Episodic Contributions to Model-Based Reinforcement Learning

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Presentation Abstract Summary Much research indicates that organisms can plan actions using maps or models of the environment, and that such model-based (MB) learning trades off against simpler model-free (MF) mechanisms. However, standard models of both use incremental learning rules that extract statistical summaries from experience. Another possibility is that individual events are stored as episodic memories and later sampled to guide choice. Such episodic evaluation may confound standard tests for model use, since individual trajectories contain the same information as the map.

We examined the contribution of episodic memory to MB vs MF learning using a a task that combines 2-step MDP dynamics with trial-unique memory cues that also predict reward. The task reveals whether episodic information influences choices via MB or MF evaluation, and also whether these effects trade off against what has previously been interpreted as incrementally learned estimates.

Subjects displayed standard, putatively incremental MF and MB strategies, but also strong MB planning using individually cued episodes. Furthermore, on trials that contained episodic cues, incremental MB planning was reduced. This tradeoff suggests that previous interpretations of choices reflecting running averages may reflect covert retrieval of episodes, which are replaced by cued episodes when these are provided.

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