

Sensory Expectations Shape Neural Population Dynamics in Motor Circuits

October 7

Tuesday, 12:30 pm

Billings Building—Rosedale Room

SPEAKER:



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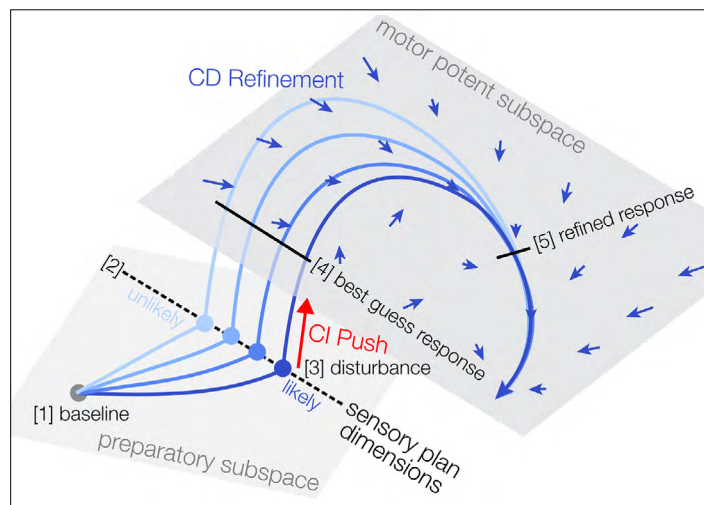
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Abstract

When preparing a movement, motor cortical activity represents future movement parameters and is causally linked to motor execution by setting the initial state of the dynamical



system that ultimately produces movement. Although preparing movement parameters is an essential aspect of self-initiated actions, movements need to be constantly adjusted based on disturbances to the body or environment. Since such disturbances can often be predicted based on experience or other streams of sensory input and since preparing for potential disturbances would improve motor performance, we have been working under the hypothesis that sensory expectations are also directly represented by preparatory activity in motor cortical areas. Such a scheme would be consistent with modern theories of biological motor control and with previous reports that motor cortical areas rapidly respond to sensory inputs in a way that accounts for biomechanical and task constraints. In this talk, I will show that humans and macaques readily incorporate expectations about future sensory input into their movement preparation and that this preparation modulates transcortical feedback responses to mechanical disturbances. I will then show that information about sensory expectations is widespread in cortical (and subcortical) motor circuits and that this information is embedded in the neural population state in a way that is beneficial for rapidly responding to disturbances.

Publications

1. Andrew Pruszynski, PhD Michaels, J.A., Kashefi, M., Zheng, J., Codol, O., Weiler, J., Kersten, R., Gribble, P.L., Diedrichsen, J., Pruszynski, J.A. *Sensory expectations shape neural population dynamics in motor circuits*. bioRxiv 2024.12.22.629295.
2. Kashefi, M., Reschechtko, S., Ariani, G., Shahbazi, M., Tan, A., Diedrichsen, J., Pruszynski, J.A. (2024) *Future movement plans interact in sequential arm movements*. eLife 13:RP94485.
3. Weiler, J., Gribble, P.L., Pruszynski, J.A. (2019) *Spinal stretch reflexes exploit musculoskeletal redundancy to support postural hand control*. Nature Neuroscience 22: 529-533.

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