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Presentation Abstract

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Presentation Title:	Trial-by-trial covariation between PMd responses and action choice during a reaction time discrimination task
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Topic:	++D.04.t. Visual cognition: Decision making
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Abstract:	Lesion studies propose that dorsal premotor cortex (PMd) is involved in the selection of actions on the basis of sensory cues. One framework suggests that in uncertain conditions, populations of PMd neurons would simultaneously represent potential actions. As disambiguating cues appear, the populations would compete until one population reaches a commitment state and results in an action (Cisek and Kalaska, 2005). This proposal makes a few predictions: 1) PMd responses should covary with the evolving choice; 2) the rate at which PMd responses diverge for action choices should correlate with cue ambiguity; 3) it should be possible to decode eventual choice of the animal from PMd responses on single trials; 4) the decode time course should correlate with reaction time (RT). We

tested these predictions in a monkey performing a visual choice RT task and simultaneous recordings using U-probes. A monkey (T) used his right arm to report the dominant color in a central static checkerboard composed of isoluminant red and green squares. The percentage of red and green in the stimulus varied from trial to trial. While the monkey performed this task, we recorded small populations of single and multi-units from left PMd using 16 channel U-probes (27 sessions). Behaviorally, increases in stimulus difficulty led to more errors and slower RTs. We previously reported data consistent with the first two predictions (Chandrasekaran et al, SFN 13). A subset of the heterogeneous PMd neural population covaried with the evolving choice. Furthermore, the rate at which PMd responses diverged for eventual choices covaried with checkerboard difficulty. The new U-probe recordings confirmed these results. Here we leveraged U-probe recordings to test other predictions. We observed better than chance (> 50 %) decodes (linear discriminant, 200 folds, 70% training set) of eventual choice on single trials starting ~200 ms after stimulus onset. In addition, the time courses matched RT--- the rate at which the decoding performance increased was faster for shorter RTs and slower for longer RTs. In addition, consistent with a candidate decision variable, choice decode and its covariation with RT were observed within a stimulus difficulty. Preliminary recordings in putative M1 (n=11) suggested a different pattern than PMd. The rate at which M1 choice prediction accuracy increased was slower than PMd and in a few sites was only significant ~100-200 ms before movement onset. Our results demonstrate that in ambiguous circumstances, responses in PMd covary on a trial-by-trial basis with the evolving action choice. Competition in PMd neurons may mediate the selection of the action to perform and when to start it.

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