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Tangled Physics: Knots as a challenge for physical scene understanding

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Abstract

Humans have a remarkable capacity to make intuitive predictions about physical scenes. Recent studies suggest that this capacity recruits a general-purpose “physics engine” that reliably simulates how scenes will unfold. Here, we complicate this picture by introducing knots to the study of intuitive physics. Three experiments reveal that even basic judgments about knots strain human physical reasoning. Experiment 1-2 presented photographs of simple knots and asked participants to judge each knot’s relative strength. Strikingly, observers reliably ranked weaker knots as strong and stronger knots as weak. Experiment 3 presented photographs of tangled strings and asked participants whether the tangle forms a knot when pulled. When shown a tangle that would not form a knot when pulled taut, subjects were at or near chance discriminating knots from non-knots. These failures challenge the domain-generality of physical reasoning mechanisms, and perhaps suggest that soft-body phenomena recruit different cognitive processes than rigid-body physics.