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Presentation Abstract

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Presentation Title: Neural correlates of decision formation in PMd in a perceptual discrimination task

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Abstract: Many prior studies of visually based decision-making have employed stimuli in which subjects decide the average direction of motion in stochastic random dot stimuli. Because subjects accumulate sensory evidence over time before committing to a decision, this framework provides an opportunity for electrophysiological analysis of evolving neural decision variables that reflect integrated evidence. Most prior studies, however, have employed traditional single unit recording techniques, which limits their power to assess the dynamics of evidence accumulation and decision formation on single trials.
To address these issues, we recorded simultaneously from multiple units during the random dots motion discrimination task, using arm reach movements as the operant response. Neural activity was recorded from dorsal premotor (PMd) cortex, an area that is easily accessible to 'Utah' multielectrode arrays. Our goals were twofold: 1) to determine whether PMd activity reflects evidence accumulation toward decision about arm movement target selection, analogous to well-studied processes in pre-oculomotor structures, and 2) to leverage the statistical power conferred by simultaneous recordings to obtain insights into the decision formation process on single trials.

We used logistic regression to predict the monkey's choices from neural population activity on individual trials using leave-one-out cross-validation. Logistic predictions were made in a 150 msec sliding window, allowing us to observe the evolution of decision-related activity in PMd. For strong motion coherences, average predictive activity, as measured by the fraction of correctly predicted trials, exceeded chance levels ~ 200 msec after onset of the visual stimulus, and reached 80% correct by 300 msec. As in LIP and other pre-oculomotor structures, predictive activity varied with stimulus coherence, rising faster and reaching higher levels for stronger coherences. Our data suggest that PMd activity reflects the accumulation of sensory evidence in the reach system, providing an opportunity to examine single trial neural dynamics underlying decision formation.

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