Abstract

In everyday life, we encounter many situations in which we need to make decisions that are often repetitive in nature. The process of decision-making involves at least two steps - we need to first represent the various alternatives and then compute the value of these alternatives. Given that both our perception and valuation is influenced by the surrounding context, we are interested to know how context influences the process of decision-making. Contexts can be manifested in two different ways - Spatial context refers to the value of other simultaneously available options whereas temporal context is the relative valuation of outcomes experienced across time. A general mechanism for decision-making can be understood by the notion of ‘common currency’ where the comparisons of various competing alternatives can be made over the same relative scale. We investigate the integration of reward information with perceptual decisions in conjunction with computational modelling to understand the various subcomponents of a decision process. In
a two-alternative forced choice experiment, spatial context attaches differential reward values with the two alternatives; hence we call them as choice values. The value information in spatial context is presented as symmetric or asymmetric rewards, which in turn influences decision process in different ways. The temporal context refers to differential outcomes across multiple trials that we refer as stimulus values. By manipulating the processing order temporally between reward values and perceptual stimuli, we dissociate the mechanisms underlying the stimulus encoding stage and the response execution stage. We used drift diffusion models to estimate parameters that encode the evidence accumulation process for perceptual judgments that could be influenced by integration with reward values. We extend the evidence accumulation approach to value-based decision making in a new task setting that studies choice exploration as a sequential sampling process. A novel particle filter based reinforcement learning model is used for studying the dynamic evolution of decision parameters in value-based decisions. Neural correlates of integration of value and perceptual information are studied using two complementary approaches. EEG (electrical recordings from the scalp) provides a good temporal resolution to study the dynamics of integration process, and using meta-analysis of brain imaging studies, we aim at consistent and specific brain regions participating in different types of decision making. By studying the contextual influences, we have proposed and established that the valuation process involves prior information based on temporal context, and the simultaneously available information in spatial context determines the choice. Overall, our findings have suggested the fundamental processes involved by which an individual integrates multiple sources of information to arrive at a decision.