

HOW IT ENDS: THE MOST LIKELY EXTINCTION EVENTS

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Midnight Facts for Insomniacs

Podcast Transcript

**(Note: transcript
consists of episode
outline)**

Tell me what you know
about The doomsday
clock. Since 1947, a group
of scientists who were
involved in the Manhattan
project—the super secret
effort to create the atom

bomb—have been releasing a publication known as *The Bulletin of the Atomic Scientists*. Pretty on the nose. "What should we call this bulletin, fellow atomic scientists?" The publication is intended to monitor man-made threats to human civilization, and it includes an image of the aforementioned Doomsday Clock, which sounds way more sinister and super villain than it actually is. It's just a picture of a clock. But the time on this imaginary clock indicates how close we are to catastrophe, with midnight signifying the end of humanity. The group measures existential threats, taking into consideration international crises and the worldwide state of human relations, setting the time on the

clock accordingly. The closer the clock gets to midnight, the closer we are to an extinction event. When the clock was first created in the wake of world war 2 in 1947—after the bombing of Hiroshima and Nagasaki—as the Cold War dawned, the time was set at 7 minutes to midnight. It has changed 24 times since then in response to world events. In 1991 the clock was set to its least threatening level, a relatively comforting 17 minutes to midnight. Relatively. I'd prefer like 3pm, but apparently that's not happening any time soon. In fact, as of right now the clock sits at 100 seconds to midnight. Note that the clock is only supposed to reflect man-made threats to civilization. So covid is not

the explanation for the clock being the closest it's ever been to Armageddon. The official explanation includes "

Failure of world leaders to deal with the increased threats of nuclear war, such as the end of the intermediate-range nuclear forces treaty (INF) between the United States and Russia as well as increased tensions between the US and Iran, along with the continued neglect of climate change

Note that Donald Trump withdrew America from the intermediate-range nuclear forces treaty in 2018. Sweet. North Korean relations with America are also cited as a potential contributor. You'll probably notice that America is involved in all of these

predictions. We are the most heavily armed nuclear power on earth, and also we tend to get a little...feisty. We are a warlike people. But we're not the only potential aggressors. I think Germany should always be in the discussion. As far as we know they aren't currently manufacturing nor harboring nuclear weapons, but they have the capacity and technology, and historically...I'm just saying...I've got my eye on you, Germans. Consider yourselves on notice. I'm not making any accusations but I do enjoy scapegoating, and this is a convenient way to take the heat off of us.

So even setting aside a worldwide pandemic, this

is a scary time. When it comes to the end of humanity, there are a number of possible culprits, but they all fall under two distinct umbrellas: anthropogenic risks, which are manmade (human made) or non-anthropogenic, which are external. But not necessarily natural. An alien invasion would be non-anthropogenic. We didn't cause it to happen. Unless we did. Like if some rogue scientist has been taunting space. Sending screenshots of his middle finger to Alpha Centauri. But when we think of external factors that could wipe us out, we're typically talking about nature: asteroids, etc.

But let's start by discussing anthropogenic

events. The ways we might off ourselves. In 2008, Oxford university hosted a Global Catastrophic Risk Conference, and a survey of attendees revealed that the gathered scientists estimated approximately a 20% chance that the human race would destroy itself before the year 2100. Now I want to point out that we're talking about a survey of people attending a catastrophic global risk conference, so this isn't exactly an unbiased group. "90% chance that pigs will fly, say attendees of the flying pigs conference" So yeah, there's a bit of confirmation bias at play, but that doesn't mean these people are wrong. These are actually scientist, not pig-flight predicting flat earthers. They also ranked the various potential threats to

civilization based on their percentage likelihood of occurring. The top two were tied at five percent each: Artificial Intelligence, and molecular weapons nanotechnology. Skynet or nanobots. So the Bots, either way. Bots! (like "Newman!")

Next most likely was war, at 4%. Then pandemic, at only 2%. Feels low, considering. This was 2008, and these guys were at a conference...there were still *conferences*...so they didn't know. But it's actually totally possible that they're correct; we're all just a little sensitive right now. As we've seen in the past and unfortunately to a smaller extent now, a global pandemic is more likely to thin the herd of humanity than wipe us out entirely.

So in case these scientists sound like a bunch of alarmists, true story: The 2016 annual report by the global challenges foundation estimates that an average American is more than five times more likely to die during a human-extinction event than in a car crash.

The reason is that first off, it's relatively unlikely that you'll die in a car crash, even if you experience one. Yay seatbelts. But in an extinction level event, your chances of dying are pretty good. You're more likely to survive a fender bender than a nuclear Holocaust. And look, extinction events aren't as unlikely as you might think...we've come closer than most people know. Which brings us to Nuclear war. This one we'll cover more extensively in

future episodes but I think it's worth noting that it's impossible to realistically calculate the odds of a nuclear Holocaust. As a Medium article noted when explaining the silliness of trying to calculate these types of events, "We can establish a base rate for the probability of nuclear war by looking at the number of times nuclear weapons have been used during a war: one time since they were developed 74 years ago. This could be interpreted to mean that the likelihood of nuclear war is around 1.4% per year." And that's obviously stupid. By this logic if a thing happens once, then the following year there is a 50% chance that the thing will happen again. But human nature isn't math. If a child sticks his

finger in a socket, it isn't even odds that the kid is going to do it again the following year. There's more like a 30% chance...kids are stupid. But you get the idea. However, most experts will tell you that we should be way more scared than we are. Here's the title and tag line of the above-referenced article: "You can't calculate the odds. I did it anyway." And the title: "93.16% Likelihood Of Nuclear War." Obviously there's an element of sarcasm when delivering a number as precise as that one in an article explaining the impossibility of this calculation, but the warning is real. There have been some extremely close calls as the result of diplomatic breakdowns and even closer ones due to hardware errors and

malfunctions. And because every nation is justifiably terrified of attack, and these attacks happen so quickly, decisions have to be made within instants. Russia accidentally launches a nuke, or America does, or a country inaccurately BELIEVES another country launched a nuke, and its game on. Like irradiated falling dominoes more and more countries would be drawn into the fake conflict as a result of automated responses, and the world could easily descend into a nuclear Holocaust.

You want examples? Here are Some notable close calls:

In 1956 the North American Aerospace Defense Command (NORAD) detected and

reported a possible Russian offensive attack, an alert triggered in part based on a wedge of swans over Turkey.

On October 5, 1960, "Radar equipment in Thule, Greenland mistakenly interpreted a moonrise over Norway as a large-scale Soviet missile launch."

There were a bunch of close calls and near disasters during the Cuban missile crisis of 1962, that's a horrifying incident that I'm sure we'll cover in the future.

In 1967 a solar flare was misinterpreted as prelude to a Soviet attack, and the United States came within a hair's breadth of launching a nuclear strike.

In 1969 a drunk Richard Nixon initially ordered a nuclear strike against North Korea before the order was rescinded by Secretary of State Henry Kissinger.

A decade later, the year 1979 was an absolute nightmare of NORAD fuckups and close calls. Like, it's crazy that humanity made it to the 80s. The worst crisis involved a computer glitch at NORAD which caused it to report that Russia had launched 2,200 ballistic missiles. The president was initially informed that he had between 3 and 7 minutes to react. Luckily satellite and radar systems were able to confirm the false alarm before Jimmy Carter annihilated humanity.

In 1995, " Russian systems mistook a Norwegian weather rocket for a potential nuclear attack. Russian President Boris Yeltsin retrieved launch codes and had the nuclear suitcase open in front of him. Thankfully, Russian leaders decided the incident was a false alarm."

There are more, but I think we get the idea. Another reminder...as of a few months ago the American nuclear codes were in the hands of a mentally-challenged narcissistic wannabe dictator. And of course climate change is another form of ticking time bomb.

It's not just America and Russia that we have to worry about. There are officially five countries that are "allowed" to have

nuclear weapons: the United States, France, the UK, Russia, and China are the states that are officially able to possess nuclear weapons. This is because In 1970, 43 countries signed the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), which stated that it was forbidden for any country to develop nuclear weapons unless that country already had them. Specifically, nuclear weapons were limited to those nations that had built and tested a nuclear explosive device before January first, 1967. This treaty was very popular with countries that already had nuclear weapons, and the other countries...well, they didn't have nuclear weapons so what were they gonna do? They

didn't want to piss off nuclear-equipped nations. I love that this happened. It's so nakedly cynical and unfair. It's like if all the world's rich people got together and collectively decided...no more rich people. It wouldn't be safe. Only we can handle the massive responsibility of having millions of dollars. "You want a million dollars? You can't HANDLE a million dollars." You can have 999,999 dollars, but if you try to earn one more dollar, we will crush you." So in addition to the five countries that declared themselves allowed to have nuclear weapons, there are other countries that developed weapons covertly and no longer conceal their capabilities, like India and Pakistan and North Korea, and finally there are states that are

known to have nukes but won't admit it. Well, state. Israel has been suspiciously quiet whenever the subject comes up. "Nuclear what? Who's a when? I can't understand you, gentile." Notice that some of those nuclear states don't get along great. North Korean and America. China and America. Russia and America. There's a theme here. But seriously, it's not just us. Pakistan and India have historically had a frosty relationship. And France...no one cares about France. Let's be honest, they don't have the guts to start a war. I kid. Wouldn't want to insult France. They might smoke a cigarette and write poetry. And eat. Of course, there are other nations to worry about. Iran is famously flirting

with a nuclear program, which make Israelis feel super not comfortable. Probably as not comfortable as I feel knowing that any of these nations could trigger nuclear war, and how close we've come to utter annihilation.

So we've covered nuclear war...let's switch over to a non-anthropogenic event (as a reminder those are the threats that we can't control), and we'll work our way through this very grim list by going back and forth.

Cataclysmic Asteroid

When we talk about the threat of asteroids what we're really talking about is the threat of a so-called "impact event," which sounds very nonspecific.

Stubbing your toe is technically an impact event. I think we should come up with a new name that properly conveys the magnitude of the threat. A boomsplode murder-rock cataclysm...event. Impact events haven't all been catastrophic. Some have been fortuitous. There's a good chance that water arrived on earth by hitchhiking on comets and meteoroids and arriving via boomsplode cataclysms. So in the early days of the earth these impacts were often a good thing. Asteroid strikes were common in the early days of our solar system, when space was full of debris. planets and stars would act like magnets or vacuums, sweeping through space and absorbing all the cosmic chunks of dirt, melding

into larger celestial bodies as a result. Now that most of the cosmic debris has been absorbed, in modern times those massive impacts are extremely rare. In any given year scientists tell us that there is a .1% chance that an asteroid big enough to annihilate a city will strike the earth. And if such an impact, were to happen, based on geography, there's a 70% chance that the asteroid would land in the ocean. Which could still be bad...tsunamis, not a fan. But way less bad than if it landed on Manhattan. Or even worse, my house. So an ocean landing is a best case scenario. Unless you're a fish. On the other hand, the chances of an extinction level boomsploode, e.g. an asteroid larger than five

kilometers, has a less-than-terrifying 0.000001% chance of occurring. Not super scary, but hey. Tell that to the dinosaurs. It's happened before, and over the massive span of time it will probably happen again. But lucky for us, our lifespans are infinitesimally short on a universal scale. lucky for us—question mark? So getting smacked by an asteroid in your lifetime would be the equivalent of winning the world's most unlikely lottery. Shittiest lottery ever. I'm not scratching that scratcher.

Back to anthropogenic threats.

ARTIFICIAL INTELLIGENCE

AI—the good news is that we're a lot farther from true artificial intelligence

than most people probably realize. Siri and Alexa are idiots, they react to basic commands with simple operations. The highly touted "Machine learning" that we hear so much about in tech advertisements is...meh. Truly incremental progress. Right now we're better at faking artificial intelligence than truly creating it. For instance, machines can write entire news articles. So-called automated text-generation is so good that it feels like the work of an actual human reporter. Simply feed one of these text generators a phrase, and it will generate a completely believable news article based on the content of that phrase. It's uncanny. Search for [talktotransformer](#) and it'll take you to the [infokit](#) site,

and try it yourself.

Example:

here's an actual input that I typed:

"15 beavers were apprehended yesterday..."

And the computer generated this:

There are now 18 beavers in captivity, at Lake of the Woods. 15 in a pen, and three that have been relocated to the Battle River Drainage. The new ones will join the rest when they are ready.

The pen is being monitored to ensure their stress levels are low.

Impressive, right?
algorithms like this one are using Deep Learning, and

in particular a very sophisticated form of coding known as Natural Language Generation. These are Algorithms that are essentially teaching themselves using probabilities and complex systems of reinforcement...the machine gets better over time as it learns which sentence structures are most realistic and convincing. But ultimately the algorithms are not thinking...the computer doesn't understand the meaning of the words, it simply absorbs massive amounts of data, huge samples of writing, and calculates the most probable next word based on its dataset. This is still impressive stuff—especially the fact that it gets better over time—but ultimately it's a completely

automated process carried out by unintelligent lines of code.

So it's spectacularly unlikely that humans will be capable of creating a true artificial intelligence any time soon. However, that doesn't mean we're out of woods. Because humans most likely won't be the ones to create AI. The real power of machine learning algorithms is the *learning* part. For instance, an emerging technology known as **Evolutionary computation**. Engineers are designing algorithms that are built to improve over time, to essentially refine their own code, and even build their own improved algorithms. We're designing the designers of AI. Fake AI that will eventually design true AI. This is Called

neuroevolution, and it's going to kill us all. I'm not worried about a mad scientist creating AI. I'm worried about an algorithm creating a smarter algorithm that creates an even smarter algorithm in a process that accelerates exponentially and creates a mad scientist algorithm...boom. Skynet.

Supervolcanoes

Here's one that might surprise you. Let's start with a specific example. Did you know that one of the most deadly threats to the earth is a giant tourist attraction? Yellowstone national park, famous for its mineral hot springs and pulsing geysers—like the iconic old faithful—sits on top of a supervolcano capable of erupting at any time and precipitating a literal extinction level

event. I recommend a great book by Bill Bryson called *A Short History of Nearly Everything*, in which he describes a conundrum that was facing geologist Bob Christiansen in the 1960s. "It had been known for a long time that Yellowstone was volcanic in nature—that's what accounted for all its geysers and other steamy features—and the one thing about volcanoes is that they are generally pretty conspicuous. But Christiansen couldn't find the Yellowstone volcano anywhere. In particular what he couldn't find was a structure known as a caldera." You know how every volcano has a caldera: the giant hole that results from eruption. "By coincidence just at this time NASA decided to test some new high-altitude

cameras by taking photographs of Yellowstone...as soon as Christiansen saw the photos he realized why he had failed to spot the caldera: virtually the whole park—2.2 million acres—was caldera." The entire 2.2 million acre Yellowstone national park is the supervolcano's blast zone. An eruption of the Yellowstone supervolcano would be almost unimaginable. "Beneath the surface is a magma chamber that is about forty-five miles across—roughly the same dimensions as the park—and about eight miles thick at its thickest point. Imagine a pile of TNT about the size of Rhode Island and reaching eight miles into the sky, to about the height of the highest cirrus clouds, and you

have some idea of what visitors to Yellowstone are shuffling around on top of."

Yellowstone is the largest active volcano in the world, and over the last 17 million years or so, it is estimated to have blown at least 100 times. "The Yellowstone eruption of two million years ago put out enough ash to bury New York State to a depth of sixty-seven feet or California to a depth of twenty... And ash, it is worth remembering, is not like a big snowfall that will melt in the spring. If you wanted to grow crops again, you would have to find some place to put all the ash. It took thousands of workers eight months to clear 1.8 billion tons of debris from the sixteen acres of the World Trade Center site in New York.

Imagine what it would take to clear Kansas."

"the cycle of Yellowstone's eruptions averaged one massive blow every 600,000 years. The last one, interestingly enough, was 630,000 years ago. Yellowstone, it appears, is due."

And Yellowstone obviously isn't the only supervolcano. Getting an accurate count is surprisingly difficult and varies based on the source, but there are currently between 6 and 20 supervolcanoes on the planet, including Toba in Indonesia, and Long valley in Eastern California, near the Nevada border, 170 miles from this studio. We're located almost at the exact center point of a circle with 150 mile radius lines between the San Louis Obispo nuclear

reactor and the Long Valley supervolcano. So many ways to die. Pick your poison.

Long valley, like all supervolcanoes, was formed when a magma pocket rose from the earth's mantle toward the outer layer of the earth but couldn't break through the crust, and so it pooled in place, building in size and pressure. Eventually that pressure will burst forth in an explosive release. This all sounds weirdly sexual. Terrifying and sexual, that's *someone's* kink.

We're going to breeze through the final extinction threats because...well, let's take them one by one.

Climate change

We're not going to talk about this one in depth, because reasons. Mostly

because everyone knows. And if you don't believe in climate change you're just not interested in science and probably aren't a fan of this podcast. Suffice to say we need to take measures to avoid climate change, stat. Our time is limited. Don't be a climate change denier, please. It's a bad look. It won't age well.

Pandemic

No one wants to hear about this. We have an entire episode on plagues and pandemics, and it was actually really interesting, so if you aren't suffering from wicked pandemic fatigue, go check that out.

Last, I want to point out that in a best case scenario, even if we do manage to not 'splodey

ourselves or get hit by an asteroid or super bug or super volcano and we get climate change under control, in about a billion years we'll be facing an event called the great Deoxygenation, when oxygen levels on earth sink to Archean levels, pre life. A few billion years later the sun will die, ballooning outward and engulfing the earth as a red giant before collapsing in on itself in its final form as a white dwarf, a dense ball of useless matter. So even if the doomsday clock's current prediction is wrong, ultimately the concept is correct. We are all on an inevitable march toward midnight.

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