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Two hemispheres, two arms: The neurophysiology of bimanual coordination

Most of our movements engage multiple limbs. In order to tie our shoes, for example, we carefully coordinate the movements of our two arms. We asked what neuronal activity underlies bimanual coordination in a macaque monkey model. The parietal reach region (PRR) in the posterior parietal cortex represents target locations for upcoming unimanual reaches. We now show that PRR plays a distinct role in bimanual coordination. Relative to single limb movements, moving both limbs results in highly non-linear patterns of activation. Surprisingly, most of the activity can be explained by just two factors: whether a task-relevant stimulus is present in the receptive field, and whether the animal plans to move the contralateral limb to that target. Ipsilateral limb movements per se have little effect on PRR activity. However, a small but significant component of activity, present in about one half of neurons, reflects the pattern of coordination between the two arms. These results demonstrate that PRR neurons represent bimanual reach plans, and suggest that bimanual coordination is computed early in the sensory-to-motor processing stream.