A Mechanistic Account of Model-Free / Model-Based Trade-off and its Change Across Development

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Abstract

The joint recruitment of two systems (habitual and goal-directed) for the control of behaviour has provoked wide interest in the last decades. The systems relative contributions have been quantified through a standard two-stage task and by applying reinforcement learning (model-free/model-based), but less is known about the processes behind their integration. We address this with an interactive activation model of the standard task in which the two systems activate, to varying degrees, the potential responses. The model is able to capture the behavioural patterns characterizing the trade-off between the two systems. Additionally, the model is able to simulate response times because activations vary over time within a trial. We explore three mechanistic hypotheses of the trade-off related to developmental data from childhood to adulthood. We argue that process-level models such as ours are needed, conjointly with new empirical tasks, to further understand changes in the control of action selection across development.