

Eight billion people: How evolution made it happen

November 16 2022, by Matthew Wills



Credit: AI-generated image ([disclaimer](#))

November 15, 2022, marks a milestone for our species, as the [global population hits 8 billion](#). Just 70 years ago, within a human lifetime, there were only 2.5 billion of us. In AD1, fewer than one-third of a billion. So how have we been so successful?

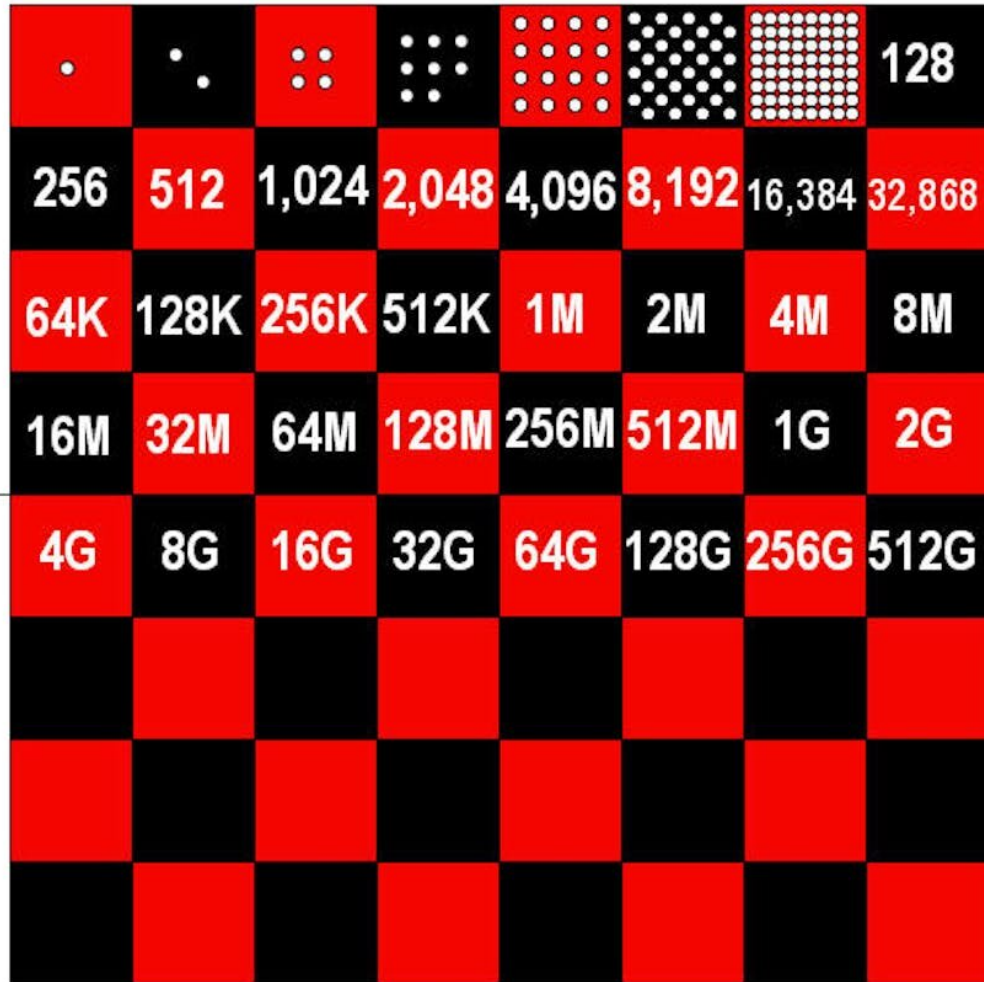
Humans are not especially fast, strong or agile. Our senses are rather poor, even in comparison to domestic livestock and pets. Instead, large brains and the complex social structures they underpin are the secrets of our success. They have allowed us to change the rules of the evolutionary game that governs the fate of most species, enabling us to shape the environment in our favor.

But there have been many unintended consequences, and now we have [raised the stakes so high](#) that human-driven climate change has put [millions of species](#) at risk of extinction.

Understanding population growth

Legend has it the king of Chemakasherri, which is in modern day India, loved to play chess and challenged a traveling priest to a game. The king asked him what prize he would like if he won. The priest only wanted some rice. But this rice had to be counted in a precise way, with a single grain on the first square of the board, two on the second, four on the third, and so on. This seemed reasonable, and the wager was set.

When the king lost, he told his servants to reward his guest as agreed. The first row of eight squares held 255 grains, but by the end of the third row, there were over 16.7 million grains. The king offered any other prize instead: even half his kingdom. To reach the last square he would need [18 quintillion grains of rice](#). That's about 210 billion tons.



A chessboard with each square containing twice the number of rice grains as the one before. K = a thousand, M = a million, G = a billion. Credit: [CC BY-SA](#)

The king learned about exponential growth the hard way.

In the beginning

Our genus—Homo—had modest beginnings at square one around [2.3 million years ago](#). We originated in [tiny, fragmented populations](#) along the east African rift valley. Genetic and [fossil evidence](#) suggests Homo

sapiens and our cousins the Neanderthals evolved from a [common ancestor](#), [possibly Homo heidelbergensis](#) . Homo heidelbergensis had a [brain slightly smaller](#) than [modern humans](#). [Neanderthals had larger brains than us](#), but the regions devoted to thinking and social interactions were less well developed.

When Homo heidelbergensis started traveling more widely, populations started to change from one another. The African lineage led to Homo sapiens, while migration into Europe [around 500,000 years ago](#) created the Neanderthals and Denisovans.

Scientists debate the extent to which later migrations of Homo sapiens out of Africa ([between 200,000](#) and [60,000 years ago](#)) displaced the Neanderthals or [interbred with them](#). Modern humans who [live outside Africa](#) typically have around 2% Neanderthal DNA. It is close to zero in people from African backgrounds.

If unchecked, all populations with more births than deaths grow exponentially. Our [population](#) does not double in each generation because the average number of children per couple is fewer than four. However, the pace of growth has been accelerating at an unprecedented rate. Those of us alive today are [7% of all the humans](#) who ever existed since the origin of our species.

Why aren't all species booming?

Biological intervention normally puts the brakes on population growth. Predator populations increase as their prey becomes more abundant, [keeping numbers in check](#). Viruses and other disease agents sweep through populations and decimate them. Habitats become overcrowded. Or rapidly changing environments can [turn the tables on once successful species and groups](#).

Charles Darwin, like the [18th-century scholar Thomas Malthus](#) before him, thought there might be a hard limit on human numbers. Malthus believed our growing population would eventually outpace our ability to produce food, leading to mass starvation. But he did not foresee 19th and 20th-century revolutions in agriculture and transport, or 21st-century advances in [genetic technology](#) that allowed us to keep making more food, however patchily, across the globe.

Our intelligence and ability to make tools and develop technologies helped us survive most of the threats our ancestors faced. [Within about 8,500 years](#) humans went from the first metal tools to AI and space exploration.

The catch

We are now kicking an increasingly heavy can down the road. The [UN estimates](#) that by 2050 there will be nearly 10 billion of us. One consequence of these vast numbers is that small changes in our behavior can have [huge effects on climate and habitats](#) across the globe. The rising energy demands of each person today are on average [twice what they were in 1900](#).

But what of our cousins, the Neanderthals? It turns out, in one sense, their fate was less dire than we might suppose. One measure of evolutionary success is the number of copies of your DNA that are dispersed. By this measure Neanderthals are more successful today than ever. When Neanderthal populations were last distinct from Homo sapiens ([around 40,000 years ago](#)) there were fewer than 150,000 of them. Even assuming a conservative average of 1% Neanderthal DNA in modern humans, there is at least 500 times as much in circulation today than at the time of their "extinction."

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