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Presentation Abstract

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| Program#/Poster#: | 735.15/NN25 |
| Presentation Title: | Macaque motor feedback responses rapidly reflect haptically-rendered environmental constraints |
| Location: | WCC Hall A-C |
| Presentation time: | Wednesday, Nov 19, 2014, 8:00 AM -12:00 PM |
| Presenter at Poster: | Wed, Nov. 19, 2014, 10:00 AM - 11:00 AM |
| Topic: | ++D.17.j. Cortical planning and execution: Neurophysiology |

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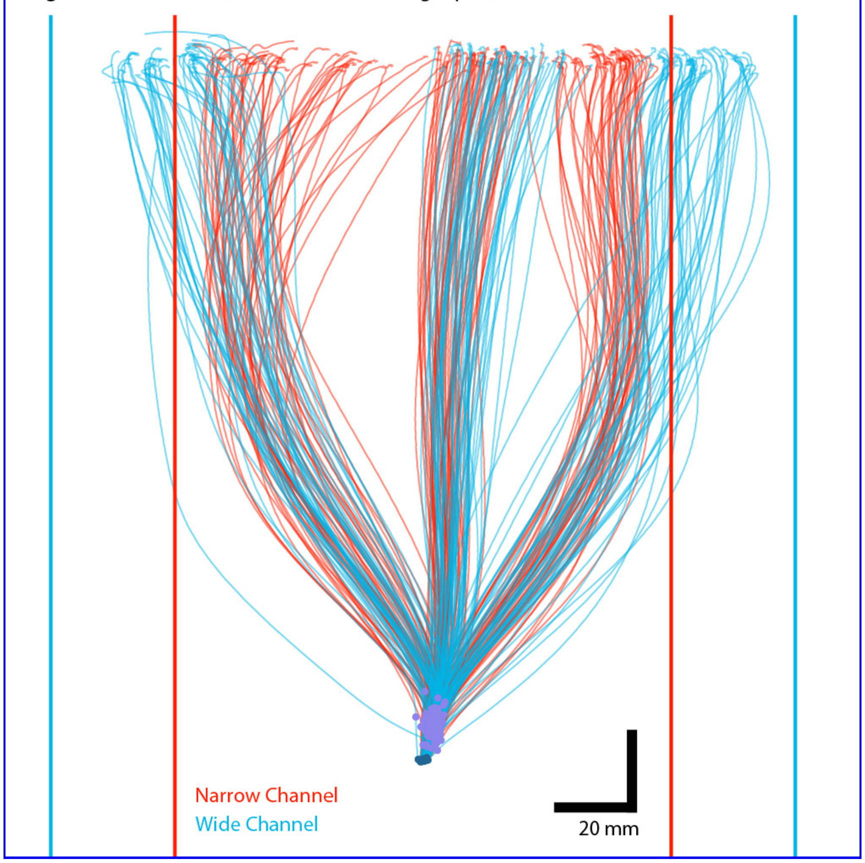
Abstract: The motor system continuously controls movements by monitoring incoming sensory feedback and driving appropriate corrective responses, accounting for sophisticated considerations of limb dynamics, task goals, and environmental constraints (e.g. Pruszynski and Scott, 2012, Cluff et al. 2013, Crevecoeur et al. 2013). However, the neural mechanisms by which cortex contributes to feedback corrective responses remain poorly understood Proprioceptive perturbations drive robust responses in motor cortical neurons (Evarts and Tanji, 1976), and recently mechanical limb manipulations have been utilized to study cortical contributions to state estimation and feedback control (e.g. London and Miller 2012, Pruszynski et al., 2014). Here, we developed a behavioral paradigm in which a rhesus macaque was trained to manipulate a 3 degree of freedom haptic feedback device (delta.3, Force Dimension) fitted with a 3d-printed handle which minimized variability in grasp position. A real-time task-logic engine controlled the device and rendered virtual obstacles and perturbation forces using the Chai3D library. We validated the utility of this paradigm by training a rhesus macaque to perform a delayed reaching task towards visually defined targets on a screen located above the haptic device, while avoiding haptically-rendered and visually displayed obstacles. We compared reaches to targets flanked by vertical obstacles that defined a reaching "channel" with varied thickness. Following lateral perturbations of the hand mid-reach, the monkey counteracted the perturbation force to avoid the flanking obstacle and reach the target (Figure 1). Corrective movements following identical perturbations diverged for narrow (red) vs. wide (blue) reaching channels as soon as 120 ms post-perturbation, comparable with similar results in humans (Nached et al. 2012). Consequently, this behavioral paradigm presents a flexible platform to explore how proprioceptive feedback modulates motor cortical activity and drives contextually-appropriate corrective responses.

**Figure 1:** Hand X/Y Position with left / no / right perturbations

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REACHING

PROPRIOCEPTION

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