

# Seeing through Occlusion: Uncertainty-aware Joint Physical Tracking and Prediction

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## Abstract

Humans can track objects and predict their motion even when they are temporarily occluded. How does the absence of changing visual evidence alter predictive beliefs about a moving object? In our study, participants were tasked with continuously anticipating the destination of a simulated ball in occluded and un-occluded 2.5D environments. Our findings reveal that humans actively update their judgments throughout the period of occlusion while making predictions grounded in physical realism, even as occlusion impairs accuracy. To model this behavior, we integrate perception with physical reasoning, unifying tracking and prediction. This is implemented via massively parallel probabilistic inference in a hierarchical generative model for the motion of intermittently visible objects, represented using the GenJAX probabilistic programming platform. This model predicts time-varying human judgments more accurately than alternative models, suggesting that humans integrate perception and physics to reason about occluded motion. Paper is available at <https://arijit-dasgupta.github.io/jtap/>.