**Discrete population states in motor cortex during different arm movement tasks**

2,300-character limit.

Despite being one of the longest-studied brain areas, we have yet to elucidate the role of primary motor cortex (M1) in the generation of movement. An essential part of understanding the role of M1 is the temporal structure of commands sent from its neural population to the spinal cord. Previous research indicates that although M1 activity continuously changes throughout a movement, there remains a latent structure with discrete states, corresponding to accelerative and decelerative kinematic components of movement (Kadmon Harpaz et al., 2018). Rhesus macaques performed either a random target pursuit task (RTP), or a standard eight direction center-out reaching task. We recorded from M1 and premotor cortex (PM) using chronically implanted, multi-electrode arrays while each monkey performed two alternating tasks, allowing us to evaluate activity from two tasks in the same population of neurons. We also recorded muscle activity during the tasks. We used a hidden Markov model to identify common latent states in M1 neural population activity. We then compared the timing and length of those latent states to the kinematics of arm movements. We also compared the performance of models trained on one task (either RTP or center-out) with that trained on the other task. We were able to replicate previous findings, supporting the idea that latent states in M1 map to accelerative and decelerative components of motion. We are also in the process of identifying whether models trained on one task effectively identify consistent kinematic parameters in the other task. We also anticipate that the latent states observed in cortical activity will not be present during analysis of EMG activity. These results suggest that neural representations of arm movements may be constructed from elementary sets of building blocks. These elementary states, put together in different discrete combinations, create the vast array of movements of which animals are capable. This method can also be used to interrogate the differences in temporal structure between M1 and PM.