Session 247 - Reaching: Neurophysiology

Add To Itinerary

247.27 / TT9 - Dorsal premotor cortex activity reflects a candidate decision variable during the action selection epoch of an abstract perceptual decision-making task

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Presenter at Poster
Sun, Nov. 13, 2016, 3:00 PM - 4:00 PM

Session Type
Poster

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Abstract
Neuroscientists have often studied decision-making using tasks in which decisions about a stimulus are made concomitantly with the action selection to report the outcome. These two processes, perceptual decision-making and action selection, may be independent or may occur together as one broader sensorimotor process. Here, we use psychophysics and electrophysiology to compare the role of dorsal premotor cortex (PMd) when these processes are concurrent or temporally dissociated. We trained rhesus monkey T to report the dominant color of a red-green checkerboard by reaching to a corresponding colored target (Wang et al., SfN 15; Montanède and Kalaska, SfN 16), under two task blocks, within session. The target locations are fixed, but the colors are assigned randomly. In the Target First (TF) task, targets are presented before checkerboard onset, so that decision-making (determining checkerboard color) and action selection (determining reach direction) are concurrent. In the Stimulus First (SF) task, this presentation order is reversed. The animal cannot plan a reach when the checkerboard alone is present, since the target colors are not yet available. In addition, a blank screen is introduced between the two events to further dissociate decision-making and action selection. In the SF task, psychophysical thresholds are higher and reaction times (RT) longer overall. RT are weakly negatively correlated with checkerboard strength. We used single electrodes and linear electrode arrays to record 159 units (54 single, 105 multi) in PMd. 1) Firing rates (FR) during the TF task are consistent with previous reports: initially there is no response to the targets, and after checkerboard onset, FR increase in a manner that correlates with reach direction, checkerboard strength, and RT (Chandrasekaran et al., SfN 13, 14, 15). 2) In the SF task by contrast, FR do not change in response to checkerboard onset. 3) Rather, FR modulate only after the target onset in the SF task, in a manner that is correlated with reach direction, checkerboard strength, and RT. This is surprising because the putative decision epoch has already passed. These SF task data are consistent with two possible interpretations. One possibility is that the perceptual decision is made before target onset and is represented elsewhere but not in PMd; other cognitive elements involved in action selection are then reflected in neural activity after

target onset. Alternatively, decision-making may be intentionally delayed until target onset, and the stimulus-dependent activity that follows target onset could reflect integration of the noisy stimulus representation retrieved from working memory.