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Adaptive coordination of working-memory and reinforcement learning in non-human primates performing a trial-and-error problem solving task

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Abstract

Accumulating evidence suggest that human behavior in trial-and-error learning tasks based on decisions between discrete actions may involve a combination of reinforcement learning (RL) and working-memory (WM). While the understanding of brain activity at stake in this type of tasks often involve the comparison with non-human primate neurophysiological results, it is not clear whether monkeys use similar combined RL and WM processes to solve these tasks. Here we analyzed the behavior of five monkeys with computational models combining RL and WM. Our model-based analysis approach enables to not only fit trial-by-trial choices but also transient slowdowns in reaction times, indicative of WM use. We found that the behavior of the five monkeys was better explained in terms of a combination of RL and WM despite inter-individual differences. The same coordination dynamics we used in a previous study in humans best explained the behavior of some monkeys while the behavior of others showed the opposite pattern, revealing a possible different dynamics of WM process. We further analyzed different variants of the tested models to open a discussion on how the long pretraining in these tasks may have favored particular coordination dynamics between RL and WM. This points towards either inter-species differences or protocol differences which could be further tested in humans.

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