Complex Population Response of Dorsal Putamen Neurons Predicts the Ability to Learn

By Ikaplan
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Laquitaine, Steeve, Piron Camille, Abellanas David, Loewenstein Yonatan, and Boraud Thomas. 2013.

Abstract:

Day-to-day variability in performance is a common experience. We investigated its neural correlate by studying learning behavior of monkeys in a two-alternative forced choice task, the two-armed bandit task. We found substantial session-to-session variability in the monkeys’ learning behavior. Recording the activity of single dorsal putamen neurons we uncovered a dual function of this structure. It has been previously shown that a population of neurons in the DLP exhibits firing activity sensitive to the reward value of chosen actions. Here, we identify putative medium spiny neurons in the dorsal putamen that are cue-selective and whose activity builds up with learning. Remarkably we show that session-to-session changes in the size of this population and in the intensity with which this population encodes cue-selectivity is correlated with session-to-session changes in the ability to learn the task. Moreover, at the population level, dorsal putamen activity in the very beginning of the session is correlated with the performance at the end of the session, thus predicting whether the monkey will have a "good" or "bad" learning day. These results provide important insights on the neural basis of inter-temporal performance variability.

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