Beyond the Homunculus: visual responses of primary somatosensory cortex (S1) neurons to virtual touch of a virtual arm

***S. SHOKUR [1,2], J.A.WINANS [1,3], J.E. O'DOHERTY [2,3], M. A. LEBEDEV [2,4], H. BLEULER [1], M. A. L. NICOLELIS [2,3,4,6]**

1 Laboratory of Robotic Systems (LSRO), Lausanne, Switzerland; 2 Ctr. for Neuroengineering, 3 Biomed.Engin., 4 Neurobio., Duke Univ., Durham, NC; 5 Ctr. for Neuroprosthetics, EPFL, Lausanne, Switzerland; 6 Edmond and Lily Safra Intl. Inst. of Neurosci. of Natal, Natal, Brazil

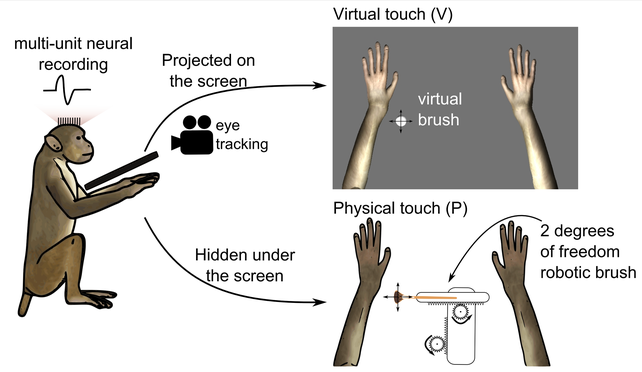
OO4, Hall F-J

ABSTRACT

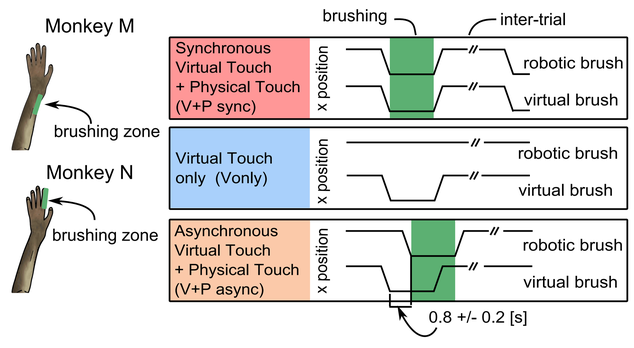
Following a brief period of brushing monkey arms with a real brush, synchronized with the vision of an arm avatar being brushed virtually, neurons in the primary somatosensory and motor cortices began to fire in response to the virtual brushing alone, suggesting that cortical representation of the body can be reshaped, in a matter of minutes, to incorporate even virtual limbs

EXPERIMENTAL PARADIGM

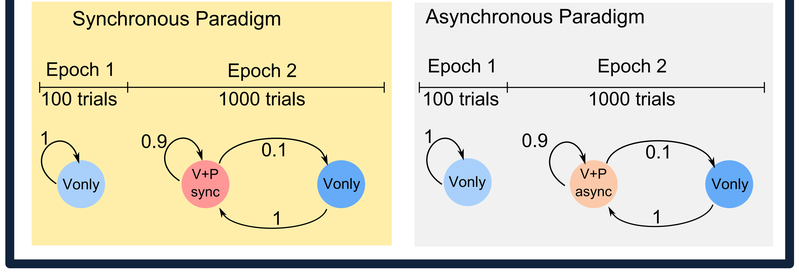
SETUP



TRIALS

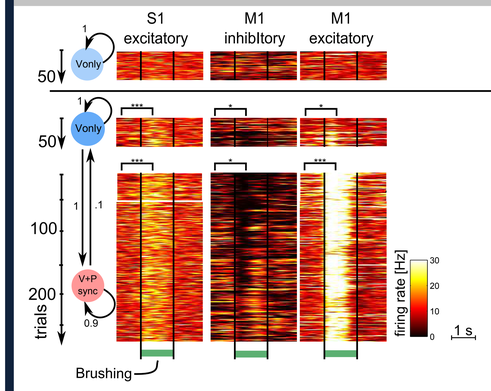


SESSIONS

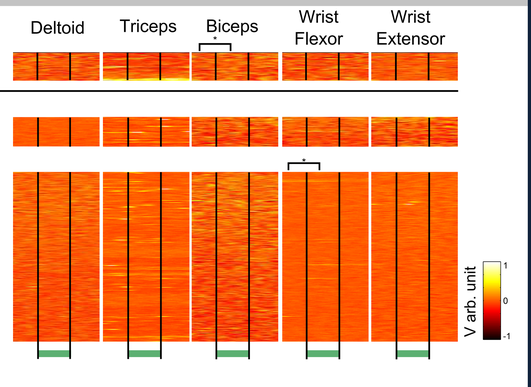


RESULTS

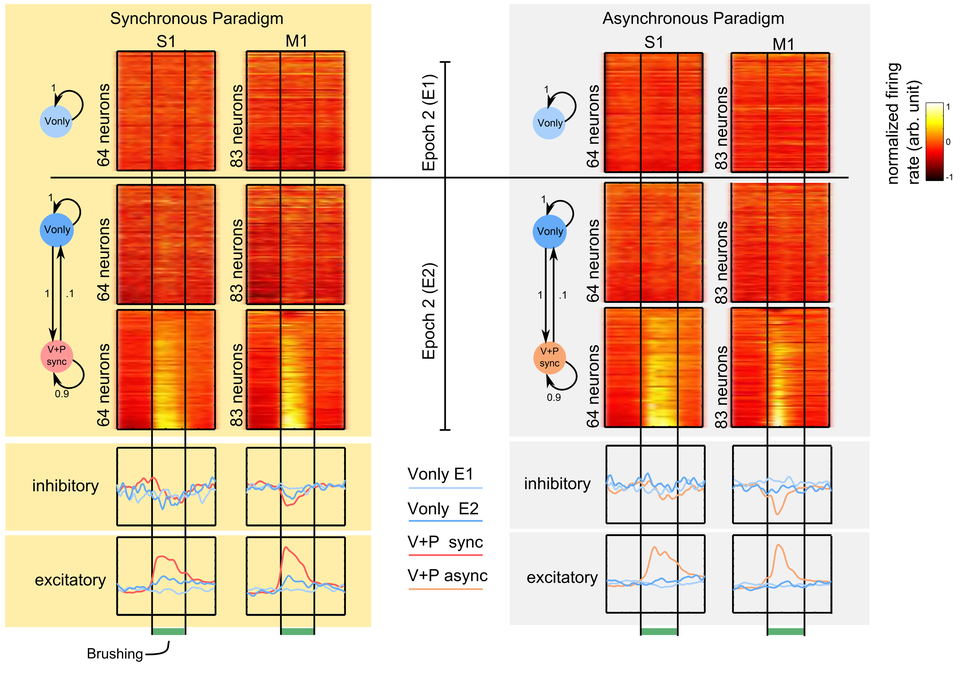
SINGLE NEURONS



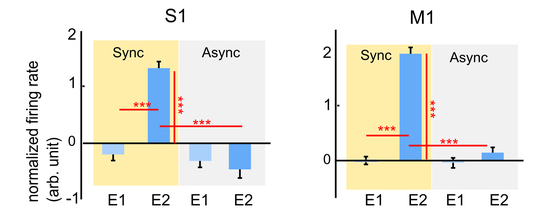
EMG'S



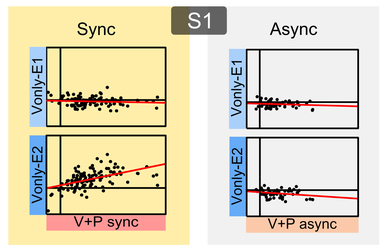
POPULATION RESPONSES



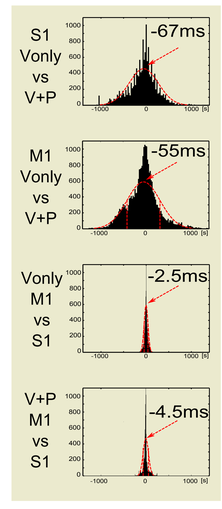
RESPONSES TO THE VIRTUAL TOUCH



V+P VS. VONLY



LATENCY



CONCLUSION

- Body representation in primary somatosensory (S1) and motor (M1) cortical area can be reshaped by vision of vitual tactile stimuli
- Our results suggest that body schema representation emerges due to highly distributed processing in multiple viso-tactile cortical areas linked by polysynaptic connections.
- S1 and M1 are capable of multi-modal (e.g. vision) processing after proper conditioning.