

It could be you



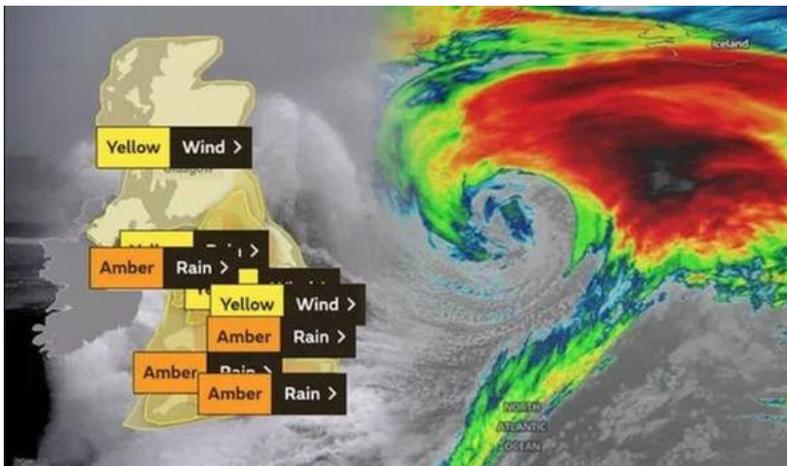
...but it probably won't be. In strict mathematical terms, your chance of winning the National Lottery jackpot is 1 in 45,057,474. It's actually easy (with a calculator!) to work this out. There are 59 numbered balls, so if you pick one at random, then another (not the same one again), and so on for six balls, the total number of possible sets of six is $59 \times 58 \times 57 \times 56 \times 55 \times 54$. This includes many sets with the same six numbers in different orders (like 3-10-18-29-42-55 and 18-42-10-55-3-29); there are $6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$ such sets, which

are all identical if the numbers are rearranged in increasing order like the winning lottery ball numbers. So the number of *unique* possible combinations of the six numbers is $59 \times 58 \times 57 \times 56 \times 55 \times 54$ divided by 720, and this is 45,057,474. Only one of these wins the jackpot.

If you toss a coin and see which side ends up on top, most people will readily agree that heads and tails have an equal probability of 50% (we'll discount the tiny probability that it lands on its edge and doesn't fall over). What's your prediction after three heads in a row? Some people think it's more likely to be tails next time to "even it up", but in fact it's still 50% for each of heads and tails – every throw is completely separate and independent of the others. Mind you, after a series of 25 heads, I'd put my bet on another head, because I'd suspect it's a double-headed coin; the probability of 25 heads in a row from a normal coin is about 1 in 33 million (that's 0.5 multiplied by itself 25 times), nearly as unlikely as winning the lottery jackpot.

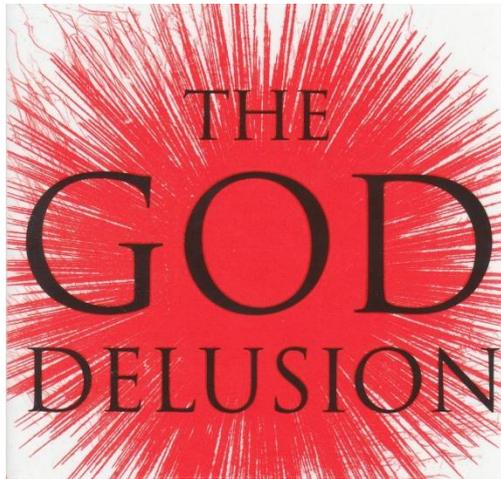


Of course, not all probabilities can be worked out exactly from a mathematical formula. Many are estimates based on experience, and these need to be revised as that experience



grows. Just look at the series of "once in a lifetime" extreme weather events in our own country, let alone the rest of the world. The probability of such storms is now considered rather higher than it used to be. Changing our estimate of probabilities applies also to updating the rain forecast during the day, and to things like sports betting odds.

Estimated tiny probabilities and their opposites – near certainties – are particularly tricky to deal with, leading to striking comparisons like a room full of monkeys with word processors producing a Shakespeare play, or a tornado in a scrapyard generating a Boeing 747. Part of the trouble is that, however improbable it may be, if something is true or has happened, then it's a fact – the probability becomes irrelevant now. This sort of argument occurs in debates about the miniscule random probability of the laws of nature and fundamental physical properties being “just right” to support life on earth. It's happened and we're here!



The atheist biologist Richard Dawkins wrote a whole book (*Climbing Mount Improbable*) in 1996 to demonstrate the reasonability of evolution based on random genetic changes and the constraints of natural selection, in response to claims that this has an extremely low probability of producing the complexity of life as we know it and so “could not have happened”. However, just a decade later, in *The God Delusion* (2006), his supposedly knock-out blow against the existence of God is based on the exact opposite argument that God (even Dawkins' distorted version) would be such a complex being that the probability of his existence is extremely small,

therefore God almost certainly doesn't exist. He was somewhat disappointed that his brilliant logic did not lead to the widespread conversion of religious believers to atheism! The same argument was probably(!) the basis of the 2008–9 “atheist bus campaign” in London and elsewhere, with the slogan “There's probably no God; now stop worrying and enjoy your life”. Responses to both the book and the buses have been robust, in print and in live debates between Dawkins and Christians. The main weakness of the crude probability argument, apart from the sheer difficulty of providing a sensible probability estimate in the first place, is that it simply doesn't apply to something that either is true or isn't and has no parallels. For that we need to look, not at statistics, but at evidence – of all kinds: scientific, historical, documentary, testimonial (as in a court of law), and personal. Statistics and probabilities have their rightful place, but they aren't the only approach to weighing evidence and coming to conclusions about what's likely to be true, particularly for something that claims to be unique.



And if you're feeling overdosed on statistics by now, don't worry. There probably won't be any in my next article!

Bill Clegg

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