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Presentation Abstract

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Title:	Ensemble activity underlying movement preparation in prearcuate cortex, and a comparison with premotor cortex
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Abstract: Much of the research about the neural basis of movement preparation has been done in the oculomotor system, taking advantage of the topographical relationship between cortical maps of visual space and eye movements. However, it is not known to what extent the principles that govern movement preparation in eye movement areas generalize to other parts of the brain. Eye and arm movements differ in many ways (e.g. effector speed, weight, number of muscles required), so one might expect oculomotor and reach systems to utilize different strategies of motor preparation. In oculomotor areas, the relationship between neural activity and the time at which a saccade is initiated is typically characterized using a rise-to-threshold model (Hanes & Schall, 1996). However, in the reach system, this model does not best describe the relationship between movement initiation and neural activity (Churchland et al., 2006).
Here we attempt to extend these previous studies, by recording peri-saccadic activity from ensembles of neurons in the prefrontal cortex. Using the same multielectrode recording methods to those used in dorsal premotor cortex (PMd), an area involved in preparing reaches, we implanted a 10-by-10 Cyberkinetics recording array into the pre-arcuate gyrus of two macaque monkeys. High-

quality, long-term (> 9 months) recordings were obtained from two animals, as they performed visually guided eye movements.
We studied (1) the relationship between saccade initiation times and responses from the neural population, and (2) how these responses compared to those recorded in PMd. The array data from prearcuate allowed us to compare responses from individual neurons with previous findings, but also allowed us to analyze the population dynamics of movement planning, by using techniques applied to the reach system. We found that oculomotor reaction times were correlated with the population dynamics of the prearcuate population response in a manner similar to that observed for reach reaction times and PMd population dynamics (see Afshar et al., SfN 2008), suggesting that some aspects of the neural strategy underlying movement preparation may be common in the two systems. This framework for analyzing neural population activity and dynamics should permit further comparisons of movement preparation across motor systems, and may offer insight as to the apparent differences seen previously at the single-neuron level.

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