

Linear Decoding Applied to V5/MT Neuronal Activity on Past Trials Predicts Current Sensory Choices

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Abstract : Perceptual decisions about sequences of sensory stimuli often show serial dependence. The behavioural choice on one trial is often affected by the choice on previous trials. We investigated whether the neuronal signals in extrastriate visual area V5/MT on preceding trials might influence choice on the current trial and thereby reveal the neuronal mechanisms of sequential choice effects. We analysed data from 30 single neurons recorded from V5/MT in three Rhesus monkeys making sequential choices about the direction of rotation of a three-dimensional cylinder. We focused exclusively on the responses of neurons that showed significant choice-related firing (mean choice probability =0.73) while the monkey viewed perceptually ambiguous stimuli. Application of a wavelet transform to the choice-related firing revealed differences in the frequency band of neuronal activity that depended on whether the previous trial resulted in a correct choice for an unambiguous stimulus that was in the neuron's preferred direction (low alpha and high beta and gamma) or non-preferred direction (high alpha and low beta and gamma). To probe this in further detail, we applied a regularized linear decoder to predict the choice for an ambiguous trial by referencing the neuronal activity of the preceding unambiguous trial. Neuronal activity on a previous trial provided a significant prediction of the current choice (61% correct, 95%CI~52%), even when limiting analysis to preceding trials that were correct and rewarded. These findings provide a potential neuronal signature of sequential choice effects in the primate visual cortex.

Keywords : perception, decision making, attention, decoding, visual system

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