

How Rev. Thomas Bayes' faith helped us understand how the brain works

It all began in 1748, when the philosopher David Hume published *An Enquiry Concerning Human Understanding*, calling into question, among other things, the existence of miracles.

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Inspired to prove Hume wrong, [Presbyterian reverend Thomas] Bayes tried to quantify the probability of an event.

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Bayes tried to quantify the probability of an event. He came up with a simple fictional scenario to start: Consider a ball thrown onto a flat table behind your back.

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[H]ave a colleague throw another ball onto the table and tell you whether it landed to the right or left of the first ball. If it landed to the right, for example, the first ball is more likely to be on the left side of the table (such an assumption leaves more space to the ball's right for the second ball to land). With each new ball your colleague throws, you can update your guess to better model the location of the original ball.

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The brain makes a "best guess" according to the rules of Bayesian inference—one that ends up being incorrect because the visual system fills in missing details by sampling from an internal model that doesn't apply. Two squares on a chess board [appear](#) to be different shades of gray, for example, or a circle [seems](#) concave at first but becomes convex when flipped 180 degrees, because the brain makes a wrong initial assumption about something as simple as lighting.

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