Reward-Sensitive Attention Dynamics during Human Reinforcement Learning

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Submitter Angela Radulescu

Affiliation Princeton University

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Presentation Abstract Summary Selective attention is thought to facilitate reinforcement learning (RL) in multidimensional environments by constraining learning to dimensions relevant for the task at hand. But how would agents know what dimensions to attend to in the first place? Here we use computational modeling of human attention data to show that selective attention is sensitive to trial-by-trial dynamics of reinforcement. Participants performed a decision-making task with multi-dimensional stimuli, while undergoing functional magnetic resonance imaging (fMRI) and eye-tracking. At any one time, one of three stimulus dimensions was relevant to predicting probabilistic binary reward. Participants had to learn which was the predictive dimension, and what feature within that dimension was the most rewarding. In previous work we showed that attention to different dimensions modulates learning in this task. To examine how subjects learn what to attend to, here we developed and compared different models that specify how attention changes trial-by-trial. Attention data were best explained by an RL model that tracks feature values learned through trial-and-error, and allocates dimensional attention in proportion to the highest-valued feature along each dimension. This model outperformed models that determined attention based on choice history alone, suggesting that attention dynamically changes as a function of recent reward history.

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Co-author Information

* Presenting Author

First Name	Last Name	Affiliation	E-mail
Angela *	Radulescu *	Princeton University	angelar@princeton.edu
Yuan Chang	Leong	Stanford University	ycleong@stanford.edu
Yael	Niv	Princeton	yael@princeton.edu

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