

Animation Script



An Introduction to Bayes' Theorem with Dr Catia Scricciolo

To make the most out of this script, you could:

- Stick it in your book as a record of watching Catia's animation
- Pause the animation and make notes as you go
- Add your own illustrations to the sheet
- Create your own animation to accompany it
- Add notes from classroom discussions
- Make notes of areas you will investigate further
- Make notes of key words and definitions
- Add questions you would like answered – you can message Catia through the comments box at the bottom of her article: futurumcareers.com/how-statistical-innovations-are-cleaning-up-noisy-data

SCRIPT:

Dr Catia Scricciolo is a statistician at the University of Verona in Italy. She uses Bayes' theorem in her research – a famous mathematical formula developed in the 1700s by an English Presbyterian minister named Thomas Bayes, which changed the way we learn from evidence.

Bayes' theorem calculates inverse conditional probabilities – that is, it allows you to calculate the probability of a cause if you know its effects. If you don't know the probability, p , of an event happening, but you watch it happen m times and fail n times, Bayes' theorem allows you to ask: 'Given your data of m successes and n failures, what is the probability that p lies between, say, 0.4 and 0.6?'

For 150 years, Bayes' theorem was largely ignored. Then, in the 20th century, computers unlocked its true potential. Engineers, economists and data scientists realised that Bayes' theorem is the logic of uncertainty, making it an incredibly useful statistical tool. Today, Bayes' theorem is everywhere, used for everything from calculating the probability of a volcano erupting to teaching AI to recognise your face so you can unlock your phone.

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For example, imagine Catia is grading essays and she suspects one of her students used AI to write theirs. When she runs the essay through an AI detector, it says there is a 99% chance that it was written by AI. But can Catia trust this? Catia knows only 1% of submitted essays are actually written by AI. She knows the detector is very good and catches 95% of those AI essays. But she also knows it makes mistakes and falsely flags 5% of human-written essays as being AI-generated.

This means that if Catia receives 10,000 essays from students, only 100 of them will be AI-generated and the detector will correctly identify 95 of these. The other 9,900 essays were written by students, yet the detector will wrongly identify 495 of these as being AI-generated.

In total, the detector will flag 590 essays as being AI-generated, but only 95 of them really are. So, when it tells Catia that a student has cheated and used AI to write their essay, the chance of this being true is only 16% – the student is probably innocent!

Bayes' theorem captures the essence of rational thinking: before seeing evidence, you hold a prior belief, then when new data arrives you update your beliefs based on this new evidence. Bayes showed that changing your mind is not weakness – it is learning. Sticking to your old belief despite new evidence is irrational.

That's why Bayes' theorem is more than a formula – it's how your phone knows you, how scientists save lives, how AI learns, and how to catch – or not catch – ChatGPT. Start with a guess, look at the evidence, and update your mind...