Memory-guided Sensory Comparison Signals in the Dorsolateral Prefrontal Cortex are affected by Stimulus Location

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Neurons in the dorsolateral prefrontal cortex (DLPFC) have been implicated in working memory for visual motion. We examined the activity of these neurons while monkeys reported whether the directions of two moving stimuli, S1 and S2, separated by a memory delay are the same or different. Many DLPFC neurons respond to S1 and S2 presented both at the fovea and at various visual field locations, reflecting the utility of the information of both direct (ipsilateral) and indirect (contralateral) inputs from the motion processing area MT. Earlier work showed that during S2, these responses were often modulated by the remembered direction of S1 (Hussar & Pasternak, 2012). In some neurons, this memory-related activity was in the form of stronger responses when S1 and S2 moved the same direction, while other neurons responded more when S1 and S2 moved in different directions. These modulations, termed Comparison Effects (CE), examined with stimuli at the fovea, have been linked to choices made by the monkeys. Because contralateral motion signals are likely to reach DLPFC directly from MT of the same hemisphere, while ipsilateral signals arrive from MT of the opposite hemisphere, the study of CE with contra- and ipsilateral provides insights into the circuitry underlying comparisons of motion information across space. We analyzed these effects and identified two distinctive groups of neurons with reliable comparison effects, similar to those observed with stimuli at the fovea. However, these effects were stronger for contralateral stimuli, revealing the difference between direct and indirect influences of motion processing neurons on comparison-related activity in the DLPFC. These results provide important new information about the nature of the mechanisms underlying memory-guided sensory comparisons.