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Presentation Abstract

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Title:	Absence of fast-timescale correlations in macaque dorsal premotor cortex
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Abstract:	Spike time correlations between pairs of neurons were found to be virtually nonexistent in the dorsal aspect of premotor cortex (PMd) in two monkeys performing a delayed center-out reaching task. Neurons were recorded on a 96-electrode array (400 μm minimum electrode spacing) in two macaque monkeys. Data for eight sessions from Monkey 1 conducted over 34 days, and one session from Monkey 2 were analyzed. Analyses were performed separately for each of the eight reach directions. For each direction, well-isolated neurons that fired at greater than 10 spikes/second during a 500 ms epoch of the delay period were analyzed. Each analysis included between 25 and 114 neurons for Monkey 1, and 130-135 neurons for Monkey 2. We looked for correlations in 111,579 unique combinations of neuron pair and reach direction for Monkey 1, and 69,706 combinations for Monkey 2. Monkey 1 performed between 18 and 164 successful trials (mean 95 trials) across all combinations, and monkey 2 performed 160-197 (mean 178) trials across combinations. Covariograms (cross-correlation

histograms minus shuffle corrector) were generated for every combination of cell pair and reach direction. Correlations were deemed significant when at least one bin of the covariogram (binned at 9ms) exceeded the 95% confidence limit around the distribution expected for no correlation. Significant correlations were observed in only 889 (0.80%) of all tested combinations (856 unique pairs of neurons) for Monkey 1; in Monkey 2, 931 (1.34%) combinations were correlated. We calibrated the sensitivity of the technique using synthetic data with known correlations: we found our recorded data sets were sufficient to detect correlations that consisted of 3% or more coincident spikes between two neurons. From this surprising lack of spike time correlation in PMd we conclude that fast-timescale interactions between cortical neurons in nearby columns are weak (<3% coincident spikes) or rare (about 1% of cell pairs). These observations do not guarantee that PMd neurons are independent: there may be correlations at slower timescales, or within particular frequency bands.

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