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SUBTHRESHOLD MICROSTIMULATION OF PMD, BUT NOT M1, INCREASES REACTION TIME

K.V.Shenoy[1,2*]; M.M.Churchland[1,2]
1. Dept EE, 2. Neurosci Prog, Stanford Univ, Stanford, CA, USA

The existence of "pre−motor processing" is suggested by experiments in which instructed delays reduce reaction time (RT). In this view, pre−motor processing normally occurs just prior to movement execution, but can be accomplished earlier when an instructed delay allows. Many neurons in primate dorsal pre−motor cortex (PMd) are active prior to movement, and also during instructed delays, suggesting they participate in pre−motor processing. If so, then disruption of PMd activity ought to increase RTs. To test this hypothesis, we delivered sub−threshold microstimulation (μstim) during a delayed reach task. Eye position was monitored to ensure that μstim did not evoke or bias saccades. When applied following the go cue (0−60 ms), μstim of PMd increased RTs by a mean of 27 ms ($p<0.0001$ overall, $p<0.05$ for 15/30 sites, ΔRT range: −7 to 98 ms). In contrast, μstim of M1 during this time had little effect (ΔRT=1 ms, $p=0.76$, 12 sites). These results are consistent with the hypothesis that PMd participates in pre−motor processing which, if disrupted, must be performed again before the movement can be executed. If, as prior work suggests, pre−motor processing occurs during instructed delays, then disruption of PMd activity *before* the go cue ought to erase the time savings provided by a delay. Conversely, when little or no delay period is present, disruption before the go cue ought to have little effect, as no processing has yet occured. This was indeed the case. In the absence of μstim, long (>100 ms) and short (<50 ms) delays produced mean RTs of 219 and 236 ms. For long delays, μstim 0−50 ms before the go cue largely erased the time savings (mean RT=231 ms, ΔRT=11 ms, $p<0.0001$). For short delays, μstim before the go cue had no effect (ΔRT=0.2 ms, $p=0.97$). These results support the hypothesis that activity in PMd is essential to pre−motor processing. They argue that such processing occurs during instructed delays, reducing reaction time.

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