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**Title**
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**Permalink**
https://escholarship.org/uc/item/8zc4g6f7

**Journal**

**ISSN**

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**Publication Date**
2021

Peer reviewed

# Bayesian Experimental Design for Intractable Models of Cognition

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### Abstract

Bayesian experimental design (BED) is a methodology to identify designs that are expected to yield informative data. Recent work in cognitive science considered BED for cognitive models with tractable and known likelihood functions. However, as cognitive models have become more complex and richer, their likelihood functions are often intractable. In this work, we leverage recent advances in BED for intractable models and demonstrate their application on a set of multi-armed bandit tasks. We further propose a generalized latent state model that unifies two previously proposed models. Our experiments show that data gathered using optimal designs results in improved model discrimination and parameter estimation, as compared to naive designs. Furthermore, we find that increasing the number of bandit arms increases the expected information gain in experiments.