Program Number: 519.19 **Day / Time:** Monday, Nov. 14, 3:00 PM - 4:00 PM

Intracortical communication prosthesis design

G.Santhanam *; S.I.Ryu; B.M.Yu; A.Afshar; K.V.Shenoy

1. Dept Elec Eng, 2. Dept Neurosurg, 3. School Med., 4. Neurosci. Prog., Stanford Univ., Stanford, CA, USA,

Cortical neural activity can be used to position computer cursors on visually presented targets. We wished to investigate the following questions central to the clinical viability of such prostheses: how quickly and accurately can targets be selected; how performance differs when running online; and whether performance is limited by electrode count or other factors. Experiments were performed with two rhesus macaques trained on an instructed-delay center-out reach task (2, 4, 8 or 16 target locations). Single and multi-unit activity was recorded from a 96-electrode array in premotor cortex. The desired target was estimated using 50-275 ms of delay activity (Tint epoch) starting 150 ms after target onset (Tskip epoch). If the target prediction was correct a cursor was positioned, the monkey received a reward, and the next target appeared immediately. Tskip was estimated in control experiments in order to exclude noise or visual transients from the Tint estimation window. With one monkey, we recently performed a series of online experiments where Tint was swept to understand the effect of this parameter on the maximum information transmission rate (bits/s) between the requested and the estimated target. Offline analyses using data from trials with targets presented ~2 sec apart indicated that 8.1 bits/s could be achieved under these conditions. For online experiments, the maximum average sustained performance achieved was 6.5 bits/s (8 targets, Tint=100 ms). The difference between offline (8.1) and online (6.5) performance appears to result from changes in neural tuning curves when targets are presented in rapid succession (Kalmar et al. in this volume). We also report results from modeling efforts to understand the prospect for higher information throughput afforded by adding electrodes to the system. This suggests that the maximum achievable throughput (~10 bits/s) is limited by task and decoding design, as opposed to the total number of recording electrodes.

Support Contributed By: BWF, CRPF, MARCO C2S2, MSTP, NDSEGF, NSF, ONR, Sloan & Whitaker

Citation: G.Santhanam, S.I.Ryu, B.M.Yu, A.Afshar, K.V.Shenoy. Intracortical communication prosthesis design. Program No. 519.19. *2005 Abstract Viewer/Itinerary Planner.* Washington, DC: Society for Neuroscience