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When Newton beats Euclid: intuitive physics underlies sensitivity to geometry

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Abstract

Reasoners consider some differences in geometric features as more similar than other differences in geometric features. For example, humans and other animals consider horizontal mirror images more similar to each other than vertical mirror images or objects that have different orientations around a point in the vertical plane. Previous theories that explain sensitivity to geometry in terms of Euclidean principles cannot account for these categorization tendencies because in Euclidean geometry, rotation is an invariant transformation. There is thus no difference between the vertical and horizontal axes in Euclidean geometry. We propose a new theory that can account for these tendencies because it considers the role that gravity plays in how minds categorize geometric objects. Our theory makes new predictions about how reasoners categorize geometric objects in different contexts: 3D contexts with gravity, 3D contexts with gravity where objects were manipulated, and 2D contexts. Five experiments with adults support our theory.