

Basic understanding of geometry not dependent on education: study

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Mundurucu chief. Image: Fabio Rodrigues Pozzebom/ABr, via Wikipedia.

(PhysOrg.com) -- In a recent study published in the *Proceedings of the National Academy of Sciences*, psychologist Veronique Izard from the Universite Paris Descartes and her colleagues show how abstract geometric principles are understood despite a lack of formal education.

Izard and her team administered geometry-based tests to an Amazonian group known as the [Mundurucu](#). They tested 22 adults and 8 children (ages 7 - 13) and then compared their results with adults and children from France and America (French children ages 7 - 13 and American

children ages 5 - 7). One test focused on the geometrical properties of lines, while the other test asked participants to estimate the angle and location of an incomplete [triangle](#)'s apex.

Results showed that the Amazonian group, who had no formal education in [geometry](#), had results comparable to their French and American counterparts, with the exception of the American children. American children in the 5 - 7 age group were able to somewhat understand geometric space, but not to the level of the others tested, including those from the Amazon with no [formal education](#).

This leads researchers to believe that geometric knowledge is obtained through two possible routes. Either it is innate but not fully developed until around the age of seven or it is learned by experience with space, such as how our bodies move.

More information: Flexible intuitions of Euclidean geometry in an Amazonian indigene group, *PNAS*, Published online before print May 23, 2011, [doi: 10.1073/pnas.1016686108](https://doi.org/10.1073/pnas.1016686108)

Abstract

Kant argued that Euclidean geometry is synthesized on the basis of an a priori intuition of space. This proposal inspired much behavioral research probing whether spatial navigation in humans and animals conforms to the predictions of Euclidean geometry. However, Euclidean geometry also includes concepts that transcend the perceptible, such as objects that are infinitely small or infinitely large, or statements of necessity and impossibility. We tested the hypothesis that certain aspects of nonperceptible Euclidian geometry map onto intuitions of space that are present in all humans, even in the absence of formal mathematical education. Our tests probed intuitions of points, lines, and surfaces in participants from an indigene group in the Amazon, the Mundurucu, as well as adults and age-matched children controls from the United States

and France and younger US children without education in geometry. The responses of Mundurucu adults and children converged with that of mathematically educated adults and children and revealed an intuitive understanding of essential properties of Euclidean geometry. For instance, on a surface described to them as perfectly planar, the Mundurucu's estimations of the internal angles of triangles added up to ~ 180 degrees, and when asked explicitly, they stated that there exists one single parallel line to any given line through a given point. These intuitions were also partially in place in the group of younger US participants. We conclude that, during childhood, humans develop geometrical intuitions that spontaneously accord with the principles of Euclidean geometry, even in the absence of training in mathematics.

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