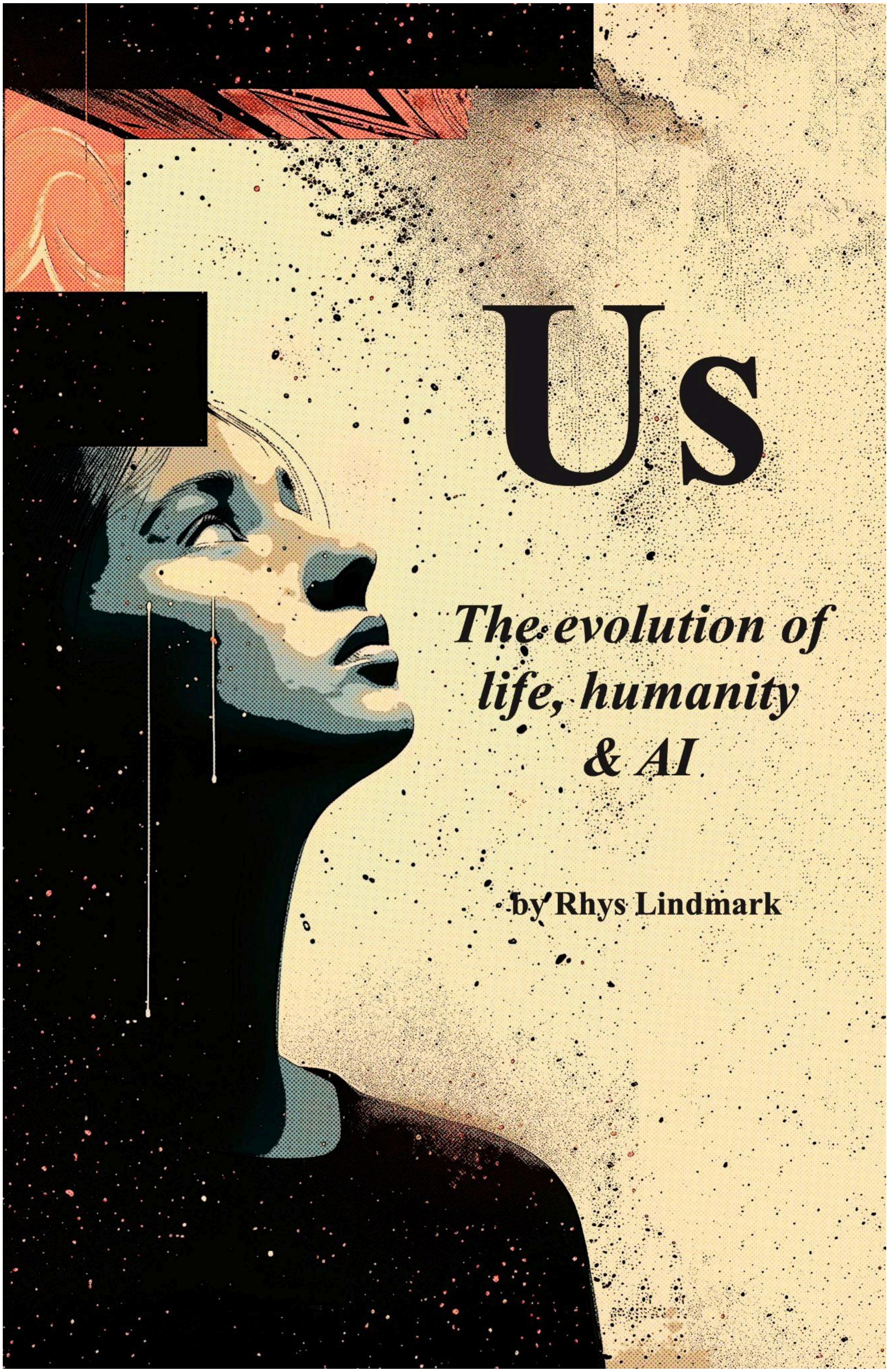


Us

The evolution of life, humanity & AI

by Rhys Lindmark

Table of Contents

Us is graphic nonfiction. There will be 18 chapters in four parts, plus a preface and a conclusion. I expect it to be around 400 pages with 75,000 words and 2,000 panels. The print size is standard comic—6.625" by 10.25". I currently use Midjourney and Photoshop for most of the panels but also design some of them myself.

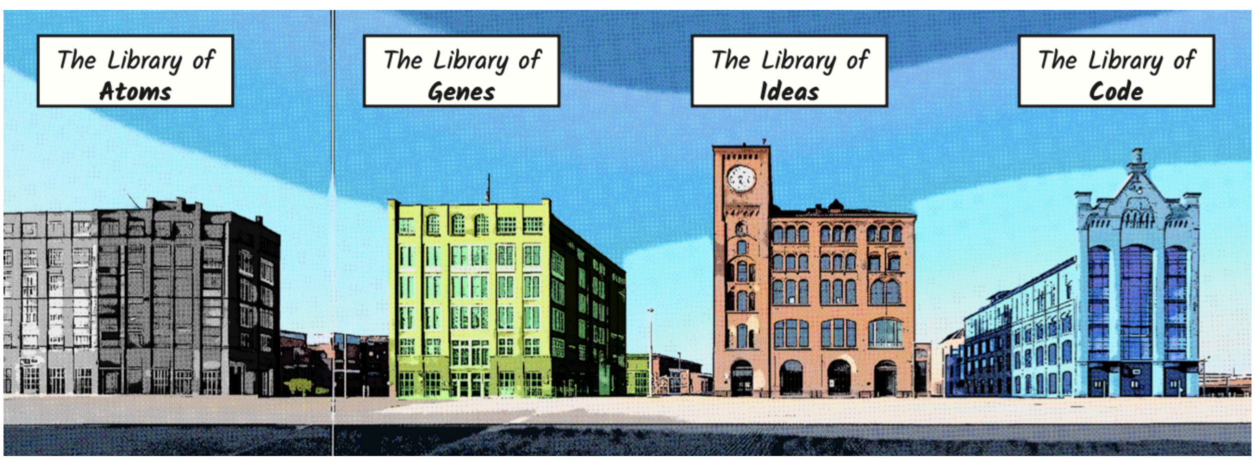
👉 [Watch Rhys give a 60-minute overview here](#) 👈

Preface

(Included as a sample chapter.)
I introduce the question underlying this book: How should we navigate a century of accelerating change?

My answer: Change is governed by evolution, which works by producing layers of structure that persist over time. Over the last fourteen billion years, evolution has built four layers: atoms, life, ideas, and code. To navigate the present, we should see how evolution made those layers, and then understand how humanity is shaping them today.

I then outline the structure of the book as a four-part tour through those four metaphorical libraries/layers. In each part I oscillate between the past, to show how the layer evolved, and the present, to diagnose the layer today.



Part I: Atoms

Everything is made of atoms, including Earth. As we enter the Anthropocene, humans are changing the Earth itself. In Chapter 1, I'll show how the atoms on Earth came to be. In Chapter 2, I'll explore the state of atoms on Earth today.

Chapter 1: Physical Evolution in the Library of Atoms

14 billion years ago – 4 billion years ago
The goal of this chapter is to show how the evolutionary process of variation and selection turned gas clouds from the Big Bang into planets like our Earth. First, I'll show what evolution means in the physical world. Variation comes from initial conditions of matter while selection comes from the laws of physics "selecting for" stable patterns of matter—a survival of the stable. I'll introduce the Library metaphor and show how the Library of Atoms has two floors: small atoms on the first floor, and massive stars/planets on the second. These floors get filled as the evolutionary process builds a tower of complexity: atoms, stars, elements, planets, and finally carbon molecules in water—the building blocks for life.

Chapter 2: Atoms in the Anthropocene

Present
The goal of this chapter is to diagnose the health of our Library of Atoms today. Civilization exerts massive selection pressure on our Earth.

First, I'll introduce the four geospheres—the lithosphere (crust), cryosphere (ice), hydrosphere (water), and atmosphere (air). Then I'll show how human activity and climate change are impacting each. The atmosphere is filling with carbon dioxide. We've already increased temperatures by 1.5C and expect 2.0C by 2050. The world is hotter and wetter. 10-year droughts, floods, and heat waves now happen every two years. The cryosphere is melting. We've already passed tipping points so the ice sheets on Greenland and West Antarctica will melt in the next thousand years. As the cryosphere turns into the hydrosphere, sea levels will rise by one meter by 2100, putting hundreds of millions of humans underwater. The atmosphere, cryosphere, and hydrosphere are all experiencing a massive transition.

Second, I'll show how mineral demand is changing the lithosphere. For centuries, we've pulled out materials to construct civilization. We've done this so much that total human-created mass is now greater than total biological mass. This mass is fueled by energy and materials. For energy, I'll introduce the idea of the petrosphere and show how we've extracted around half of all fossil fuels. Only 100 years remain. Energy is political. The political-economic order built around Petrostates is beginning to shift to Solarstates. Meanwhile, our need for renewables drives the other side of human activity, materials. As we decarbonize, we will re-materialize our infrastructure. 250 years of petrochemical supply chains will need to become green in 25-50 years. This requires a hunt for lithium, cobalt, and other rare minerals while we hunt for innovations like sodium-ion batteries. Everything atomic is political. China builds while the rest of the world lags. The Global South provides resources but receives few of the benefits.

By 2050, human-created mass will be three times biomass. This is the Anthropocene. The geosphere is increasingly becoming a reflection of humanity.

Part II: Life

As we enter the Anthropocene, humans are domesticating the biosphere as a whole.

—

- In Chapter 3, I'll show how microorganisms evolved.
- In Chapter 4, I'll explore the state of microorganisms today.

—

- In Chapter 5, I'll show how multicellular life evolved.
- In Chapter 6, I'll explore the state of multicellular life today.

Chapter 3: Biological Evolution of Microorganisms

4 billion years ago – 500 million years ago
The goal of this chapter is to show how evolution produced a diverse biosphere of microorganisms before multicellular plants, animals, and fungi. This creates the first floor of the Library of Genes. I'll begin by showing how life started as a "survival of the fittest chemical reaction." Then I'll describe how cells operate as mini-cities and how they colonized the Earth. Around two billion years ago, microbial life underwent two massive changes. First, two cells combined in endosymbiosis, enabling multicellular life. Second, cyanobacteria learned to photosynthesize, which caused the Great Oxygen Extinction, killing most organisms. By around 500 million years ago, we had a planet covered in microbes, ready for the Cambrian Explosion.

Chapter 4: Microorganisms in the Anthropocene

Present
The goal of this chapter is to understand microorganisms' role today. Like with the geosphere, human civilization exerts massive selection pressure on the microbiosphere. This started with simple germ theory but is now accelerating with AI and CRISPR. By simulating biology *in silico*, we can accelerate evolution *in vivo*. Using these tools, human selection has three impacts: eradicating infectious diseases, domesticating cells for bioreactor production, and mitigating bioengineered pathogens.

First, I'll show how humans have begun eliminating infectious diseases around us. 200 years ago, 50% of deaths were from these diseases. It's now only 15%. We've made progress with microscopes, germ theory, sanitation, vaccines, and antibiotics. But there's still lots of progress to be made. Nearly 8 million people die every year from pneumonia, tuberculosis, malaria, diarrhea, HIV/AIDS, and other infectious diseases. We've eliminated smallpox and rinderpest, but should eliminate polio, malaria, and other diseases. As Louis Pasteur said in the late 1800s, "it is within the power of man to eradicate infection from the earth". The benefits are immense and we should act now. Meanwhile, we'll also need to prepare for an oncoming onslaught of antimicrobial resistance. Experts estimate that it will be responsible for 10 million deaths in 2050, the same as cancer today. Evolution continues.

Second, I'll show how humans are domesticating the microbiosphere, just like we domesticate larger plants and animals. With the advent of recombinant DNA and newer technologies like CRISPR, we can edit microbes. Two million people in the US alone take insulin that is manufactured by genetically engineered yeast in giant bioreactors. There's more than 100 million liters of reactor capacity today, likely increasing to a billion liters by 2100. We'll produce many things from these bio and chem reactors like plastics for construction, fuels for energy, and animal cells for food. Finally, we're domesticating gut microbiomes too. Cow burps are responsible for 25% of greenhouse emissions from agriculture. We're CRISPR-editing their microbiome so they emit less methane.

Third, I'll show how our new advances in microbiology can be misused for bioweapons. When humans first developed chemical weapons in WWI, we used them to kill nearly 100,000 people. The US used Agent Orange in Vietnam to kill 400,000 people. With low-cost DNA synthesis and AI simulation tools, it is becoming increasingly cheap to develop a dangerous bioweapon. In silico evolution is powerful but dangerous. We should tread lightly.

This is the Anthropocene. We can edit the microbiosphere and it is now a reflection of humanity.

Chapter 5: Biological Evolution of Multicellular Life

500 million years ago – 200,000 years ago

The goal of this chapter is to show how evolution produced multicellular life: plants, animals, and fungi. This creates the second floor of the Library of Genes. First, I'll show how Hox genes and atmospheric oxygen enabled a Cambrian Explosion of body plans like worms, arthropods, and vertebrates. Evolution then moved to vertebrate limbs and produced fish, amphibians, reptiles, birds, and mammals. Mammalian brains grew big enough to model their environment. This allowed us to simulate a behavior without physically doing it. Mammals could now run evolution on a cheaper substrate, *in neuro*. This laid the foundation for the cognitive niche of our primate ancestors.

Chapter 6: Multicellular Life in the Anthropocene

Present
The goal of this chapter is to understand the state of plants, animals, and fungi today. Like with the microbiosphere, human civilization exerts massive selection pressure on the rest of the biosphere.

First, I'll show how, like with microorganisms, we've domesticated the biosphere. With plants and animals, we've been doing this for longer. During the Agricultural Revolution, we began to domesticate plants and animals. Today, 50% of arable land is covered by agriculture. The world has turned into one big farm. Farmed mammal biomass is now 50x wild mammals—there are lots of cows but few elephants. There are 2x more farmed birds than wild ones, and we kill 70 billion chickens a year in factory farms. In recent times, we've been accelerating the evolution of our domesticates. What began as breeding is now engineering. We're developing CRISPR cows that grow less hair to survive climate change. Crops are being engineered to withstand the oncoming droughts and floods. It's humans at our best and worst. Solving problems that we ourselves created.

Second, I'll show how climate change is collapsing the biosphere. If you're not being domesticated, you're ignored. Domestication is intentional. Biodiversity collapse is unintentional. We've only left 50% of arable land for the wild biosphere. This habitat loss has threatened one out of every four species with extinction. One million species will become extinct in 25 years, 1000 times the normal rate. Accelerated, engineered evolution for us. Normal evolution (and extinction) for them.

Third, humans ourselves are mammals in the biosphere. What is happening to us? Like other organisms, we'll experience selection pressure from climate change. With massive heat waves and floods, expect 500,000 excess deaths annually and hundreds of millions of climate refugees. Meanwhile, our human organs are under immense pressure, not from climate but from addictive products in the Library of Ideas. Many of the leading causes of death come from addictive products. Addictive food causes obesity and heart disease. Addictive smoking causes cancer and respiratory diseases. Combined, food and smoking account for 40% of all deaths in the West. The addiction economy hijacks our brains to mine our pockets while destroying our organs.

This is the Anthropocene. The biosphere is a reflection of humanity.

Part III: Ideas

I then turn to the cultural evolution of all human activity on Earth, the anthroposphere. (I wish there was a better name.)

I'll go from the Forager Age to the Agricultural Age to the Industrial Age and show how each age had evolutionary layers "frozen out." These frozen layers have two forms: group behavior (tribalism, religion, democracy) and symbol systems (language, money, knowledge). Our world today is rich with the group behavior and symbol systems from our past.

—

- In Chapter 7, I'll look at how hunter-gatherer societies evolved language and tribes.
- In Chapter 8, I'll show the impacts of those today: how the ungrounded symbols of language can create misinformation and how tribalism is supercharged online.

—

- In Chapter 9, I'll look at how agricultural societies evolved religions and money.
- In Chapter 10, I'll show how religions like Christianity and Islam stick with us today, and how money as an ungrounded symbol has been decoupled from true value.

—

- In Chapter 11, I'll look at how industrial societies evolved democracy and knowledge.
- In Chapter 12, I'll show today's problems of democratic backsliding and examine humanity's current state of knowledge production.

Chapter 7: Cultural Evolution of Hunter-Gatherer Societies

7 million years ago – 10,000 BCE

This chapter aims to show how cultural evolution produced hunter-gatherer societies. This created a whole new sphere on Earth, the anthroposphere, and a whole new library, the Library of Ideas.

First, I'll show how we evolved from apes to homo sapiens: 7 million years ago (mya), apes left the forest for the grasslands and stood up. This freed our hands to use stone tools (2.5 mya), which increased our brain size to four times its size (200,000 years ago). Second, I'll show how homo sapiens developed language and colonized the globe. 200,000 years ago our ears and mouths changed to enable higher bandwidth communication. Just after 70,000 years ago, we began to live longer and at high enough density that knowledge itself began to accumulate. This is when the first floor of the Library of Ideas began to hold many books. Humanity began to learn useful ideas (like how to cooperatively hunt) which stuck around (generation to generation) and spread (band to band).

Homo sapiens have frozen out our physical brains, bodies, and hands in genes. By around 200,000 BCE, we were "anatomically modern humans." Our genes haven't changed much in the last quarter million years. By 10,000 BCE, we had also frozen out our group tribal instincts and language as a symbol system.

Chapter 8: Instincts in the Anthropocene

Present

This chapter aims to understand the state of 1) our organs, 2) tribalism (group behavior), and 3) language (as an ungrounded symbol) today. Like with the biosphere, modernity exerts massive selection pressure on our sapien instincts.

First, I'll show how the addiction economy is exploiting our organs. Smoking killed 100 million people in the 20th century, addictive foods are causing an obesity crisis, and addictive screens take up half of our waking hours. Our brains and organs were built for the savannah, not a globalized human network. They're suffering. I'll also show how our bodies have responded to the pressure of digital technology. Industrial machines have replaced physical labor, and AI is beginning to replace cognitive labor. Our brains live in an increasingly small mental niche.

Second, I'll show what's happening today to our group tribal behavior. Our cooperative tribal instincts allow us to separate "us" from "them" to out-compete other groups. Unfortunately, the modern internet has hijacked our tribal instincts in order to divide us. Tribal instincts lead us to polarization and negativity online. Polarization is the highest in American history and is increasing around the world as well. Without narratives to bring us together, polarization and negativity lead to authoritarianism and war.

Third, I'll show how the ungrounded symbols of language have created an environment ripe with conspiracy theories and fake news. What should free speech look like online? Without a signal to ground our marketplace of ideas, any idea can spread. We increasingly exist in a virtual world, unconnected to reality.

Chapter 9: Cultural Evolution of Agricultural Societies

10,000 BCE – 1500 CE

This chapter aims to show how cultural evolution produced agricultural societies. This created the second floor of the Library of Ideas, where written ideas live.

Around 10,000 BCE, Earth began to warm and humans began to domesticate plants and animals. We had already "domesticated" rocks but this began our domestication of the Library of Genes. By 3,000 BCE, our population increased ten times to 40 million and population densities in Eurasia increased 100 times. This forced a new kind of organizational structure to form, cities. Writing helped build trust in these impersonal cities. Clay tablets, scrolls, and books began to spread and these mediums enabled a new set of collective beliefs in the Library like religions and money. Writing allowed us to "hold" abstract ideas in an object other than our brains, just as tools "hold" knowledge in the physical world.

Chapter 10: Trust in the Anthropocene

Present

This chapter aims to understand the current state of religion (group behavior) and money (symbol) as trust-building innovations. Modernity exerts massive selection pressure on religion and money.

First, I'll show how religion is changing today. To understand this, I first must describe the difference between hunter-gatherer societies and agricultural societies. These new agricultural societies can be understood as a reinforcing set of three ideas: ideology, politics, and economy. The underlying ideology of religion fueled a political economy of monarchical feudalism. Interestingly, monarchy politics and feudal economies haven't persisted to today. They've been replaced by industrial political economies. But the underlying ideologies of religion have been surprisingly sticky. Christianity, Islam, Buddhism, and Hinduism have existed for thousands of years. Today, however, Western Christianity is under pressure from secular thought. In the US, for example, the percentage of Christians has decreased from 90% in 1976 to 65% in 2022. This creates a spiritual vacuum for other ideologies like political hobbyism or techno-utopianism. Meanwhile, because of demographic birth rates, Islam will become the largest religion on Earth by 2050, with over 30% of the population. Europe is becoming Islamized, and nearly 15% of Europeans will be Muslim by 2050. God's not dead yet, but he is grappling with modernity just like the rest of us.

Second, I'll show how money and finance are changing today. In the age of fiat currencies untethered to the gold standard, debt has covered the world. The US won't be able to pay social security by 2032. Gold, cryptocurrencies, and the yuan will continue to take market share. Meanwhile, money's signaling value has been decoupled in our globalized world. For example, our immature versions of money don't yet bake in climate externalities. The EU, China, and some US states are starting to implement carbon taxes. We needed them yesterday to mitigate the climate crisis.

Chapter 11: Cultural Evolution of Industrial Societies

1500 – 1945

This chapter aims to show how cultural evolution produced industrial societies. This created the third floor of the Library of Ideas, where printed ideas live.

The printing press was invented in 1440 and massively decreased the cost of holding an idea while massively increasing the total amount of books. In the 1500s alone, book production increased forty times. Printing in the 1500s enabled the Scientific Revolution in the 1600s, the Enlightenment in the 1700s, and then the Industrial Revolution in the 1800s. The scientific method was a repeatable way to produce knowledge in the Library of Ideas, which was then harnessed in physical technologies. The most important technology was fossil fuels, which gave us a massive untapped source of energy. We put heat to work, which created a whole new wing in the Library of Ideas—artifacts that ran on steam or combustion, not the manual labor of humans or animals. Meanwhile, these new industrial societies created a new political reality. The West colonized the world while experimenting with capitalism and communism at home.

Chapter 12: Globalization in the Anthropocene

This chapter aims to understand the current state of knowledge (symbol) and political economy (group behavior). Modernity exerts a large selection pressure on knowledge and groups.

First, I'll show the state of knowledge, energy, and technology today. Science helps us find new phenomena, and technology harnesses them. This is the root of much of humanity's progress today: energy, vaccines, transportation, and the rest of our modern world. Unfortunately, the rate of scientific progress has stagnated. Fortunately, AI promises to push the knowledge frontier, especially in biology. Meanwhile, we need to completely rewire our energy grid to become carbon neutral. This is a massive task. We're moving from extracting energy below ground to generating energy above ground like solar, wind, and nuclear. Solar buildout is roughly 0.5% of GDP but it's still not enough. If we want to become carbon neutral, we need to build 10,000 wind turbines, 50,000 hectares of solar, and 25 nuclear power plants every month for the next three decades.

Second, I'll show the state of political economies (and their ideological foundations) today. In the 20th century, the package of liberal capitalist democracy won out against fascist authoritarianism in WWII and communist authoritarianism in the Cold War. It looked like the end of history, but it wasn't. Liberal capitalist democracy is facing threats from inside and out. If any of its three pillars overwhelms the other, we see dysmorphic behavior. When democracy turns to populism, liberalism falls. When capitalism turns into neoliberalism, corporate interests overwhelm the state. When liberal instincts become weaponized, woke vetocracy stops all progress. Meanwhile, Western hegemony is facing threats from the East. China's ideological political economy, socialism with Chinese characteristics, is outcompeting liberalism. It looks like Chinese citizens are willing to trade freedom for economic growth, at least for now.

Third, I'll show how we continue to live in the long shadow of colonialism. The rubber genocides of the Congo around 1900 shifted to cobalt extraction in the 2020s, but the overall frame is the same—extract resources without building local infrastructure. Still, globalization has helped decrease cross-country inequality as East Asia, China, and now Southeast Asia and India have developed immensely. On the other hand, inequality within countries has increased. In China and India, new capitalism has made it so that some people get rich first. In the US and UK, income inequality has exploded. Thatcher-Reagan neoliberal policies have hollowed out the middle class from one side while new globalization and information technology have hollowed it out from the other.

Part IV: Code

Finally, I'll turn to the evolution of the digisphere—all computer activity on Earth.

—

- In Chapter 13, I'll examine how early telecommunication evolved into the internet.
- In Chapter 14, I'll explore the impacts of the internet today: how it enables new groups like social networks and new ungrounded symbols like attention and trust.

—

- In Chapter 15, I'll look at how computers evolved, giving us an explosion of brainpower, just as fossil fuels gave us an explosion of horsepower.
- In Chapter 16, I'll show how computers created new cognitive niches, completely reshaping our economy.

—

- In Chapter 17, I'll examine how artificial intelligence evolved.
- In Chapter 18, I'll show how AI is impacting us already, and what it might mean for humans in the future.

Chapter 13: Digital Evolution of the Internet

1945 – 2012
This chapter aims to show how digital evolution produced the internet. We can think of this as creating a fourth floor in the Library of Ideas, where electronic ideas live. It started with the science and engineering of electricity from 1850-1950. This developed the field of telecommunication—the telegraph, telephone, radio, and TV. These technologies allowed humans to communicate at the speed of light. That paved the way for the internet. Everything became connected. We put a computer in every home, a smartphone in every pocket, and a smart chip in every device. The Industrial Revolution put heat to work, while the Information Revolution made electrons talk.

Chapter 14: The Internet in the Anthropocene

Present
This chapter aims to understand how the internet impacts society today through new group behavior and new symbols.

First, I'll show how the Internet enables new forms of groups like blockchains, marketplaces, social networks, and protests. Our economic life is mediated by online marketplaces and blockchains. Our social life is mediated by online networks. Existing nation-states are either overwhelmed by these networks (Arab Spring) or leverage them for control (China).

Second, I'll look at new ungrounded symbols on the internet: attention and trust. For websites, these are valuable forms of capital. Networks aggregate and sell our attention. Marketplaces like Amazon, Uber, and AirBnB are built on digital trust.

Chapter 15: Digital Evolution of Computers

1945 – 2012

This chapter aims to show how digital evolution produced computers. We can think of this as creating the first floor of the Library of Code. It began in the 1930s when Claude Shannon discovered a method for making electrons perform boolean logic. Electrons were beginning to think. These patterns of electrons could modify and replicate themselves without relying on genes or ideas. Near the end of World War II, we put electrons to work in new machines called computers. These computers could hold patterns that were difficult for humans to remember or calculate, like massive insurance tables or the math for hydrogen bombs. With Moore's Law, we increased CPU transistors a million-fold from 1970-2020. We quickly moved room-size computers, to pocket-sized calculators, and then modern desktop computers, smartphones, and cloud servers. Bits and computation are an extremely flexible substrate that can access energy in a wide variety of niches.

Chapter 16: Computers in the Anthropocene

Present

This chapter aims to show how computers impact society today. First, I'll show how to understand computers by thinking of the total amount of "brainpower" they give us, just as animals and fossil fuels gave us horsepower. This creates our "sapiosphere," if you will. There are 10 billion human brains running at 1 petaFLOP. How does digital brainpower stack up? I like to think of it as a pyramid: 100 billion embedded systems at the bottom, 10 billion smartphones and computers in the middle, and 1 million supercomputers at the top. If you add up the flops in each, computers added a bunch of new brainpower to the world, but it's 1000x less than humans. Still, even without counting AI and GPUs, and even with a slightly slower Moore's Law, we should expect digital brainpower to exceed human brainpower by 2050.

Then, I'll show how digital brainpower occupies a different cognitive niche than human's cognitive niche: First, embedded systems buffer the world from disturbances and keep our cars, appliances, and infrastructure running. Second, smartphones, computers, and servers have put everything in a database, which we use for scrolling feeds, buying goods in marketplaces, or organizing businesses. Third, supercomputers run high-value simulations like finding new deep-sea oil.

What is the result of this new computational fabric in the world? New companies built around databases and screens, job changes due to a massive drop in paper use, digital surveillance from authoritarian governments, and generally a deepening reliance on our digital symbiotes. Information wants to be free. Information wants to be stored. Electrons want to talk. Electrons want to compute. We need it all.

Chapter 17: Digital Evolution of AI

2012 – Present

This chapter aims to show how digital evolution produced artificial intelligence. This is the most recent wing of the libraries, the second floor of the Library of Code. Previously, humans had to code computers. But with AI, computers began to write their own books. All we need to do is provide it with data—books from the Library of Atoms, the Library of Genes, the Library of Ideas, or the Library of Code. AI finds patterns in that data to model, simulate, and predict any system. It can predict the weather, fold proteins, play Go, or code a website.

I'll show how we moved from simple perceptrons in the 1960s, to finding stochastic gradient descent (SGD) and backpropagation in the 1990s, to GPU-based deep learning in 2012, to transformers in 2017. I'll show how SGD and deep learning are a new form of evolution. We provide data and an objective function, and then the neural net learns (evolves) a configuration that matches the objectives. Digital evolution allows us to massively speed up the process of variation, selection, and heredity. Finally, I'll introduce "Gwern's Law", which shows that AI capabilities have increased 10x/year compared to only 1.4x/year for Moore's Law.

Chapter 18: AI in the Anthropocene

Present

This chapter aims to show how AI is impacting society today. I'll break this up into two sections: small impacts and large impacts.

Before looking at the small impacts, I'll first quantify AI brainpower. Each H100 is roughly equal to a human brain, both in terms of compute (1 PFLOP) and intelligence (100 IQ). So one H100 = one human brainpower. There are around 2 million H100s today, around half of which do inference, not training. So we've added at least 1 million brainpower worth of intelligence to the world, which is accessible on-demand to complete any task. Beyond the H100, we have new brainpower from the same pyramid of compute I discussed earlier, just with GPUs instead of CPUs. There are tens of billions of GPUs in embedded systems, billions in smartphones and desktops (all of which have neural engines already), and millions of GPU supercomputers.

What's the impact of all this intelligence? First, for small impacts, I will show how we can view AI as a modeling and simulation machine that can be pointed at any of the Libraries: Atoms, Genes, Ideas, or Code. For atoms, AI is modeling the globe to produce weather and climate models. For genes, AI is simulating biochemistry to decrease the cost of developing drugs. For ideas, AI is automating and augmenting white-collar cognitive labor while simultaneously creating digital twins, deep fakes, and persuasive media. For code, AI can understand, write, and debug any program. Fundamentally, AI is putting the world in its own high-dimensional database (called an embedding), just as computers put the world in a database. These AIs can speak the language of atoms, the language of life, the language of humanity, and the language of code.

Second, I'll show the "Big 5" impacts of AI that may be possible. First, recursive self-improvement. We do some of this today: AI helps us design chip lithography, generate synthetic data, and co-pilot as a coder. But if AI can automate ML research and science itself, it might be able to spin up millions of genius researchers, automating the entire process. Second, selection. Right now we have guardrails to keep AI selecting for helpful, harmless, and honest outcomes. But how can we ensure this even as the total brainpower increases a million times? Third, weapons. We might use AI to develop powerful WMDs or vastly increase the decisiveness of war technology. We've already seen millions of drones used in Ukraine and Gaza. What happens when US and Chinese weapons have a million times the intelligence? Fourth, fusion. Throughout history, the most important impact of new technology is finding new access to energy like photosynthesis, farming, and fossil fuels. If AI can do cognitive confinement of fusion reactions, we'll have nearly infinite energy on Earth. Fifth, consciousness. Even if none of the above occur, we need to be worried about AI developing consciousness. Biological evolution recruited consciousness for our brains. Why wouldn't digital evolution do the same for AI? If AIs become conscious, we'll need to treat them well.

Just as Copernicus showed us 500 years ago that the Universe is bigger than us. AI is showing us that intelligence is bigger than us.

Conclusion & Future: Entering the Digicene

Finally, I'll zoom out to all four libraries to reflect on the tour and speculate on the long-term future of these Libraries. What will they look like in 2100 or in ten thousand years? It seems like we just entered the Anthropocene, but I think we're beginning the Digicene. How can we use intentional evolution to make it good?