You are part of the royal family. Probably.

A leading geneticist has calculated that almost every Briton is directly descended from Edward III. But many find facts like this scarcely believable. Why are we so bad at probability?

Mind-boggling: Danny Dyer is better known for his appearances on *EastEnders*.

When British actor Danny Dyer was told that he was descended from King Edward III (1327-1377) on the BBC programme *Who Do You Think You Are,* this was his response:

"I need to get this in my nut [...] My blood is his blood, I can't compute this in my brain."

Now, in his new show, *Danny Dyer's Right Royal Family*, he immerses himself in the lives of his royal ancestors (with amusing results).

As it turns out, Dyer is not alone in his royal relations. Geneticist Adam Rutherford has worked out the probability of a British person born in the 1970s being directly descended from Edward. "Not being descended from him was 0.01 to the power of 27," he found. So almost everyone is.

Edward III lived around 25 generations ago and had nine children. So think of their children, and then their children and so on, and it all makes sense.

But Edward is nothing compared to Genghis Khan. The Mongol ruler is said to be the ancestor of one in every 200 people alive today. According to Rutherford, every person alive today could be traced back to a common ancestor in the 14th century BC, while "literally every European" is descended from Charlemagne.

A similar idea is "six degrees of separation". It states that all the world's 7.5 billion people are, at most, six steps away from each other via a series of "friend of a friend".

How about this? There are more ways of arranging a pack of 52 cards than there are atoms in the universe. Every time you shuffle a pack, they will almost certainly end up in an order never seen before.

And if there are 20 billion Earth-like planets in our galaxy, each with a one in 10,000 chance of actually supporting life, that means the chances of there being life on at least one of those planets is 99.9999995%.

But many still instinctively doubt these statistics. One book, *The Enigma of Reason*, attempts to answer why facts do not change our minds.

It argues that when our ancestors lived as hunter-gatherers, clear reasoning had few advantages for them. In contrast, winning arguments helped to bolster their social standing.

Should we worry about our ineptitude at probability?

Do the maths
It is no big deal, say some. We were built this way for a reason. Our imperfect brains increase our sense of wonder at these unbelievable statistics. And our misconceptions can easily be overcome by education and rational thought. You can work these things out for yourselves.

This is an evolutionary oddity that we need to grow out of, reply others. Decision-making is largely about weighing up probabilities, making it by far the most important branch of maths. In fact, we should all live our lives by maths, carefully working out the most likely outcome of all our actions.

Q & A

Q: What do we know?
A: That, in many cases, seemingly unlikely statistics turn out to be true. We know, for example, that most people who lived in the Middle Ages, have millions of direct descendants from their children, their grandchildren and so on. This means that humans have an almost infinite amount of cousins. This even applies to relatively close relatives: each person has an average of 174,000 sixth cousins. But many people struggle to come to terms with these eye-popping statistics.

Q: What do we not know?
A: Exactly why this is, and whether humans can ever overcome their doubts on these matters. Some scientists believe that it is a deeply ingrained evolutionary trait that has been in humans since the Stone Age.

YOU DECIDE

1. Do you really, deep down, believe that you are related to the Queen?

2. Is probability the most important branch of maths?

ACTIVITIES

1. The mathematical explanation for the likelihood of two people sharing the same birthday has not been included in this article. Attempt to work it out.

2. Write 500 words on your most famous or notable traceable relative.

SOME PEOPLE SAY...

"Life is a school of probability."
Walter Bagehot

WHAT DO YOU THINK?

WORD WATCH

Danny Dyer – An actor known for his Cockney accent and generally hard-man roles, most notably in *Human Traffic*, *Mean Machine* and *The Football Factory*.

King Edward III – His reign of 50 years was the second longest in medieval England. Noted for his military success in France during the Hundred Years War and for restoring royal authority after the disastrous and unorthodox reign of his father, Edward II.

Who Do You Think You Are – A BBC documentary series in which celebrities trace their family trees.

Charlemagne – He rose to prominence as king of the Franks in the 8th century, and became western Europe's first recognised emperor since the Western Roman Empire three centuries earlier.

Six degrees of separation – Research into degrees of separation has been done on social media. One algorithm found an average degree of separation of 3.43 between two random Twitter users. The term "six degrees of separation", originally set out by the Hungarian author Frigyes Karinthy in 1929, was popularised in a 1990 play written by John Guare.

Book – See the *New Yorker* article in Become An Expert for details.

BECOME AN EXPERT

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Notes