Program Number: 918.2
Day / time: Wednesday, Nov. 12, 2:00 PM − 3:00 PM
Presentation Type: Poster
Presentation Location: Morial Convention Center − Hall F−I, Board # G3

MOVEMENT SPEED ALTERS DISTANCE TUNING OF PLAN ACTIVITY IN MONKEY PRE−MOTOR CORTEX.

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Neurons in pre−motor cortex show "plan" activity: increased activity after an instructive cue, but prior to a "go" cue. Previous research has shown that plan activity varies with reach direction and distance. Such variation could indicate tuning for the reach endpoint. However, a variety of other factors co−vary with direction and distance. In particular, movement duration and velocity co−vary with distance. Thus, distance "tuning" might be due to sensitivity to velocity or duration. To address this issue, we trained a rhesus monkey to reach at different speeds, depending on the color of the target. Green targets elicited mean peak reach speeds of 41−106 cm/s, depending on distance. Peak speed versus distance was fit well by a regression with intercept 19 cm/s and slope 7.2 (cm/s)/cm. Red targets elicited mean peak reach speeds of 68−147 cm/s (int = 41 cm/s, slope = 8.8 (cm/s)/cm). For a given distance, peak reach speeds for the two conditions formed clearly separate distributions that overlapped little. 23 single units were recorded from pre−motor cortex (putatively caudal PMd), and from M1. After assessing direction tuning, targets were presented in 2 opposing directions and at 5 distances from 3−12 cm. Using ANOVA ($P<0.05$), the plan activity of 87% of neurons showed either a main effect of direction or an interaction involving direction. 74% showed either a main effect of distance or an interaction involving distance. 96% showed either a main effect of the speed instruction, or an interaction involving speed. Activity was frequently greater when a fast movement was instructed, though the reverse pattern was also common. Many neurons showed more complex patterns, with preferred distance or even direction changing as a function of the instructed speed. Thus, plan activity was heavily influenced by the speed of the upcoming movement, and distance tuning was far from invariant.

Support Contributed By: NIH, NSF, Burroughs Wellcome Fund, Sloan Foundation

Citation:
M.M. Churchland, K.V. Shenoy. MOVEMENT SPEED ALTERS DISTANCE TUNING OF PLAN ACTIVITY IN MONKEY PRE−MOTOR CORTEX. Program No. 918.2. *2003 Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience, 2003. Online.