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HIGH SPEED NEURAL PROSTHETIC ICON POSITIONING

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Recent research has shown that neural activity from the primate brain can maneuver a computer icon to specified visual targets. This icon positioning can take over a second, longer than the time for the actual reach. We ask if this acquisition time can be reduced, thereby increasing the number of targets that can be hit per second. We implemented a system that positions a prosthetic icon at discrete locations, based on pre−movement neural activity. We trained a rhesus monkey to perform delayed (200−1000 ms) center−out reaches in several target layouts on a frontal screen. These included layouts with 2, 4, or 8 directions at a 10 cm radial distance and layouts with 4 or 8 directions at 6 and 12 cm radial distances. Neural activity was simultaneously recorded from single (~15) and multi (~140) neuron units from a 96−channel electrode array in the dorsal pre−motor cortex. Given a target location, the distribution of spike rates for each trial was modeled as a multivariate Gaussian. Models were computed on ~25 reaches to each target. During icon trials, using maximum likelihood methods, we chose the most probable reach target using 100−275 ms of delay activity starting 150 ms after target onset. If the choice matched the cued target, an icon was positioned and the monkey received juice. The maximum average sustained rate of target acquisition was 3.6 targets per second (tps) obtained with the 2 directions, 1 distance (2x1) target layout and 100 ms of delay activity. At this window length, the icon success rate was 84.1%. For other layouts, we observed the following rates −− (4x1): 2.7 tps @ 82.4%; (8x1): 2.5 tps @ 77.4%; (4x2): 1.9 tps @ 63.2%; (8x2): 2.2 tps @ 25.9%. Our system is capable of fast and accurate positioning of prosthetic icons, faster than the monkey's real reaches to the same target.

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