

Two-Stage Task

Title	Two-Stage Task
Domain	Self-Regulation
Type	Behavioral
Duration (min)	26
Description	Subjects participate in a two-stage decision task where they make a binary choice in each stage and probabilistically receive reward in the final stage. First-stage choices are primarily associated with one of two second-stages (labeled 2a and 2b): one first-stage choice leads to 2a 70% of the time and 2b 30% of the time, while the opposite is true of the other first-stage choice. Each second-stage choice has its own probability of reward (constantly changing via a random-walk). The ultimate goal of the subject is to maximize reward, which are only given in the second stage. The ideal subject would identify the most rewarding second-stage stim and make first-stage choices that make it more likely to arrive at the relevant second stage. Model-free decision making is related to the likelihood of repeating a first-stage choice after receiving a reward in the second-stage (or switching after punishment). Model-based decision making is related to the likelihood of switching a first-stage choice after receiving reward in the second-stage not normally associated with that first-stage choice. The logic is that after receiving reward in a second-stage you should be more likely to choose the first-stage choice you know will be more likely to lead you to the rewarded second-stage.
OSF Link	https://osf.io/br2c9/
Adult/Child	adult
Computerized	
Identified	1
Identified Description	In the decision-making literature, two categories of reinforcement learning (RL) have gained prominence: model-free and model-based RL. Model-free RL proceeds by updating and caching values associated with actions in particular states. It is a computationally efficient procedure at the time of decision (decisions only require retrieving the cached state-action value), but it is insensitive to rapid transitions in environment structure or reward contingencies. In contrast, model-based RL computes the value of actions by explicitly using a model of the environment and calculating the

value of different action trajectories at the time of decisions. These two descriptions represent extremes along a spectrum, and human decision-making has been described as a combination of the two - either explicitly arbitrating by separable model-free and model-based systems, or else acting in a way that can profitably be described by these terms.

In order to gain quantitative traction of the interaction between model-free and model-based RL on human choices, Daw et al (2011) created the two-step RL task. In this task, participants made two sequential decisions that navigated them through a number of "stages" defined by different stimuli. The ending stages were each associated with different probabilities of reward which changed slowly over time (requiring that the participant continuously learns to succeed at the task).

Importantly, the choice at the first stage was preferentially associated with different second-stage options. By analyzing people's decisions in the first stage as a function of the previous trial's reward, and the type of transition between first and second stage (frequent or infrequent), Daw and colleagues (2011) created metrics that reflected influences of putative model-based and model-free systems. A specific type of learning, perhaps model-based learning, may be important to self-regulation.

Identified Supporting Documentation	
Identified PMCID, PUBMED ID, or CITATION	Text Citation: Daw, N. D., Gershman, S. J., Seymour, B., Dayan, P., & Dolan, R. J. (2011). Model-based influences on humans' choices and striatal prediction errors. <i>Neuron</i> , 69(6), 1204–1215.
Measured	
Measured Description	
Measured Supporting Documentation	
Measured PMCID, PUBMED ID, or CITATION	
Influenced	
Influenced Description	
Influenced Supporting Documentation	
Influenced PMCID, PUBMED ID, or CITATION	
Outcome (Validated vs Invalidated)	

Outcome	
Outcome Description	
Outcome Supporting Documentation	
Outcome PMCID, PUBMED ID, or CITATION	
Owner	Teon Brooks Send email to Teon