Chess

Almost nothing looks more orderly than chess pieces before a match starts. The first move, however, begins a spiral into chaos. After both players move, 400 possible board setups exist. After the second pair of turns, there are 197,742 possible games, and after three moves, 121 million. At every turn, players chart a progressively more distinctive path, and each game evolves into one that has probably never been played before.

According to Jonathan Schaeffer, a computer scientist at the University of Alberta who demonstrates A.I. using games, "The possible number of chess games is so huge that no one will invest the effort to calculate the exact number." Some have estimated it at around $10^{100,000}$. Out of those, 10^{120} games are "typical": about 40 moves long with an average of 30 choices per move.

There are only 10^{15} total hairs on all the human heads in the world, 10^{23} grains of sand on Earth, and about 10^{81} atoms in the universe. The number of typical chess games is many times as great as all those numbers multiplied together—an impressive feat for 32 wooden pieces lined up on a board.

Black Hole

Scientists have detected evidence of a colossal explosion in space - five times bigger than anything observed before.

The huge release of energy is thought to have emanated from a supermassive black hole some 390 million light years from Earth.

The eruption is said to have left a giant dent in the Ophiuchus galaxy cluster.

Researchers reported their findings in The Astrophysical Journal.

"I've tried to put this explosion into human terms and it's really, really difficult," co-author Melanie Johnston-Hollitt told BBC News.

"The best I can do is tell you that if this explosion continued to occur over the 240 million years of the outburst - which it probably didn't, but anyway - it'd be like setting off 20 billion, billion megaton TNT explosions every thousandth of a second for the entire 240 million years. So that's incomprehensibly big. Huge."

Stars in the Universe

Which Is Greater, The Number Of Sand Grains On Earth Or Stars In The Sky?

Here's an old, old, question, but this time with a surprise twist. The question is — and I bet you asked it when you were 8 years old and sitting on a beach: Which are there more of — grains of sand on the Earth or stars in the sky?

Obviously, grains and stars can't be counted, not literally. But you can guestimate.

Science writer David Blatner, in his new book Spectrums, says a group of researchers at the University of Hawaii, being well-versed in all things beachy, tried to calculate the number of grains of sand.

They said, if you assume a grain of sand has an average size and you calculate how many grains are in a teaspoon and then multiply by all the beaches and deserts in the world, the Earth has roughly (and we're speaking very roughly here) 7.5×10^{18} grains of sand, or seven quintillion, five hundred quadrillion grains.

That's a lot of grains.

Stars in the constellation of Lyra.

Gilles Chapdelaine/NASA & ESA

OK, so how about stars? Well, to my amazement, it turns out that when you look up, even on a clear and starry night, you won't see very many stars. Blatner says the number is a low, low "several thousand," which gives the sand grain folks a landslide victory. But we're not limiting ourselves to what an ordinary stargazer can see.

Our stargazer gets a Hubble telescope and a calculator, so now we can count distant galaxies, faint stars, red dwarfs, everything we've ever recorded in the sky, and boom! Now the population of stars jumps enormously, to 70 thousand million, million, million stars in the observable universe (a 2003 estimate), so that we've got multiple stars for every grain of sand — which means, sorry, grains, you are nowhere near as numerous as the stars.

So that makes stars the champions of numerosity, no?

Ummm, no. This is when Blatner hits us with his sucker punch. Yes, he says, the number of stars in the heavens is "an unbelievably large number," but then, very matter-of-factly, he adds that you will find the same number of molecules "in just ten drops of water."

A single drop of water.

Say what?

Let me repeat: If you took 10 drops of water (not extra-big drops, just regular drops, I'm presuming) and counted the number of H_2O molecules in those drops, you'd get a number equal to all the stars in the universe.

This is amazing to me. For some reason, when someone says million, billion or trillion, I see an enormous pile of something, a grand scene, great sweeps of desert sand, twirling masses of stars. Big things come from lots of stuff; little things from less stuff. That seems intuitive.

But that's wrong. Little things, if they're really little, can pile up just like big things, and yes, says Blatner, water molecules "really are that small."

So next time I look up at the sky at all those stars, I will be impressed, of course, by the great numbers that are out there. But I will remind myself that at the other end of the scale, in the nooks and crannies of the physical world, in the teeniest of places, there are equally vast numbers of teenier things.

We are surrounded by vastness, high and low, and either way, as Blatner's book says, we "can't handle the biggitude."

Are there more stars than all the words ever spoken by humans?

A while ago I saw Neil deGrasse Tyson comparing the number of stars in the universe with the number of words spoken by all of humankind, ever since.

I realize both of these numbers are not strictly defined, but still, we can use our best observations together with our best guesses to find out which number is larger, and by how many magnitudes. It's a good example of making you realize the size of astronomical numbers in the true sense of the word.

Number of stars in the observable universe

There are about 100 to 200 billion galaxies in the observable universe. Galaxies range in size from a few billion to hundreds of trillions stars. Using 100 billion galaxies and 1 trillion stars in a galaxy yields 1023 stars in the observable universe as a rough order of magnitude estimate. (After getting this result, I found multiple sources that give answers ranging from 1021 to 1024 stars in the universe.)

Number of words ever spoken

We're talkative, but we also sleep and eat and listen. Assuming we talk for the equivalent of 3 hours per day and we speak at about 150 words per minute, or about 10 million words per year. I recall 100 billion as being a rough estimate of the number of modern humans who have ever lived. Many of those people died during or shortly after childbirth. Assuming an average life expectancy at birth of 25 years (generous), that means humans have spoken 2.5×1019 words since we first gained the gift of gab.

That might be off by a factor of ten, but it's not off by a factor of ten thousand. There are a lot more stars in the observable universe than the number of words ever spoken by humans.

10 million words per year means about one per 3 seconds - rather overestimation for me; on the contrary 25 years isn't probably that generous as one might think. – Mithoron Feb 19 '15 at 1:03

People are either silent or speaking at about 90 to 150 words per minute, or 1.5 to 2.5 per second. I intentionally picked the upper end. Three hours a day of speaking might be a bit high, but not by a factor of three. The 25 years is overly generous, by a factor of two. That 100 billion people includes a lot of people who died in their infancy and thus never said a

single word. Except for the last few hundred years, life expectancy at birth has been about 12 years, and that's when most of those 100 billion lived.

Amusingly, though, at 2.5 words/sec, we can each speak as many words in half an hour as there are stars in the night sky (about 4,500 visible, on a perfectly clear black night).

10^{19} words have been spoken in all of human history. This accounts for 109 billion people who have ever lived and each speaking 309 billion words in their life time. The amount of stars in the universe in a very rough estimate is somewhere around 10^{24}. For every word spoken in human existence there are over 100,000 stars in the universe. In conclusion, there are more stars in the universe than for every word ever spoken by humankind as well as every grain of sand on all the beaches on earth and many many more.