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Neuroscience 2015

Presentation Abstract

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Topic:	++D.04.o. Visual cognition: Decision making
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Abstract:	Dorsal premotor cortex (PMd) is involved in choosing appropriate motor actions on the basis of visual cues. However, we currently do not understand how the action selection process unfolds in the underlying circuit in PMd. We addressed this question by recording with linear multi-contact electrodes (16 contacts, 150 μm) in PMd of monkeys performing a visual discrimination reaction time (RT) task. Monkeys discriminated the dominant color in a central static checkerboard containing mixtures of isoluminant red and green squares, and then reached to either a red or green target (presented prior to the checkerboard) as the behavioral report. Changing checkerboard difficulty modulated the monkeys' accuracy and induced a range of RTs. Thus, the task induces rich behavior, which allows study of the neural correlates of this deliberative action selection process. We have previously demonstrated that a diverse PMd neural population covaries with action choice. A subpopulation of these cells had properties consistent with a candidate

decision variable (Chandrasekaran et al., SFN 13, 14). Here we report physiological data from 416 single and 131 multi-units in monkey T PMd (385 from U-probes). The PMd units fell into two broadly overlapping classes. The first class of cells modulated their responses with checkerboard onset;the response duration covaried with RT. The other class is perimovement cells that respond around movement onset (104 units, 17%). The first class can be subdivided into cells, which on checkerboard onset either suppress (105, 20%) or enhance their firing rates (348, 63%). The responses of enhanced cells were consistent with a candidate decision variable. We captured this diversity using a visuomotor index. To test for an organization as a function of depth, we related the visuomotor index to the electrode contact at which the unit was recorded; contact 1 was superficial and 16 the deepest. We pooled across days to identify distributions of contact indices for each cell class. Although pooling likely reduced depth differences, enhanced units were more likely in superficial electrodes when compared to suppressed (7 vs 11, $p < .001$) and perimovement units (7 vs 10, $p<.001$). Perimovement and suppressed units were not found at different depths ($p > .05$). Consistent with this finding, the visuomotor index decreased with increases in depth ($r=-0.66$, $p<.01$). Finally, on average, choice predictive activity was present at least 27 ms ($p<.001$) earlier in superficial electrodes (1-6) than deeper electrodes (10-14). This basic statistical analysis suggests a depth, and thus laminar, organization of functional neural populations in PMd mediating action choice.

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PREMOTOR

REACHING

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