Adaptive Decision Making: A Role for Choice Certainty in Updating Decision Strategies

Abstract: Decision-making in a natural environment depends on a hierarchy of interacting decision processes. A high-level strategy guides ongoing choices, while the outcomes of those choices determine whether or not the strategy should change. When the right decision strategy is uncertain—as in most natural settings, feedback becomes ambiguous. For one cannot unequivocally attribute negative outcomes to a bad choice or bad strategy. Disambiguation of the cause of feedback requires active inference and is key to updating the strategy. We hypothesize that expected accuracy of a choice (i.e., confidence) plays a crucial rule in this inference, and setting the strategy depends on integration of outcome and expectations across choices. We test this hypothesis with a task in which subjects report the net direction of random dot kinematograms with varying difficulty while the correct stimulus-response association undergoes uncued switches every few trials. We show that subjects treat negative feedback as evidence for a switch but weigh it with their expected accuracy. They accumulate switch evidence (in units of log-odds ratio) across trials and update their response strategy when the accumulated evidence reaches a threshold. A computational framework based on these principles quantitatively explains all aspects of the behavior, providing a plausible neural mechanism for the implementation of hierarchical
multi-scale decision processes. We suggest that a similar neural computation—bounded accumulation of evidence—underlies both the choice and switches in the strategy that governs the choice.