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Movements, Decisions, and Wholistic Behavior

Dr. Churchland's laboratory aims to uncover the computations implemented by neural circuits to support decision-making. They develop sophisticated decision-making paradigms for rodents and humans, measure neural activity in rodents, and develop analysis and modeling tools to connect the two. They have demonstrated that rodents, like humans, can integrate sensory signals in a Bayes-optimal manner to guide decisions. To understand the neural mechanisms supporting this ability, they use multiple cutting-edge methods to measure and manipulate neural areas and pathways with precision.

Abstract: When experts are immersed in a task, do their brains prioritize task-related activity? Most efforts to understand neural activity during well-learned tasks focus on cognitive computations and task-related movements. We wondered whether task-performing animals explore a broader movement landscape, and how this impacts neural activity. We characterized movements using video and measured neural activity using widefield and two-photon imaging. Cortex-wide activity was dominated by movements, especially uninstructed movements not required for the task. This held true throughout task-learning and for extracellular Neuropixels recordings that included subcortical areas. Our observations argue that animals execute expert decisions while performing richly varied, uninstructed movements that profoundly shape neural activity.

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