A dedicated mental resource for intuitive physics
Alex Mitko & Jason Fischer
Department of Psychological and Brain Sciences, Johns Hopkins University

Do we possess a flexible mental system for understanding and predicting physical events?

Do we use task-specific strategies for physical judgments or do we draw on a general physics resource?

A flexible physics system that we deploy in a variety of scenarios would predict correlated individual differences across tasks.

Intuitive Physics Tasks

- 360° view of unstable towers about to topple
- On which side of the platform will a majority of the blocks come to rest?

- 1 disc becomes invisible for 2 secs in the middle of each video
- Does the disc reappear with the correct position and velocity?

- A collision between 2 differently weighted bowling balls
- Based on the collision, which ball is heavier?

- 2 videos of an actor lifting differently weighted canisters
- In which video was the canister heavier?

- Static image of ball about to roll down a ramp and collide with a red object
- Will the red object be knocked off the platform?

Comparing individual differences across tasks

General intuitive physics system

Task specific strategies

Overall performance

How correlated is performance between pairs of tasks?

Can a single underlying factor capture substantial variance across all tasks?

Factor analysis with split half validation

Correlation of single factor with left out individual task data

Bootstrapped split half reliability

Explainable variance in each task is largely captured by a single factor

Is the general physics factor distinct from spatial ability and working memory?

Shortened Test of Intuitive Physics (TIP)

- 10 stimuli from each task
- Captures 95% of variance in full version

Reliable individual differences remain in physics performance after accounting for spatial and working memory ability

Conclusions

- A single underlying factor explained a large amount of variance across a collection of reliable physics tasks

- The TIP provided a highly reliable and efficient measure of intuitive physics ability that was distinct from spatial reasoning and working memory.

- Our findings point to a general mental resource for intuitive physics that we can flexibly deploy across scenarios.