Contrasting RNN-based and simulation-based models of human physical parameter inference

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Abstract

A number of recent studies have used ideal observer models to capture human physical reasoning as based on approximate mental simulation driven through a realistic inner physics engine. While these approaches can match human competence in specific tasks, they are still relatively far from cognitive plausibility and are limited in their ability to capture patterns of human biases and errors. In this work, we train a recurrent neural network (RNN) extensively on a physical reasoning task – conceptually mimicking the lifetime of experience that human adults have to build physical competence. We then examine its behavior alongside that of adults in the same test set of problems. We find that the RNN matches human patterns of judgments and errors much better than the idealised simulation account. We highlight specific situations where both RNN and humans erred and discuss the ramifications for current debates about the prevalence of physical simulation in cognition.