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Presentation Abstract

Program#/Poster#:	142.01/E16
Presentation Title:	Towards a freely moving animal model: Combining markerless multi-camera video capture and wirelessly transmitted neural recording for the analysis of walking
Location:	Hall A-C
Presentation time:	Sunday, Nov 13, 2011, 8:00 AM - 9:00 AM
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Abstract:	Neural control of movement is typically studied in constrained environments where the set of possible behaviors is reduced. These constrained environments may unintentionally limit the applicability of findings to the generalized case of unconstrained behavior. We hypothesize that examining a wider range of behaviors across multiple contexts will lead to new insights into the neural control of movement and help advance the design of neural prosthetic decode algorithms. However, to pursue electrophysiological studies in such a manner requires a more flexible framework for experimentation. We propose that head-mounted neural recording systems with wireless data transmission, combined with markerless computer-vision based motion tracking, will enable new unconstrained experiments. As a proof-of-concept, we studied the cortical activity of a rhesus macaque walking on a treadmill. As the monkey walked, we recorded and wirelessly transmitted broadband neural data from 32 electrodes surgically implanted in the monkey's premotor cortex. Simultaneously, we acquired video data from 8 camera views of the walking behavior to obtain kinematic

measurements. We demonstrate the ability to extract behavioral kinematics using an automated computer vision algorithm without the use of markers and to predict kinematics based on the neural data. Preliminary results demonstrate that neural firing rates can predict the phase of the contralateral arm (R^2 of 0.83). We then developed a 3-dimensional model of a rhesus macaque, and we measured whole body kinematics by fitting the model to match 2-dimensional video evidence from each of the 8 camera views. This technique for extracting whole body posture does not assume any specific behavioral task and can be fit to any class of behaviors, not just walking. Together these advances suggest that a new class of "freely moving monkey" experiments should be possible and may help broaden our understanding of the neural control of movement.

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