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Permalink
https://escholarship.org/uc/item/88r620fm

Journal
Proceedings of the Annual Meeting of the Cognitive Science Society, 43(43)

ISSN
1069-7977

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Publication Date
2021

Peer reviewed

Tracking the Unknown: Modeling Long-Term Implicit Skill Acquisition as Non-Parametric Bayesian Sequence Learning

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Abstract

Long perceptuo-motor sequences underlie skills from walking to language learning, and are often learned gradually and unconsciously in the face of noise. We used a non-parametric Bayesian n-gram model (Teh, 2006) to characterize the multi-day evolution of human subjects' implicit representation of a serial reaction time task sequence with second-order contingencies. The reaction time for an element in the sequence depended on zero, one and more preceding elements at the same time, predicting frequency, repetition and higher-order learning effects. Our trial-level dynamic model captured these coexistent facilitation effects by seamlessly combining information from shorter and longer windows onto past events. We show how shifting their priors over window lengths allowed subjects to grow and refine their internal sequence representations week by week.