The fine structure of surprise in intuitive physics: when, why, and how much?

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Introduction

• Surprise when objects/events violate physics is used to understand physical expectations
• Often relies on binary measures: surprising or not
• We study this surprise in a fine-grained manner:
  - How surprising is a scene?
  - When do people register a surprise?
  - Why do people find a scene surprising?

Experiments

• Used Violation of Expectations: register surprise differences between matched scenes with/without physics violation
• Eight types of violations inspired by developmental studies, taken from Smith, Mei, Yao, et al., (2019); measures expectations about object permanence, solidity, & continuity
• Three experiments for three measures of surprise:
  - How: rate surprise on a sliding scale (n=60)
  - When: push a button when surprising event is noticed (n=60)
  - Why: choose from a list of descriptions of what occurred (n=95)

Discussion

• Consistency across subjects; some variability suggests different interpretations
• Timing responses are explained well by the ADEPT model designed to interpret scenes

ADEPT model of surprise

Smith, Mei, Yao, et al. (2019)