activity into subspaces shared between decision contexts or unique to self-paced decisions. Above-chance classification remains possible within both subspaces. These results imply that decision-making contexts differ through distinct temporal profiles within shared subspaces, and through activity modes specific to self-paced decisions. Finally, projecting single trial activity onto either subspace allows prediction of subsequent movement initiation. Preliminary results show that prediction accuracy improves closer to movement onset, in line with stochastic models. Collectively, our work helps arbitrate between models underlying the neural basis of self-paced action decisions.

Keywords
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