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Rapid Trial-and-Error Learning in Physical Problem Solving

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Abstract

We introduce a new problem solving paradigm: solving physical puzzles by placing tool-like objects in a scene. The puzzles are designed to explicitly evoke different physical concepts such as support, blocking, tipping, and launching, and are typically solved in a handful of trials. We study human participants' problem solving strategies, including what they try first, how they update their actions based on failed attempts, and how many attempts they eventually take to solve the puzzles. We introduce the 'Sample, Simulate, Remember' model that incorporates object-based priors to generate hypotheses, mental simulation to test hypotheses, and a memory and generalization system to update across simulations and real-world trials, and show that all three components are needed to explain human performance. Further results can be found at https://k-r-allen.github.io/tool-games/