A cognitive process model captures near-optimal confidence-guided waiting in rats

Jonathan Tyler Boyd-Meredith*[1], Alex Piet[2], Charles Kopec , and Carlos Brody[3,4]

[1]Sainsbury Wellcome Centre – United Kingdom
[2]Allen Institute [Seattle] – United States
[3]Princeton Neuroscience Institute [Princeton] – United States
[4]Howard Hughes Medical Institute – United States

Abstract

Cognitive neuroscience seeks to understand unobservable cognitive variables using behavioral tasks to elicit proxies of these latents. One popular task uses subjects' willingness to wait for delayed rewards to indirectly measure decision confidence. Existing models of confidence-guided waiting do not account for a key task statistic, known to be important in foraging decisions: the travel time incurred when deciding to stop waiting and move on. We found that rats are overly patient relative to fully optimal agents, but behave similarly to agents constrained to have travel times equal to the rats'. We developed a model of the waiting process in which a decision variable evolves toward a stopping bound as time elapses without reward. This model allowed comparison of sources of internal variability on behavior, with the dominant source best explained by variability in the stopping bound. This work demonstrates the value of detailed cognitive models that account for both the latent variables of interest and nuisance variables that may also affect behavior.

*Speaker