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Modeling the Role of Hippocampus in Extinction and Spontaneous Recovery

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Abstract: The ability of animals to learn complex tasks from reward is still not fully understood. While models of such reinforcement learning exist (e.g., Sutton & Barto 1990), it is unclear how these models might reflect the functioning of biological neural networks. One recent model has shown how networks of spiking neurons can model reinforcement learning in animals (Chorley & Seth 2011), however, it and the existing models of animal behavior do not fully account for learning phenomena such as extinction, spontaneous recovery, and gradual extinction (Gershman et al. 2013). Interestingly, the model's failures in extinction and spontaneous recovery are the same as those of rodents with hippocampal lesions (e.g., Kimble & Kimble 1970), suggesting that adding a spiking model of the hippocampus will better model these phenomena. We present data on the original model's performance in learning, extinction, and spontaneous recovery, and we explore modifications to better capture these phenomena.