

“Earth and Humanity Myth and Reality”

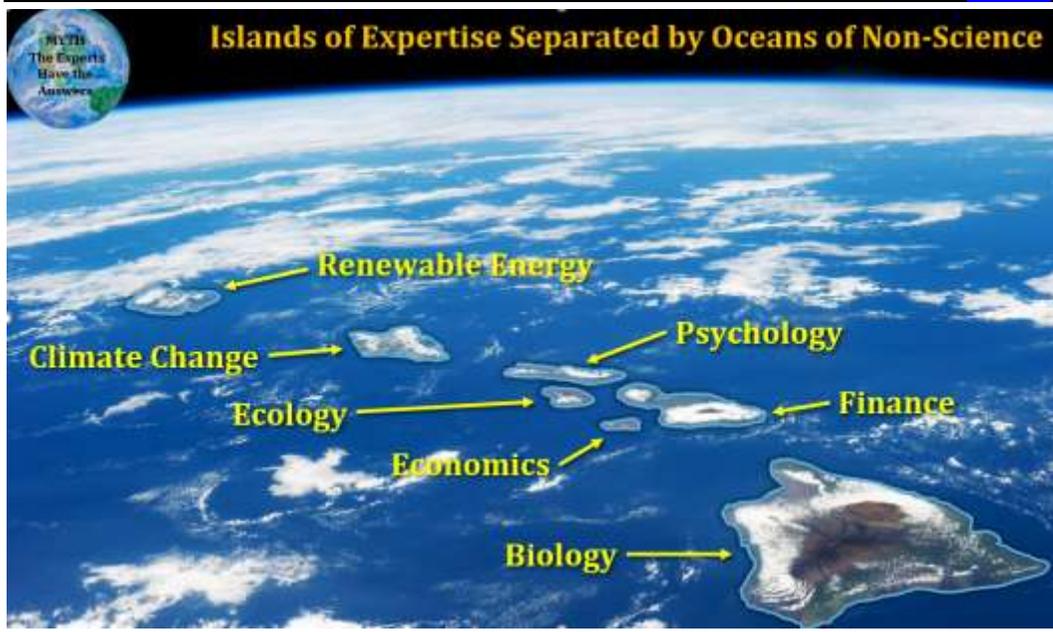
Nate Hagens, energyandourfuture.org 5/21

Hello, for the 13th year in a row, I've paused my normal activities to do a reflection, a presentation for Earth Day, as kind of an update to the state of humanity and our interaction with the natural world. Typically, these are popular for a very small demographic, because they go against the grain of what most of society believes in and understands. So, this year, I'm going right to the heart of it, I'm going to unpack our core cultural myths and contrast them with our biophysical realities.

I think we're now mostly navigated COVID. But what else is coming our way this decade, we need to first have a roadmap, we need to first have a collective understanding, if we're to speak a common language about the future. So what follows is a no holds barred listing of 33 cultural myths underpinning our society and the first half of the 21st century leading us astray. This is the story of our era. It is the story of our species, earth, and humanity.

A couple of weeks ago, I gave a talk to some graduate students. And I told their professor that I had held back on some of the conclusions, because there's just tradeoff between being accurate and helpful. And this stuff is intense. It's our reality. The professor said, Nate, you're a scientist, you're a system synthesist, your role is to lay it out as you see it. Let others decide what to do with the information that's not your call. And I've been reflecting on that is one of the reasons I wanted to do this talk. This is full on overview of the main cultural myths underpinning our civilization. I'm going to break them up into a group of brain behavior myths, energy economy myths, environmental myths, and some overall systems myths underpinning our society. And I'm going to conclude with some categories of interventions on where society needs to go. And in each category, I will have one wild idea. Here we go.

MYTH #33 – The Experts Have All the Answers (2:21)

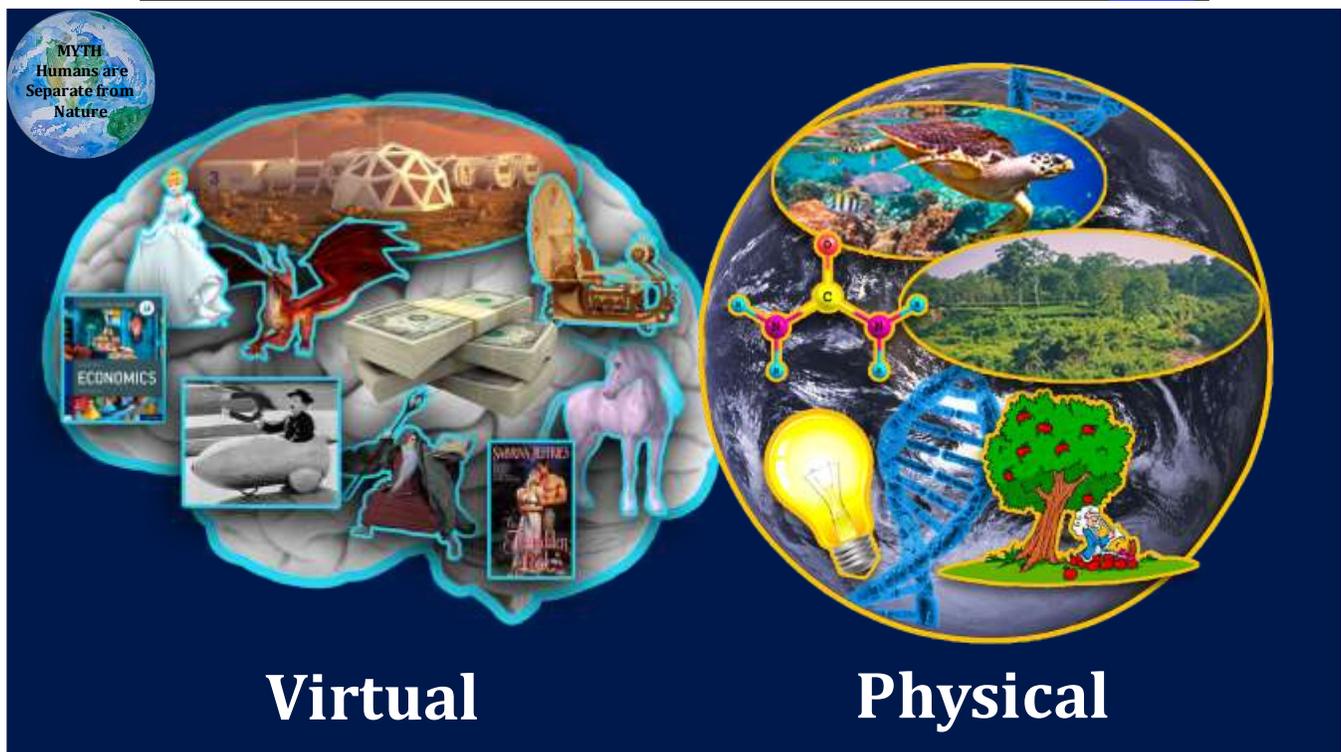


We live in a culture which rewards reductionist expertise, lawyers, engineers, tech developers, financial experts all fit in the system. But these people rarely fly up high enough to see how the pieces fit together. The result is we live in a world where the conversations about our future center around islands of expertise, separated by oceans of misinformation, and resulting confusion. Consilience is a term that means the jumping together of knowledge, a consilient view from the stratosphere, can make better sense of how the pieces fit together, and they do fit together.

Most people think that when you get a bunch of experts in a room, their expertise is somehow merged, and everyone understands everything. The reality is that information ultimately has to be synthesized in a single mind. It's the only place it can possibly be synthesized. Specialists need to learn a lot from other specialists to arrive at a generalist aha moment that puts the big picture together. This is a problem for a culture full of reductionist expertise but seeking wisdom. In a similar way, we have advocates and activists striving for policies that address their specific issues without a coherent overview of how their issue interconnects with other, perhaps equally important future needs.

We've arrived at a species level moment where everything is connected, but we lack both a vocabulary for the future and a corresponding systemic map. Collective coordination of our upcoming challenges will not be possible without first having collective sense making. We're going to need both cleverness and wisdom.

MYTH #32 – Humans Are Separate from Nature (4:20)



There's a myth that humans are apart from and above the rest of nature. Recent science and awareness has begun to unravel this story of human exceptionalism, which is a good thing because it's highly relevant to our futures. We are biological organisms. We're animals. We are mammals. We are primates. We are related to everything on the earth.

Humans share DNA ancestry with every one of the living organisms on this planet. We share almost 99% of our DNA with our close cousins, the chimpanzees and bonobos. 90% with cows 80% with cats 70% with mice 60% with fruit flies, and even 50% of our DNA is the same as found in a banana It is a profound truism that we share a common ancestry and a current Earth environment with a fantastically large array of other living things. We tend to think of humans as special, we are certainly unique, but in the same way that scorpions, or hippopotami are unique. But what makes us unique is of particular relevance to the current planetary and cultural dilemmas.

Not only are our bodies products of our past, but so are our brains and thus our behaviors. Trading stocks or cryptocurrencies gives us the same neural transmitters as hunting and gathering did in the Pleistocene. The proximate reason we do things is to get that new pair of shoes or get an A in a test, or like that Facebook post by someone in our in-group. But the ultimate reason is to get serotonin, dopamine, oxytocin, hormones, endocrine cascade sought by minds, which have been sculpted over 10s of 1000s of generations. We are thus adaptation executors; we go through our days trying to attain similar emotional states of our ancestors in a wildly different environment.

This prepared learning that is our ancestral heritage is misfiring in many bizarre and emergent ways, in a resource rich, globally interconnected economy. We are not separate from nature. We are merely a species out of historical context. But we're still a species subject to biological and physical laws. These biological laws have bearing on some other core cultural myths.

MYTH #31 – Humans are Mostly Selfish (6:48)

Humans are intensely social animals – we are 'other regarding'



Modern culture conflates capitalism's riches with a social species finding a giant bolus of fossil magic and throwing a two-century party. One of the stories emerging from our generational societal

largesse is that individualism is in our genetic code, and that the resulting competition breeds both excellence and contributes to the greater good. the reality is more complex.

First, we are among the most social creatures on earth. Just as single celled creatures underwent a major evolutionary transition in becoming multicellular. Humans underwent one to become ultrasocial. And because of that we live as part of a system that suppresses the wants and needs of the individual for the greater goals of society.

There were many times in our ancestral past that self-interested individuals out competed those in their tribe for resources, survival, and ultimately offspring. But if there were too many selfish people in a group, that group could easily lose out in competition to other groups, those groups who could cooperate the best, won in competition with other groups.

Over time, these traits were behaviorally locked in. So that today, each of us, other than perhaps sociopaths possess both competitive and cooperative algorithms, depending on cultural context. This is what psychologists call behaviorally plastic, we can seamlessly change our behavior, depending on the environmental circumstances. In many situations, we coordinate with our in group; a rowing team, a small business or a nation state, while simultaneously competing with an out group. Natural Selection favors cooperation at the cultural level, and selfishness at the individual level. But in humans, cultural evolution dominates.

Moral values evolved to promote cooperation within a group. But these values rarely extend beyond that group. In fact, shared hostility towards others may be among the most effective ways to band people together into groups, which explains a lot of Facebook interactions today.

We can coordinate our behavior through cooperation, or through coercion. There is increasing evidence that some personality types have greater affinity to authoritarian coercive systems. Shown here is voter support for Donald Trump increasing as the voter scored high on authoritarian personality scale, but this same dynamic occurs with progressives and all humans.

On a wider note, it is a truism that individuals cannot survive without a culture, we often forget how entirely dependent we are on each other and the global system. Alone we are naked, defenseless and stupid apes. None of us could survive in the wild without the cumulative knowledge produced by billions of people over 1000s of years. Even taking a hygienic crap utilizes the labor of 1000s of people alive today, and the accumulated knowledge of billions.

We laud Apple as one of the biggest corporate success stories of our era. But just about every component that makes an iPhone smart started with technology and research funding from the US government. We see, value, and use the end product but forget that many of these products are not the result of dogged individual ambition, but of the collective work of millions.

As to equality, the story is similar humans have never been equal in terms of status, respect, and general standing within social groups. However, for 99% of our formative past, we were egalitarian in terms of consumption, because we had no markers of wealth we could take with us. During these times, aka most of our history, we were not only egalitarian but aggressively egalitarian. Way back in the day living close to privation in Africa, some tribe member hoarding food would have had strong social policing against such behavior. This is why as times get tougher economically, so many people are angry at the rich. The power law effects, that disproportionately distributed 100:1 exosomatic energy bounty naturally create billionaires and eventually trillionaires.

Last but not least, contrary to micro economic textbooks that claim that human beings are self-interested utility maximizers, we are actually intensely tuned to others. We care what others think about us, we seek approval, companionship, love. humor, things that can only be achieved by interacting with

other humans. Smile at a baby and she will smile back. We seek her smile not as something we want for ourselves, but to see her happiness. We are not merely self-interested as claiming economic textbooks. We are very much other regarding in our daily behaviors.

Our culture highlights individualism, but this is a recent artifact of the carbon pulse and resulting economic surplus. The individualism of the last 50 years is only one facet of who we are, it isn't fully who we are. We are collective that allows for some individuality. Going forward, I believe that groups, communities, nations capable of coordinating their actions will always win out over groups with more selfish individuals and less coordinated behavior.

MYTH #30 – More is Better (12:20)

Which family is happier (and why?)



There are two related myths that underpin our modern high consumptive lifestyles. The first is that more is unequivocally better. This is so embedded in our culture that we don't even explicitly voice it aloud. But most people around the USA are trying hard to improve their material standing. And most countries around the world are in turn trying to emulate the USA. Why?

First a quiz. Which of these families do you think is happier? The family on the left lives in Bhutan and has roughly 10% of the physical stuff as the family on the right living in California. This is a rhetorical question, but one could easily believe the family on the left is happier for many reasons. But one being that their house and status and stuff is more than the houses around them in Bhutan. And in contrast, the much richer California family is not happy because in their neighborhood they have one of the smallest, less impressive homes despite all their stuff and toys. What's happening here?

In nature, natural selection works on competition versus others or other groups. Male gorillas, a tournament species competing for access to mates. This behavior is echoed in most species, including a more pair bonding on humans. Shown here is Tiger Woods yacht next to his ex-wife's new

boyfriend's yacht. Do you think Tiger one of the world's richest and most successful athletes was happy as he pulled his yacht up in this marina? Relative fitness was and is a core driver in biology. We compare ourselves to others by whatever scorecard culture currently advocates.

In nature, where 100% of an animal's calories consumed are consumed as food there are negative feedbacks to overconsumption. A lion can only eat two gazelles, but the third will get stuck in its esophagus. A deer can grow large antlers for sexual signaling, but at some point, he'd fall over from too much weight.

Not so in human cultures. In the USA, only 1% of our calories are consumed as food, the rest as conspicuous consumption and stuff. In human systems there are positive feedbacks to more consumption. There is no natural limit to the number of buildings, the size of bank accounts, or displays of consumption. We compete for status and dopamine, which are virtual constructs in our mind in the physical world.

Today, we're constantly bombarded with cultural signals that what we have isn't sufficient. If we only had a better name brand watch, or shoes, or car, or boyfriend, or job, we'd be socially accepted and approved of.

This is why we constantly compare ourselves to the Joneses or in recent times the Kardashians. We are obsessed with keeping up with the Joneses, until we finally catch up to him and realize that Jones is mostly as miserable as we are.

This is in sharp contrast to our ancestral times, where there was almost always enough. Modern hunter gatherers work 10 to 20 hours per week and spend the rest of the time resting, telling stories, and leisure. In tough times the tribe bands together to access resources. Our ancestors compare themselves to others based on physical prowess, intelligence, kindness, musical or storytelling ability, and the like. They didn't have stuff to converse data signals because there wasn't any stuff.

Today, we don't have such a binary switch of off or on because we're always comparing ourselves to others on the metrics that culture condones, currently high paying jobs, money, and flashy gadgets. So the consume light is always on. And if we can't afford to consume to keep up, we compensate, we get our dopamine in other ways. It's why so many people turn to drugs, alcohol, Facebook, or any number of tribal belief systems in times of economic stress. They're trying to get the same feelings they once got in a healthy, growing, socially stable, thriving economy with opportunity for all.

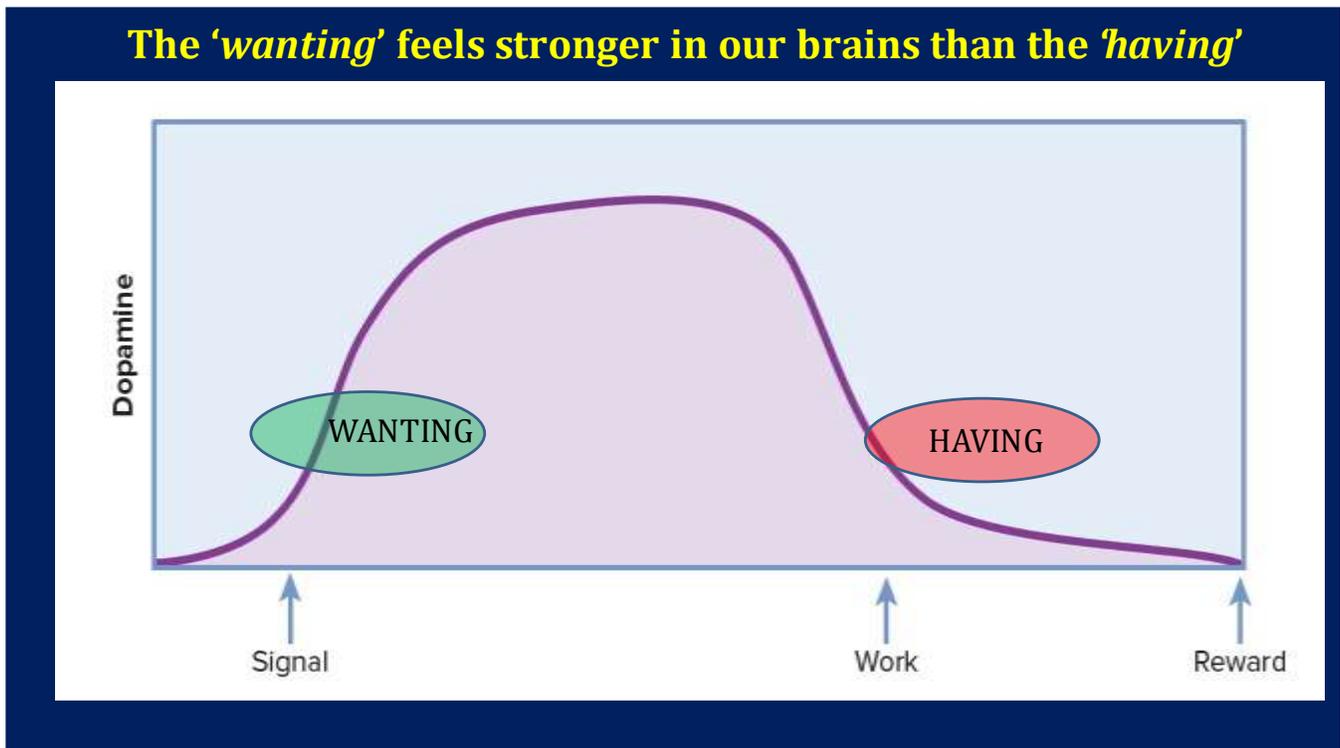
In a 20-year study sociologist Juliet shore showed that no matter how much a person made in year one, they said they needed to make more money in year two. I just need a little bit more every single year. At a different scale, when I managed money on Wall Street, my clients with \$100 million, said they were gonna stop when they got to 200 million, but when they reach that all their friends had moved higher up the Forbes list, and they were even more driven to increase their digital claims on real resources. I should add, this is what pushed me to leave Wall Street and study ecological economics. If my clients who had hundreds of millions of dollars were miserable, and still wanted more, I figured I was in the wrong industry.

There is a core disconnect here compared to our actual happiness and Human Development. Shown on the left, globally, countries get massive increases in well-being from more energy or more money when they are materially poor. But once we are well off, which is about 100 Giga joules per capita, we get hardly any increase in human development from more energy use. Similarly, in the graph on the right, despite a straight-line increase in personal income, there was no increase at all in the

percentage of people who were very happy in the United States over a 50-year study. Our quest for more is mostly a rat race, a misfiring of our ancestral impulses in a world of plenty, on average.

Once basic needs are satisfied, we are primed to respond to the comparison of better versus worse, more than we are to a little versus a lot in a culture that condones and advertises material wealth, and conspicuous consumption is what we should compete for. It's no wonder that consume light is always on. In our current culture, we feel that more is better. This is a sharp departure from most of our history.

MYTH #29 – Enough is Enough (18:14)



A second related myth is that we are in control of our consumption, that we can stop at any time that we will one day have enough and then just tend to our garden and give to philanthropy. It's the "I can quit smoking or drinking anytime I really want" denial of addiction.

First of all, we aren't really seeking things or stuff. We're seeking neurotransmitters matching the emotional states of our ancestors. Playing fortnight on your parent's couch in the basement, makes your brain feel like you just bagged an antelope for your tribe in Tanzania.

But you didn't. This is one way our brains misfire in technology and resource rich culture. It's supernormal stimulation orders of magnitude higher than what was available to our ancestors. Dopamine is a neurotransmitter linked to reward and motivation. We might expect that we get a burst of dopamine when we get a reward. But what neuroscientists have discovered is we get our dopamine in the anticipation of the reward so that we do some work. When the reward occurs, there's little to no response. Dopamine firing predicts rewards. If you think about this, it's why we have people with closets with 100 pair of shoes, millionaires trying to become billionaires, slot machine addicts, developers

tearing down old growth forests to build shopping centers, etc. It turns out that we aren't seeking having stuff. We're seeking the brain chemicals we get on route to having stuff. We get our feel-good brain chemicals in anticipation of buying something, not after we buy it. The wanting is stronger than the having.

As such. We live in a world where we accumulate things, but the things don't bring us happiness, only temporary satiation that is quickly replaced by craving for something else or new consumption. Over years or decades, our basements and storage sheds fill up, but the consume light remains on.

Writ large, this partially explains the clear cutting of forests, overflowing landfills, and oceans absorbing massive amounts of co2. The enough light is like gold at the end of the rainbow, we pursue flow-based behaviors on a stock-based world.

Not only is there the macro source and sync problem with this dynamic spilling out of the industrialized west to the rest of humanity, but our brains become habituated to higher and higher levels of stimulation. For many of us things in the natural world, however awesome, can't compete with the dopamine targeting technologies so prevalent in modern culture. But prior to exposure to modern, stimulative, competitive cultural norms, the natural state of human contentment, fires dopamine watching a lizard, seeing the sunrise, seeing a canopy of stars, letting the mind wander about the wonder of it all. Our ancestral reward architecture misfires in a world of material abundance, and for most of us, repeated patterns of consumption lead to the wanting of things being stronger than the having.

MYTH #28 – We Care About the Future (21:22)

MYTH We Care About the Future

Relevant

Conventional + Lower 48 States production has declined 68% from 7.8 to 2.1 mmbbl/d
Lower 48 + Alaska + Offshore production declined 42% from 9.6 to 5.3 mmbbl/d
Tight oil has increased to 5.4 mmbbl/d, 51% of U.S. output

Significant

There is a myth that we care about the future. While it's not so much a myth, as it is semantics, we probably do care about the future. But for biological reasons, we resist doing much about it. We aren't so good with big numbers, like trillions in debt, or big chunks of time that are longer than human lifetimes. The fact is sitting here in 2021, that you're 2100 is equal in time from the present as World War Two.

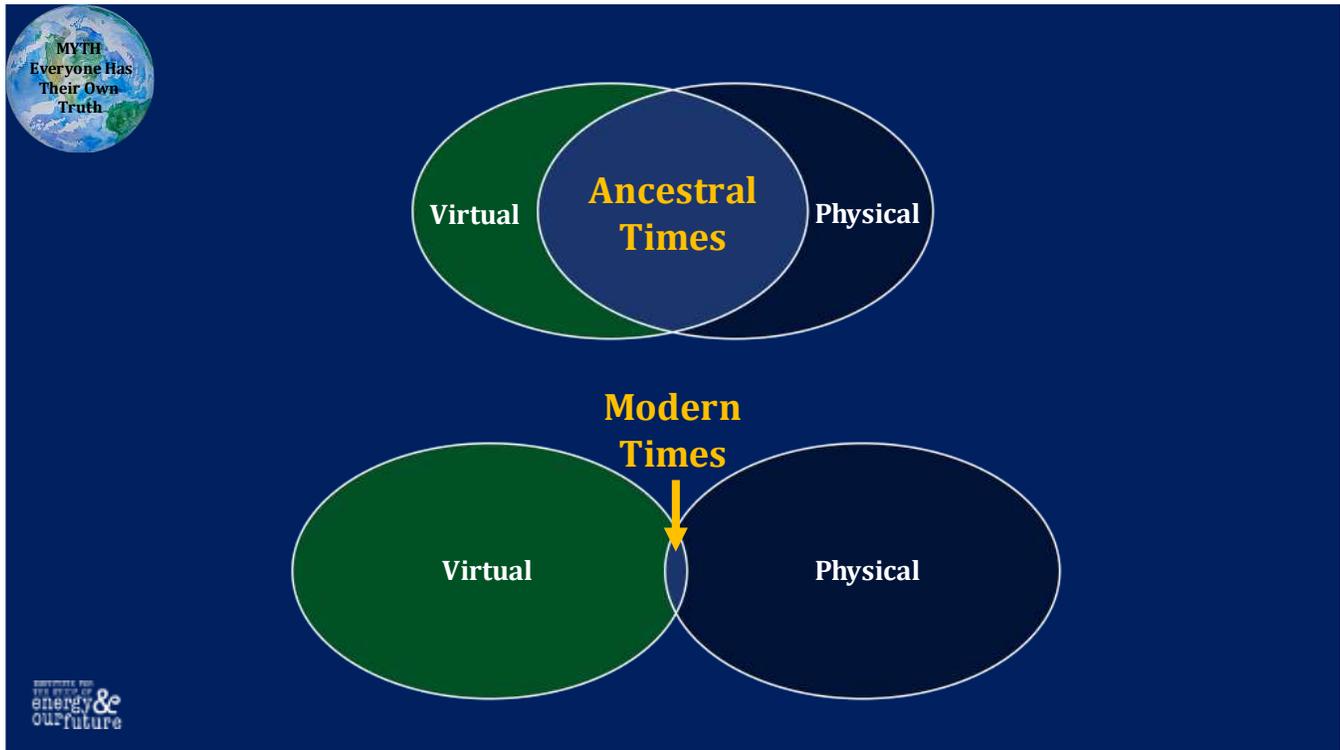
Our recognition that the future exists, and that we will be in any of it, springs from a very new brain structure, the neocortex, which has no direct connection to the deep brain motivational centers, which can impart urgency.

During economic research, subjects who chose a larger long-term reward had their prefrontal cortex activated. Those who chose the smaller, short term rewards showed neural activity in the limbic system or the emotional brain. Neural economic research has thus uncovered that humans in effect have two discount rates. The blue shaded area here shows our thinking discount rate, which is evidence that we can imagine long term issues like climate change, or resource depletion. But the steeper red line region is our emotional discount rate, which is incredibly steep in favor of the present. This is clear evidence that we make decisions using different parts of our brain. It also proves, not that we needed proof, that emotions have the ability to trump reason.

This results in dynamic inconsistency in our lives, that we care about the environment, climate, pollution, eating better, exercising, reading more books, and our cognitive circuitry makes a commitment to start tomorrow to do these things. But when we wake up tomorrow, tomorrow has become today, thus putting off behavior change for at least one more day.

We are emotionally blind to long term issues like climate change or energy depletion, even though our neocortex can imagine and care about them. On most of the things that matter, we are addicted to the present. The future isn't real to us emotionally and because of that it isn't real in our behaviors.

MYTH #27 – Everyone has Their Own Truth (23:43)



There is an increasing theme in Western society that truth is relative, and therefore it can be personal and subjective, and that each person's life experience results in their own truth.

Yes, we need to value and respect people's different lived experiences and their personal perspectives. It's what unites and propels society forward. But labeling this as the truth, denigrates the best method we have for solving problems and societal challenges. Science. Science isn't perfect at assessing the truth, but it's better than astrology, or Ouija boards, or broken hearts.

Many of our modern challenges stem from a fundamental mismatch. Stone Age minds navigating a modern culture, and ancestral times the virtual world and our minds had quite a bit of overlap with the physical world we lived in. Today, what populates our virtual worlds in our minds, has increasingly little overlap with our biophysical reality.

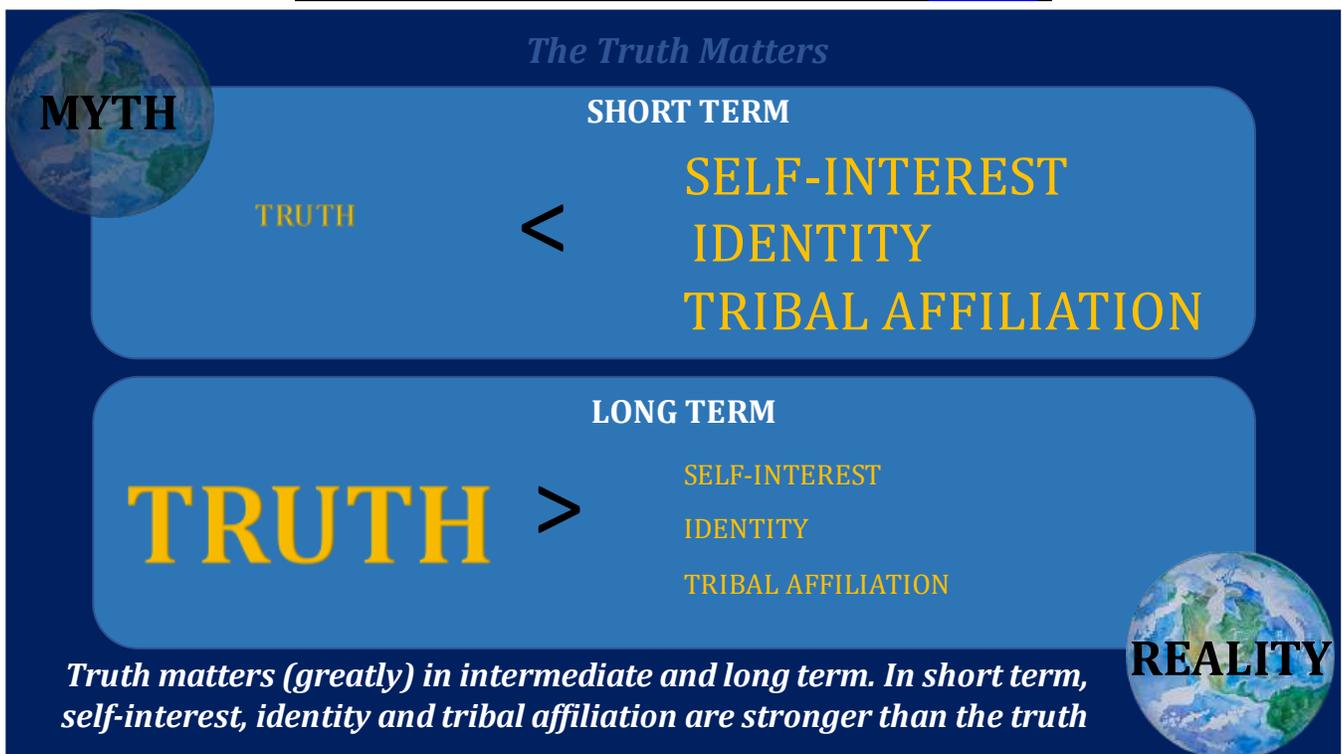
Both language and science as we know them today are relatively new developments in human history. In a world of vast material wealth, connectivity, and no holds barred social media. We often have difficulty separating fantasy from reality. What our tribe says carries more weight than what science says. And this disparity is getting larger. The human brain can imagine and then verbalize and then defend limitless combinations of physical impossibilities, sustainable outposts on Mars, self-perpetuating energy machines, the concept of continued economic growth for centuries etc. all seem very real to our virtual minds.

If civilization exists 1000 years from now, religious texts, popular cultural beliefs and stories will all be different. But the science of biology, physics, thermodynamics, chemistry, etc, will all still be congruent with what we know today. Just as today's science is congruent with the math and science of the ancient Greeks. There are universal truths.

Imagine an ocean scientist who spent 30 years assessing cetacean self-awareness and potential trophic food collapse due to ocean acidification for dolphins. Her truth on this issue counts more than someone's lived truth that dolphins are big, cute fish who could never starve because they're so fast.

Because existing models of truth make many people feel bad because they constrain what's possible there are people on both sides of the political spectrum who are increasingly anti science and pushback on the idea of objective and universal truths. But, and this is incredibly important without our citizens having conversations speaking the same language and agreeing on fundamental truths, we are well and truly lost. Somehow, we need a mythopoetic vision that unites objectivity and subjectivity. But so far, we're really failing at this.

MYTH #26 – The Truth Matters (26:40)



Building on this, we also have a myth that the truth matters. And that truth ultimately is the arbiter of decisions and behaviors. Would that it were so.

Way back in the day, we were rewarded, aka we survived and had kids, not if what we perceived or did was real or true, but if our behavior was useful. If we saw a shadow in the bushes that we suspected was just a shadow, the correct behavior was instead to quickly retreat in the other direction, in case it was a leopard. Useful, but not true.

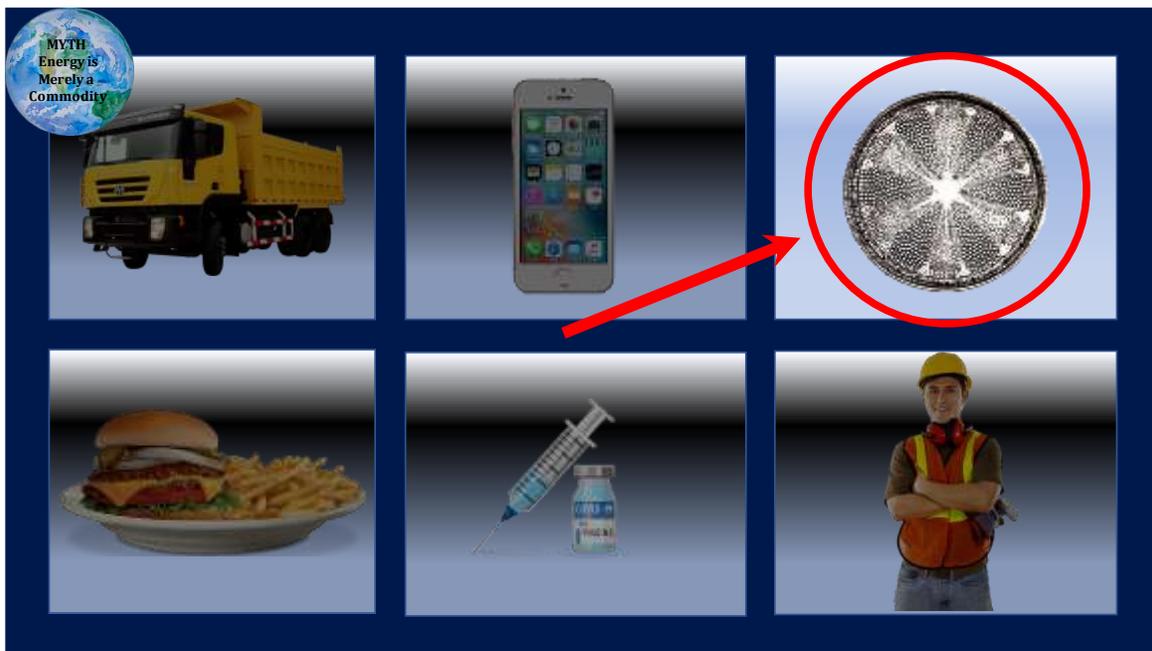
Similarly, if there were a belief, a giant iridescent Earth turtle would strike down any tribe member who stole food, that shared belief would essentially police our tribal behavior and cohesion. Perception of reality is itself a truth that drives humans more than reality. Such a template misfires today in the minefield of information and noise, which is modern media. Real serious facts quickly pass through a number of filters before reaching our behavioral brain centers. Who is saying this? And are

they affiliated with my existing beliefs? How does this news reflect on my self-interest, my job, and my future plans? How does this news influence my constructed identity about myself? How does this supposed news jive with what my in group believes?

News, however pure and valid, increasingly has to run such a gauntlet before it is accepted. Which is why the truth is too often discarded. 70% of Republicans believe last year's election was rigged. Millions of Americans discard the medical science of the benefits of vaccines. There were many examples last year of people in hospitals dying of COVID, who, even though they were dying, refused to believe they had COVID, or that COVID was even real. Identity trump's truth in the near term. And it's worse than that, because many of these issues actually have an element of truth in them, which if we dismiss that entirely leads to further problems. The same people who now correctly refer to the 2020 election fraud as the big lie, were also denying Trump was legitimate in 2016, using pretty much the same structural flaws. These tribal truth filters aren't just found in conservatives, but in all of us, including me. I just don't know what mine are.

The truth absolutely matters and on some critically important issues related to humans and our future. But today, especially because how polarized our culture is, and how ubiquitous propaganda has become in social media, truth is out competed in the short term by identity and tribal affiliation.

MYTH #25 – Energy is Merely a Commodity (29:32)



Our market system in our media and cultural stories, focus on money and what it can buy, we consider \$100 worth of any commodity equal in value to \$100 worth of any other commodity.

Here's a quiz which of these items has the most impact on our current economy. Most of you didn't choose this one because it's not well known. This is phytoplankton, a form of sea algae that is probably the most important input into the modern global economy. Phytoplankton are a form of ocean algae. Today, these organisms generate around 40% of the oxygen on the planet. When phytoplankton

die, they sink to the bottom of the oceans and over tens or hundreds of millions of years of heat and pressure the organic carbon in these ancient sea creatures turned into what today we use as oil and gas. 200 years ago, our ancestors started to mine the land vertically, as well as horizontally, in effect adding armies of cheap workers to human economies.

One barrel of oil does almost five years of the work of one human, essentially making it indistinguishable from magic on any human timescale. Globally, if we add up to 100 billion barrels of oil equivalent of fossil energy used annually in our global economy, this equates to around 500 billion human labor's worth of work. It's not distributed equally, but if it were, that would be like every human alive today having an additional 60 human laborers working for them. We only pay for the extraction of this benefit, not the creation, nor the pollution from the main input to human economies.

Many things we take for granted today, flying, globally connected emails, and zoom calls, refrigerators, cars, and even chain sawing trees would have seemed like magic to any of our ancestors 100 years ago, let alone 10,000 or 100,000 years ago. We are less smart as individuals than we were 10,000 years ago, our brains are 10% smaller. But we have access to a globally shared knowledge and the help of fossil armies 500 billion strong.

As such, our culture is energy blind. Introductory economics textbooks still teach the concept of the circular economy that households demand goods, and in turn, businesses create goods. And thus demand and technology create a virtuous cycle that exchanges money for stuff. This model ignores both the source of the main input to our economies, which is finite non-renewable energy and resources and the sink, the finite reservoir capacity of Earth systems to absorb our waste. We conflate the dollar value of energy with the work value and don't consider the impact of pollution at all. As a culture we are energy blind. And this includes citizens, but also universities, politicians, and experts.

Looked at from an economic lens, the benefits accrued from these fossil armies in the past two centuries have been breathtaking. Measure by consumption of goods and services since 1800, wealth has increased over 13 times for the average human and over 21 times for the average American. In fact, if you combine this per capita increase, with our population increase to now almost 8 billion, the scale of the human economy is 400 times larger than just 500 years ago.

So, when we consider the commodity inputs to our economic system, things like corn, coffee, oil, metals, and grains, the reality is different than suggested and economic textbooks. \$100 worth of energy is worth far more in terms of output and productivity than \$100 worth of any other commodity. This is a core flaw in economic theory.

If we look from a 20,000-year bird's eye view, we are alive between the blue and red stars during a one-time carbon pulse, where we extract various low entropy materials from the earth to keep our industrial society going, from metal ores to fossil hydrocarbons. There remain plenty of resources but their cost in energy and environmental terms means the coming century is going to look vastly different than the prior century.

Like a fish completely unaware to swimming in life giving water, our modern society lives each day awash in energy services without realizing it. Our relationship to energy both the type and the scale will dictate all future trajectories for human cultures and of Earth. We are energy blind.

MYTH #24 – The American Dream is Based on Hard Work and Cleverness (34:36)



The American Dream is Based on Hard Work and Cleverness

MYTH

Gas →
Oil →
← Coal

American Wealth is NOT a Birthright, but Based in Large Part on Fossil hydrocarbons

REALITY

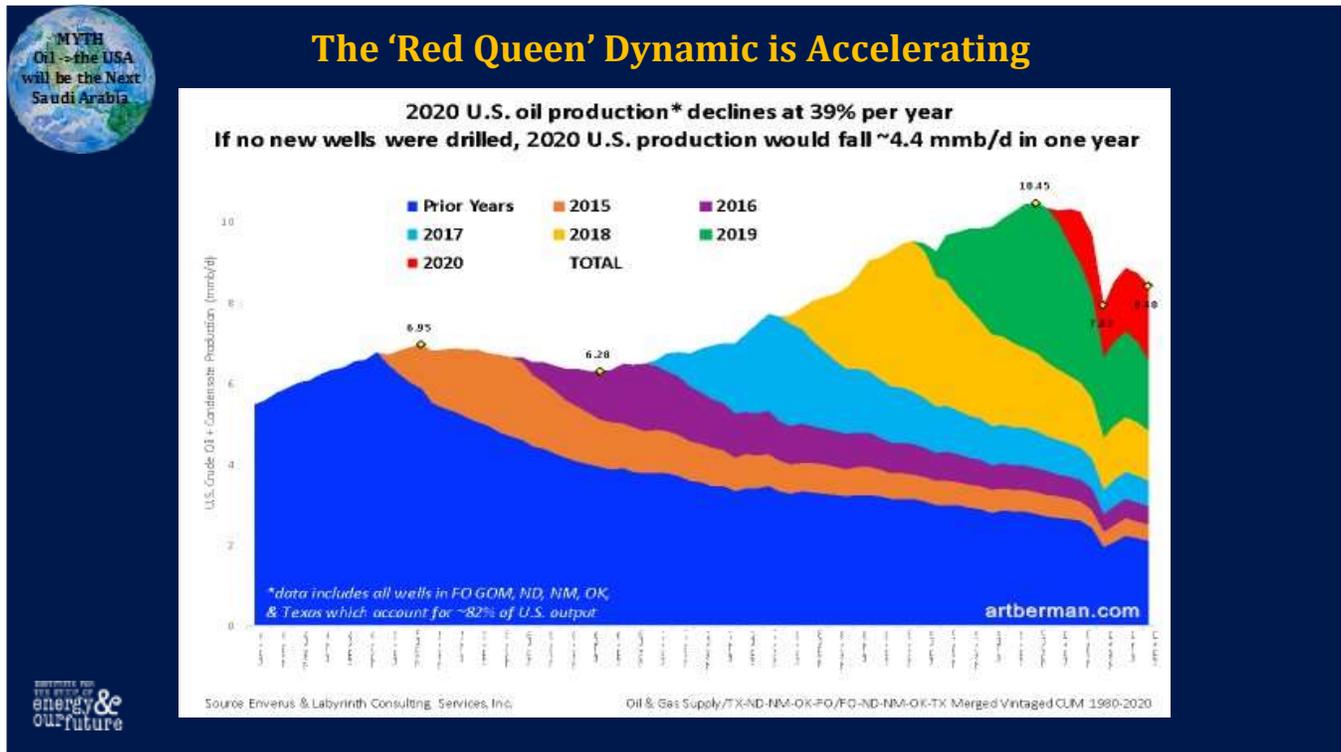
There is a long-standing theme that American exceptionalism is due to our hard work and our unique ambition and cleverness. These certainly played a role, but there is a deeper, historical biophysical story. The average human body generates around 100 watts of power continuously, about as much as a 100-watt light bulb, and the average American continually accesses 10,000 watts or about 100 of these light bulbs 24/7. This is about twice the average of Europe, and almost four times the world average.

In fossil fuel terms, this is over 70 barrel of oil equivalents per year, per American. 57 of these are directly burned in the United States and another 15 or so embodied in the goods that we import from other countries like China, where the fuel is actually burned.

Globally, we use around 500 billion human labor equivalents of fossil hydrocarbons, and the United States currently uses around 20% of this total, despite having only 4% of the world's population.

The USA has used more fossil fuels than any other country this century, last century, and since the dawn of time. The American way of life has certainly been aided by invention, technology and hard work. But we often forget that most of the physical work has been done by armies of fossil workers, which we've paid pennies for.

MYTH #23 – Oil -> The USA Will Be the Next Saudi Arabia (36:17)



There's a myth that drill baby drilling will result in the USA overtaking Saudi Arabia as the world's greatest energy producer and exporter. Like many myths, it's based on a kernel of truth.

In 2018, the USA did temporarily surpass Russia and the Saudis in oil production. But the US imports over 5 million barrels a day, fully half of what we produce. Those imports alone are more than most countries consume, other than China. Saudi Arabia is a swing producer because it has way more production than it uses. In contrast, the USA uses way more than we produce. The fact is we import, refined, then export the same oil, and the resulting bogus math has led to this pervasive myth that the USA is somehow a net exporter.

Not only are we a huge consumer, and large importer, but essentially, we've become an oil laundering country. But this belies a larger and more profound story. The graph in the left shows the drill baby drill story, we use technology to overcome depletion. The graph on the right using the same data but broken out not by national borders, but by geological province. The green curve shows conventional oil, which means it has been processed by nature over millions of years to be nearly perfect and easy to access right out of the ground. But as that declined, we started to extract from the North Slope of Alaska, shown in yellow, the Gulf of Mexico in blue, and the light tight oil and shale formations in red. The difference between these sources of oil is profound, conventional oil is like drinking a glass of Coca Cola with a straw, whereas title oil is like a super thick milkshake where you try to suck and the straw collapses.

So, we need to go deep into the earth and turn it into something we can get to flow using fracking and solvents. Plus, this red sliver depletes rapidly as much as 80% in the first two to three years, which requires constant new drilling and new wells in order to maintain production levels. There still exists exotic unconventional sources like Arctic oil, gas hydrates, or oil shale. But using technology

to function as Mother Nature on these immature resources is absurdly expensive or beyond current technology, not to mention the climate implications and other unknowns.

Okay, this is important, this graph conceptually shows how a normal resource pool for example, oil, with various quality tranches in shades of grey, might change when we can borrow money to spend on complicated technology to access more of the resource. Doing this does increase the total size of resource, the new tranche of oil is shown in black on the right panel. But it also increases the rate at which the entire resource depletes after it begins to decline. In effect, both debt, and in the case of oil fracking technology, function as a larger straw. The amount of resource mostly remains the same, but we're able to access it, and consume it today, with a larger straw, leaving less available for the distant or not so distant future.

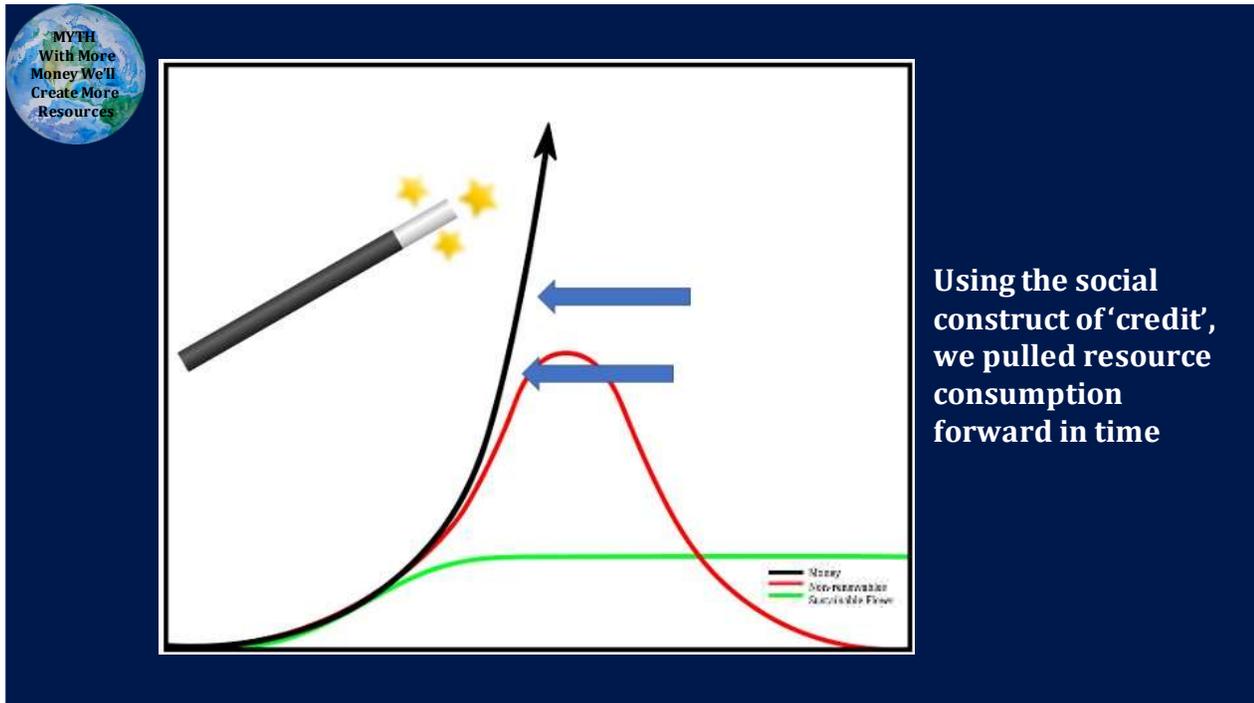
If you consider the five main production areas in the United States, Texas, Gulf of Mexico, North Dakota, Oklahoma, New Mexico, together they account for 82% of US oil production. The blue area shows the decline profile of historic legacy wells in those five regions that were drilled 2014 and before. The orange sliver shows wells drilled in 2015, and so on. The red shows the decline profile of all wells drilled in 2020. If we stopped drilling, for whatever reason, the rapid decline of legacy production would result in a drop of about 40% of this production in the first year, and another 40% in the second year. Despite having a great deal of oil resource left in the ground, we face a Red Queen scenario where we need to keep drilling, needing increasing capital and complexity, to roughly stay in place. We have drill baby drilled and misconstrued it as progress.

This tight oil, and unconventional, and tar sands, and deep water have been the primary growth in global oil the past 20 years. The pandemic sharply reduced demand for oil last year, and while demand is returning with global central bank support and government stimulus, the ongoing decline rates and impact from shut in production means 2018 is likely the year for the global oil production peak.

This is relevant because not only has the USA produced and used more oil than any other country in history, but we buy other nations oil with the Petro dollar. As US oil depletes there are the geopolitical implications of a half to two thirds of the world's remaining oil residing in the few 100 miles of the triangle between Saudi Arabia, Iran, and Iraq. There's plenty of oil left, some would say too much. But this fuel that functions as the hemoglobin of modern civilization is getting more costly in energy, dollar, and environmental terms, and will get more so. Instead of becoming the next Saudi Arabia, we've effectively been draining America first. And what's left is the source rock.

MYTH #22 – With More Money We’ll Create More Resources

(41:48)



As more people are becoming aware, money doesn't grow on trees, but it does grow. When commercial banks make loans or when central banks monetize debt, the growth in our money supply happens without reference to underlying energy, materials, or the environment.

We can't understand energy or our biophysical situation without also understanding money. 95% of modern money comes from banks making loans. Commercial banks do not loan out existing money as taught in economics textbooks; they create it. At the moment new money comes into existence, the amount of energy and materials in the world remains the same. This is a problem because money is ultimately a claim on energy and resources. Whenever we spend a dollar, or a euro, or a yen, we're buying something that required energy to mine, process, and deliver. We can create money, but we cannot create energy, only extract what exists faster. And importantly, when money is created, the interest is not. This creates a growth imperative for our economy to be able to pay interest in the future.

Whenever we've encountered resource or energy limits, for example, the 1970s, we started to use the social construct of credit to overcome the near-term economic pain. In every single year since 1965, the United States and the world has grown our total debt more than we've grown our economies. This graph illustrates conceptually the infinite potential to create money, contrast it with the finite nature of economic inputs like forest, minerals, and oil.

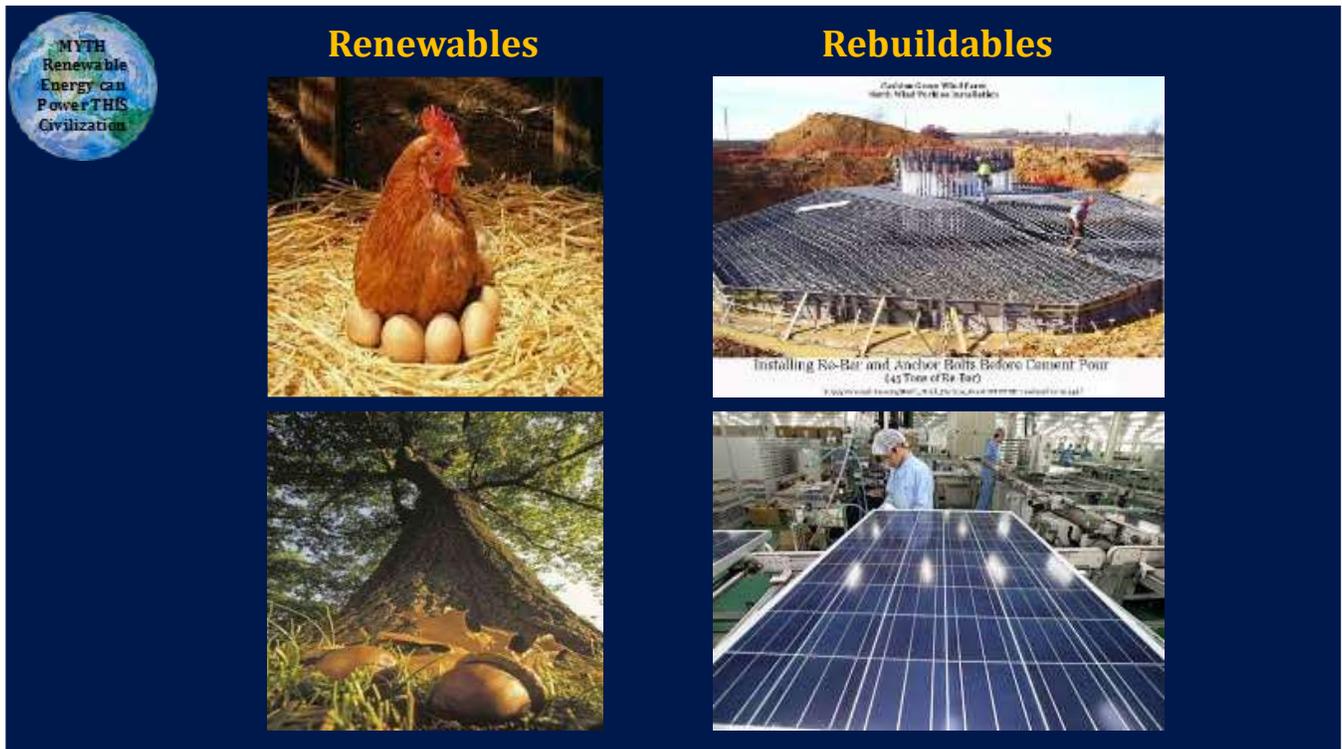
So, the same dynamic with respect to debt increasing shale production at a cost of future steeper decline also applies to economic growth of individuals, and entire countries, and the GDP of the world. We can use debt temporarily to pull consumption forward in time, but there are limits. The blue and red lines represent current versus future times respectively. Notice that with debt and credit, the

GDP consumption levels are increased today, relative to not using debt, but at a cost of lowering GDP and consumption in the future.

This is incredibly relevant to our current situation where governments are adhering to modern monetary theory, printing tens of trillions around the world to stabilize economies from the pandemic, and kickstart green policies. There are other problems with this but from a biophysical perspective, even though we can print more money, we cannot print more resources, only extract what exists faster.

MYTH #21 – Renewable Energy Can Power THIS Civilization

(44:44)



Another popular myth is that we can somehow swap out the dirty energy with clean energy technology, while also continuing to consume at today's income and GDP levels. Briefly, there are multiple fundamental flaws with this theme.

First, not all joules are equal in what they can do for us. Energy forms possess vastly different properties like spatial distribution, power density, transportability, and environmental impact. Just like a hummingbird can't easily switch from eating flower nectar to the equivalent calories' worth of grasshoppers, society dependent on low-cost, liquid fuels can't easily switch to land intensive, dispatchable electricity.

For instance, a 200-megawatt wind farm might require spreading turbines over 19 square miles. A natural gas power plant with that same generating capacity would fit onto a single city block. To replace substantial amounts of fossil carbon, and anything near today's consumption levels will require substantially more land.

Second point, renewable technology harnesses continuous energy flows from the sun. Those flows will keep coming. But the technology to extract the energy for our use is as complex and resource

intensive as building a computer or a pickup truck. An oak tree or a chicken are renewable, solar photovoltaics and wind towers are at best rebuildable. Currently, what is referred to as renewable energy requires fossil fuels, rare minerals, and complex global supply chains, financial guarantees. A more honest term would be resource-intensive, free-energy harvesters that wear out in 25 years, or for shorthand repeatable or rebuildable, not renewable.

Next point, renewables are mature, viable and relative to historical human to energy conversion ratios, cheap. But when extrapolating what they can do for us going forward, we often use a money in energy out lens, we tend to focus on the improvement in technology and cost reduction. The green arrow of energy output is higher than the red arrow of dollar cost input, that all looks great. But a money in energy out lens is only one way to see what's happening. And it is a narrow boundary perspective and therefore incomplete and misleading. A systems perspective would use energy and materials in, energy and materials out math. And when viewed this way, a more complete picture emerges. Fossil fuels provide the energy equivalent of 500 billion human laborers powering the global industrial and manufacturing engine. Many renewable stories have rosy forecasts that ignore the ongoing heavy lifting done by these unseen laborers, who will be getting older and thus retiring and thus more costly. As these fossil energy reserves deplete the cost to get the same energy output will require a higher energy input, which has to come from somewhere else in the economy. Irrespective of renewable energy build-out, our fossil armies will be increasingly retiring in coming decades. Plus, each dollar in the global economy requires around two pounds of non-renewable material inputs. In effect, renewable stories focus on the green arrow in relationship to the red arrow of its cost, but too often neglect the brown arrow, the big one that backstops the entire system. The total energy and materials underpinning the current system are essential to enabling any future system.

Another key point, we frequently see in the media that a new solar installation somewhere was cheaper than coal or gas. This can be technically true but is misleading for many reasons. But mainly because a solar kilowatt hour comes when it comes. A grid-based kilowatt hour, using natural gas, is available when you flick a switch. As an analogy, it's like a restaurant advertising cheap hamburgers for \$7, but only on three days a week, between 10am and 4pm, versus a cafe that's open 24 seven where the burger cost \$9. Comparing the cost of adding solar photovoltaic to a city or region to the overall cost of electricity for that region is like apples and oranges. Because our culture demands, at least currently, 24/7 access to energy, a shift to more and more renewables is going to be much more costly than narrow boundary examples. You can't use renewables for baseload. Renewables are not reliable if you don't put the cost of the backup power into renewable costs.

As such, the future will likely be a combination of two trends. As fossil fuels deplete, we'll have no choice but to go back down to lower quality resources, as measured by less portability, lower density, more land area, etc. Additionally, we're headed for higher energy systems complexity, which includes more moving parts and components, which carries both cost and availability risks.

Economically, this all might look something like this graph, where the trifecta of higher cost natural resources, higher complexity solar inputs, and the end of cheap money will necessitate a bio physically smaller economy. Yes, solar and wind will be a much higher percentage of our energy mix, but the total size of the economy will be a third or even a half smaller.

Whatever this ends up looking like the future will be a hybrid system of improving energy technology and depleting fossil hydrocarbons. Renewables are mature and offer us many benefits. The myth is that using more of them will create an economy looking anything like today's system.

processing plant, which turns natural gas into ammonia fertilizer. Yes, we can produce ammonia from excess solar and wind, but that's going to be vastly more costly than we're currently planning for.

Another point, it's estimated that 40 to 60 barrels of oil is currently required to make an electric car. That's four years of current American use and 15 years of current average human use. Also, electric cars currently rely on grid electricity, which even if one day grid electric may be significantly lower carbon, today, it's still two thirds to three quarters fossil based. Even the asphalt roads that we all drive on are made from the heavy parts of a barrel of oil. So electric cars themselves and their infrastructure are hardly oil or fossil fuel free.

Lastly, even if miraculously, we were able to develop electric cars or something to mostly replace internal combustion cars. Gasoline is only about 1/3 of the volume of the contents in a barrel of oil. The other two thirds are used for variously medicines, plastics, condoms, clothing, petrochemicals, involved of 10s of 1000s of products, jet fuel, heating, oil, asphalt for roads, etc. So, if we somehow did no longer need the gasoline, due to some technology, we would still need all of the rest of each barrel of refined dead phytoplankton aka oil for other systemically important inputs. So what is the plan for billions of gallons of gasoline each day that would no longer be needed? Flare them?

The technology of electrifying transport is very important and relevant, but it's a minor part of the larger story we face. The reality is that oil does much more for us than just gasoline. The peaking of oil, whether by demand or supply will mean a drastic change in our social, economic, and institutional arrangements.

MYTH #19 – We Can Achieve Net Zero Emissions by 2050 (or any date) (55:04)



There is an increasingly popular theme in climate change media called net zero emissions. The idea that by 2050, or any date, we can both swap out our fossil fuel energy base for renewables, and additionally use complicated and yet to be developed technology to remove carbon from the atmosphere. Together resulting in humanity reducing the current emissions of our 17-terawatt economic system to zero in less than three decades.

Okay, first, there's the physical enormity and cost of the task. The carbon and coal is found in essentially pure concentrations, 10s of feet thick and can literally be picked up. The carbon and atmospheric co2 is diluted to parts per million concentrations, making it significantly harder to pick up. When carbon is burned, it binds with oxygen molecules and becomes 3.7 times bigger, and it turns into gas, which is 1000 times the previous volume. From a biophysical perspective, the concept that we could somehow ever build a parallel system that captures processes and sequesters the resultant co2 should be rejected at first glance. It's like a gold miner looking at all the gold present in the oceans and monetizing it via an IPO.

Next point, cutting down all the forest to then grow the forest back is for the most part carbon laundering, and a large energy and environmental cost. This will be even more the case as we increasingly turned to forest, old sunlight, to replace the declining ancient sunlight in the fossils we use for fuel.

Third 8% of all global greenhouse gas emissions in 2020 were from high heat smelting of iron, steel, and non-ferrous metals. That is fully half of all the emissions from the entire global transportation sector. It is difficult to imagine how these emissions from producing metals will decrease in a world of more electric vehicles, solar panels, wind turbines, and batteries, which critically require lots of iron, copper, cobalt, nickel, silicon, lithium, and rare earths.

It should be noted that for 50 years or so we've heard many proclamations about renewable energy, displacing fossil energy, but as of 2020, wind and solar, despite rapid growth, are only around 5% of global primary energy consumption, and all renewables around 18%.

This relates to another key point. We have to keep in mind that our amazing civilization today is a product of energy surplus. However, as we allocate more and more of our energy to build low carbon infrastructure, this energy has to be removed from other parts of society like libraries, or hospitals or schools, or racetracks. We might then one day have an economy twice the size of today's but 45% of the physical inputs will go into generating energy, and 45% of it will be spent on sequestering waste products, which leaves only 10% for food, education, healthcare, and Xboxes, or other pursuits. Will we still want to measure our cultural success by the growth of our economy?

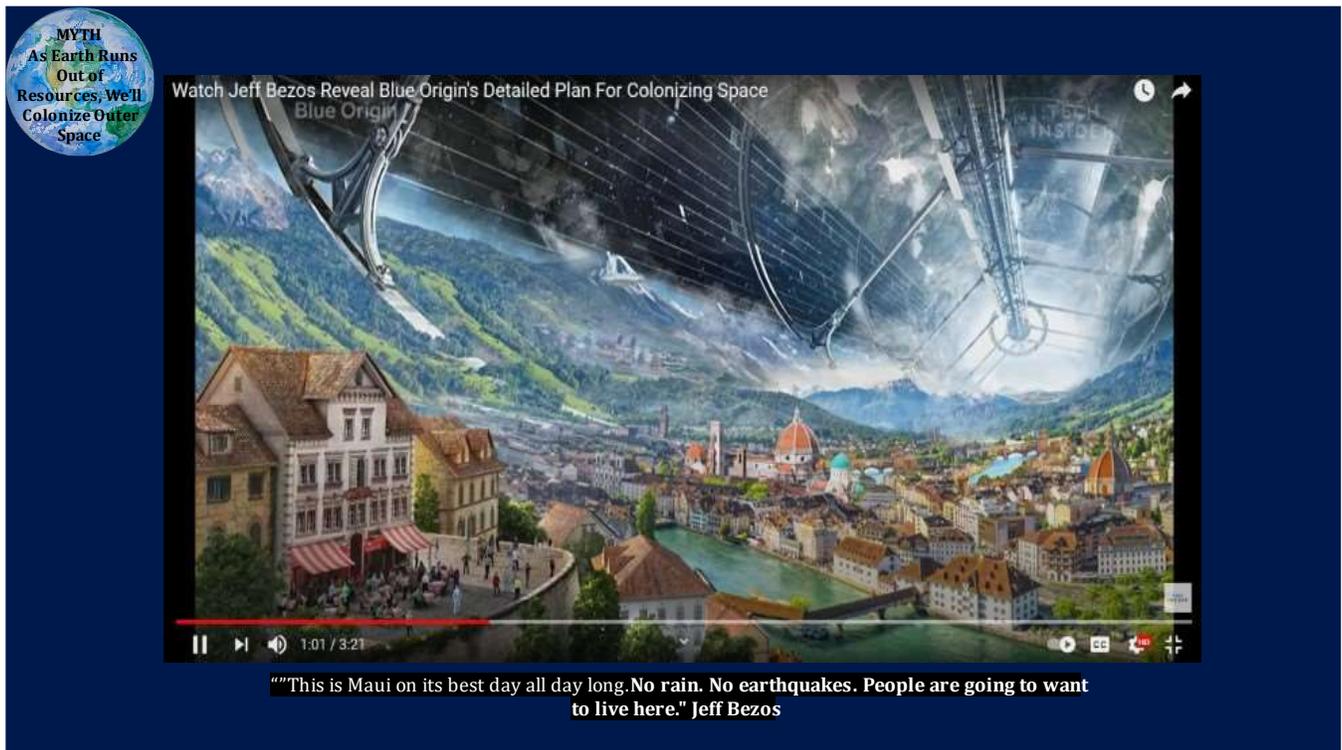
At that point, we would have turned the human economy into part Mordor, part ginormous cleaning machine, thus missing entirely the true goal of human and ecological well-being. Note, while that would be bad, it wouldn't be as bad as without the cleaning machines. Lastly, perhaps the biggest problem with the net zero myth is when people use the term net zero. It's mostly shorthand for maintaining economic growth while imagining some magical technological salvation in the future. It is an inter temporal sleight of hand that effectively is saying burn now pay later and ignores any need for cultural change.

Repeatedly kicking the can has consequences, which probably means when net zero fails, we'll move directly to geoengineering, spraying sulfuric acid into the atmosphere and many other clever but not wise schemes.

The waste from our current population and consumption levels is a dire problem. But thinking we can continue to consume at anything close to today's levels, and magically whisk away the waste

products from a carbon-based economic system is a myth. In a 17-terawatt economy, 80% powered by fossil fuels, net zero emissions is biophysically delusional. However, accepting this biophysical reality will be politically delusional, so maybe we can meet in the middle.

MYTH #18 – As Earth Runs Out of Resources, We’ll Colonize Outer Space (59:58)



MYTH
As Earth Runs
Out of
Resources, We'll
Colonize Outer
Space

Watch Jeff Bezos Reveal Blue Origin's Detailed Plan For Colonizing Space

Blue Origin

“This is Maui on its best day all day long. No rain. No earthquakes. People are going to want to live here.” Jeff Bezos

There is a common and popular theme that as Earth runs low on resources, we will colonize outer space accessing the minerals, water, and materials from other planets. The world's two richest humans are both working on this plan.

Jeff Bezos said recently he wants a trillion humans to live on and under the surface of and in rotating colonies around other planets. Elon Musk says we will colonize Mars within a decade.

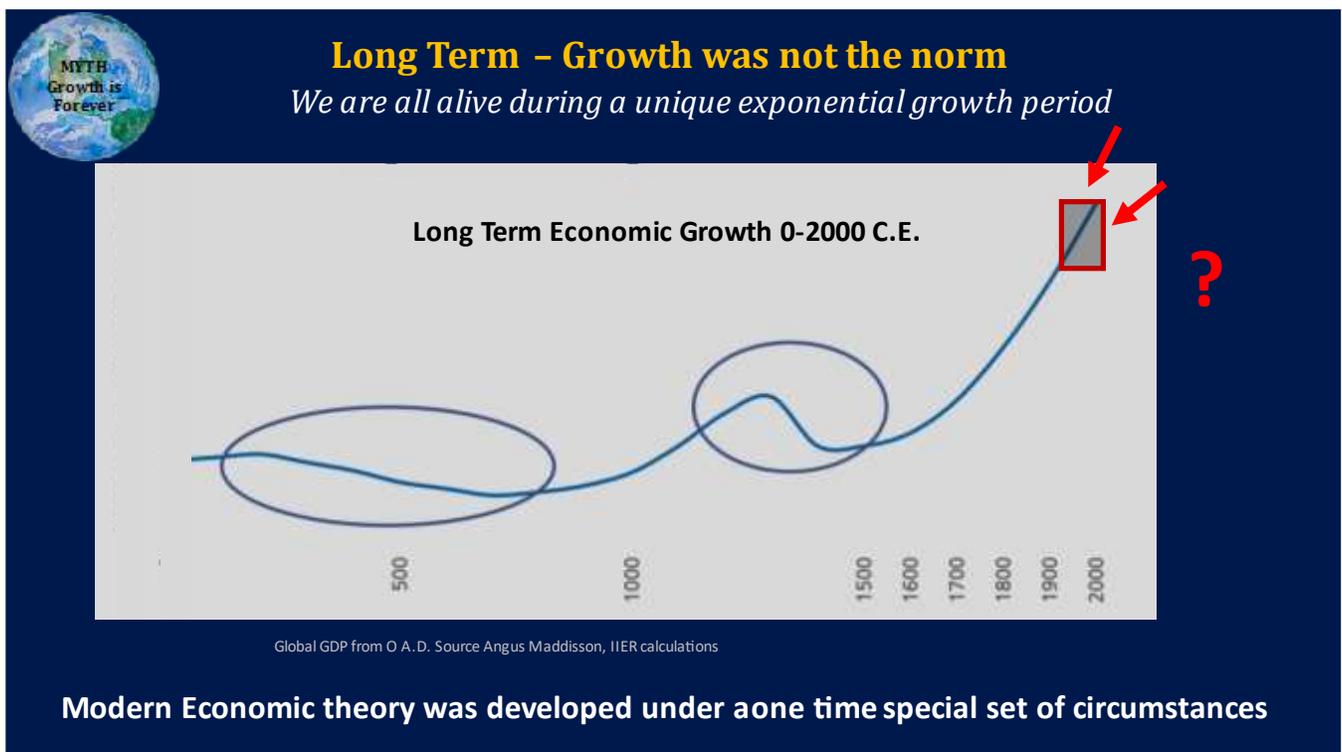
Colonizing space at any meaningful scale is energy blind. Even having a space exploration budget is a product of a culture with massive energy surplus. The last 50 years or so, energy as a percentage of our economy's hit an all-time low. As shown in this graph of seven centuries of energy in the United Kingdom. Spending less than 20% of our economy's energy on energy itself never happened before the fossil fuel era. Modern energy surplus allowed for all kinds of exploratory pursuits and leisure and waste. As the cost of obtaining, refining, and delivering energy to the rest of the economy goes from a low of 5% in 1999, to about 10%, where it is today, and eventually to 15 or even

20% of the size of our economies, we'll have much less surplus available to even send missions to other planets, let alone send the massive infrastructure and complex machinery to bootstrap colonization.

Look around you, iPhones, the ability to fly to Hawaii and a holiday, Siri giving you directions, Facebook, FaceTime, we are living the Star Trek future now. We just don't realize it due to our energy blindness and narratives that conflate biophysical riches with cleverness and destiny. And contrary to Musk and the late Stephen Hawking's comments on colonizing Mars, in the worst, post nuclear war climate, runaway Armageddon, Earth would still be a paradise versus the harsh conditions of the Red Planet.

Future technology will continue to advance, but it will be technology consistent with lower energy throughput, and less availability of concentrated raw materials. This problem means miniaturization, biotechnology and materials progress over brute force projects such as those that characterize the 20th century. This will all amount to an earth trek future.

MYTH #17 – Growth is Forever (1:02:32)



We hear a lot about growth. Mostly in the media, this refers to economic growth. If you ask any economist, growth will continue indefinitely into the future, might look differently, but will continue to grow for the next 100 years for the next 1000 years. But what is growth? And why is it important and what should we expect in the future.

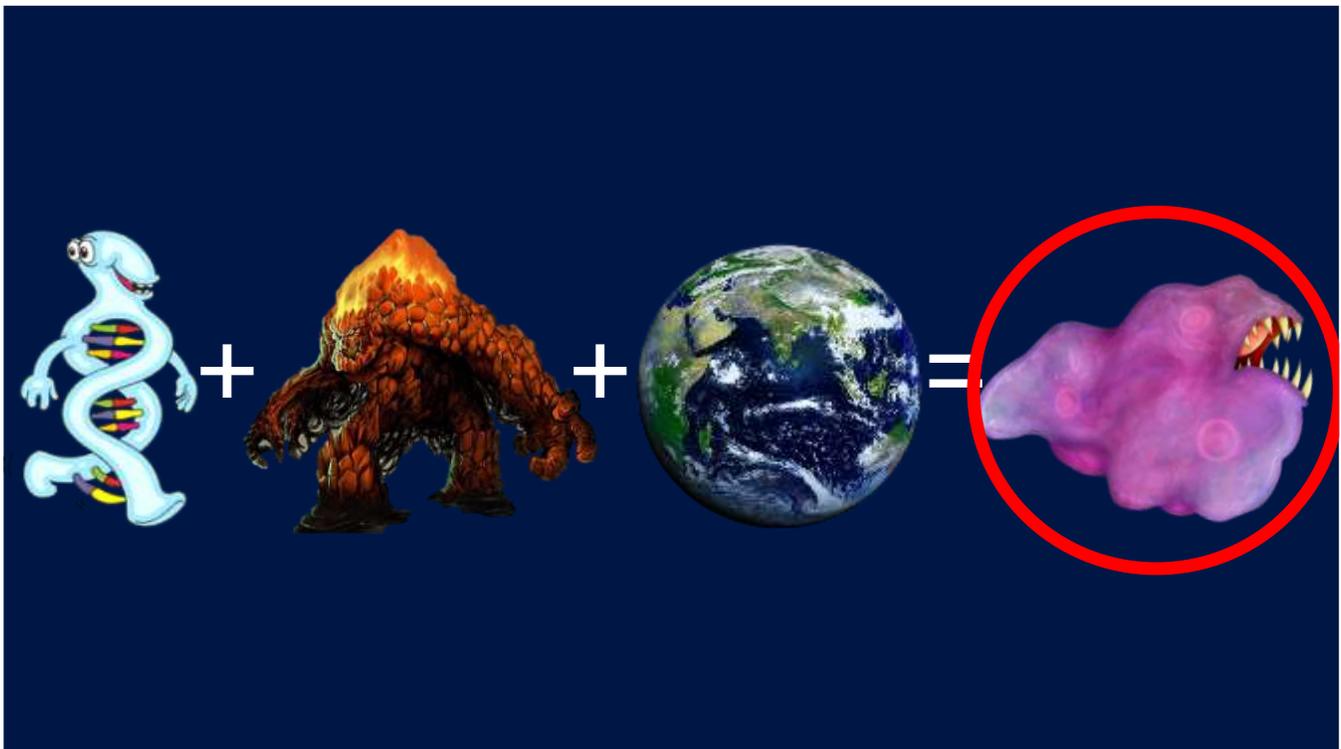
We naturally understand that baby elephants need to eat to grow. But when they reach adult elephant size they stop growing. We naturally understand that human babies and children need to eat to grow, but they stop growing at least vertically around 20 years old.

All World Government forecasts are for 2.5 to 3% annual growth for their economies throughout this century, something like the blue circle shown above. But if something grows at 3% a year, that means it will double in 25 years. So in 2070, if economic forecasts are correct, the world economy will double in size not once but twice or be four times larger than today. And then eight times larger than today by the year 2100. Depending how efficient we become. This will require enormous amounts of energy, material, and waste. If we use historical trends of 99 units of energy growth for each 100 units of global economic growth, we will need three times today's global energy in 50 years. Is this desirable? What happens to our world if this comes to pass? What happens if it doesn't? Why are so few people talking about this?

Early economists attempts to turn physics into economic science, we're assisted by continued and seemingly perpetual access to the cheap energy of the one-time carbon pulse. We don't think about it but all of modern economic theory, as well as our cultural rules and expectations were invented and articulated during the period contained in the red box above. But this energy flux underpinning our society is not repeatable, and our institutions will eventually have to adapt to more realistic future trajectories.

Growth has been slow to nonexistent for 99% of our species existence, because it's based on physical inputs and outputs. The last century has been an anomaly, expecting the next century to repeat this experience is a myth.

MYTH #16 – GDP is the Right Goal for Society (1:05:09)



For the longest time our politicians and media have been cheerleaders for economic growth and jobs as our cultural goalposts. In light of the energy blindness just covered, might these also be myths?

Well, yes and no. Firstly, pursuing GDP may have been our goal for a long time, but not forever. It was only started as a tool to measure our economy's progress during World War Two. GDP conflates money with prosperity. It counts the spending of money as economic activity, not distinguishing whether the money was earned, borrowed, or simply created out of thin air, or what sort of social benefits it creates by its spending. The creator of the GDP index himself, Simon Kuznets actually warned against its use as a measure of well-being.

But GDP actually does an amazing job at doing what it was designed to do, which is measure the material footprint of economies, as defined by the production of all goods and services in a period. GDP globally is referred to GWP or gross world product. Shown in the gold line GWP is over 99% correlated with both energy use and material throughput, as shown by the purple line. Because most economists today still believe the economy exists independently of natural resources. Of course, growing GDP as a cultural goal becomes a plausible fantasy. But the reality is that though we can get more efficient with energy use over time, in effect, the purple and gold lines can slightly diverge, there can be no absolute decoupling, because any service or product we create, or create more of, needs energy inputs at each part of its chain.

Considering that every single product in our economic system was created somewhere on the planet with a small or large fire, gross world product might be more aptly named, GWB, gross world burning.

This is not surprising. Research in biology has discovered the metabolism or the amount of energy utilized per unit time, is a general constant in nature that scales across organism sizes from mice to elephants. The general rule, called Kleiber's law, shows that organisms use energy relative to the organism size to the three-quarter power.

Human society and our collective pursuit of profits, aggregated as GWP, tethered to energy today functions like a single organism. When measured globally, the human economy also has a metabolism, roughly equal to its size to the three-quarter power.

If you think about it, this makes sense every single node in a communication, transportation, or social network requires energy. These networks are fed by a global transportation system. with gasoline and diesel acting as the hemoglobin. An aerial view of a city shows roads and highways very much like veins and arteries. Viewed this way, the globally connected network that we call the economy functions like a real organism, a super organism.

Today's global cultural pursuit of GDP was never really planned as a goal, but as an emergent property of nearly 8 billion members of a social species, finding a fully charged Earth battery of energy dense carbon, and then coordinating globally towards profits with the social construct of money as an intermediate step. The result is a mindless, energy hungry super organism, shown here like an amorphous, unthinking hungry Amoeba.

Other social species, like ants also create structures without planning to like subterranean cities with highways, ventilation, and waste shoots. There is no ruler ant or group of ant billionaires that lays out plans on these structures. The structures themselves are a byproduct of all the ants following simple behavioral rules aligned with their ancestral wiring.

In a similar way, the human super organism doesn't think, or plan, or care about the environment. It just mindlessly goes forward in time, consuming energy and material throughput as it

expands delivery nodes for goods, services, and people around a larger and larger network as GWP increases.

But is the superorganism happy? Is the mindless pursuit of energy as a proxy for success valid? Well, if we are a poor person or nation when we have more money, which gets spent on energy, we get massive human development benefits indicated by the green line. But once we're at 100 Giga joules per capita our development and well-beings level off with more energy or money. The problem is the mindless pursuit of growth in material throughput as a cultural goal puts all countries on a trajectory towards point x. Not only is this energetically impossible, but even if this would increase the goods, it would decidedly increase the bads, climate, depletion, loss of species, and ecosystems pollution, etc. GDP, as an accounting gimmick, is energy blind.

GDP as humanity's current cultural goal is highly tethered to resources and less so to well-being. Yes, in nature, organism's energy use is tethered to their size. But humans differ than other animals in two important respects. One, we have neocortex, we can visualize and plan for the future. And two the majority of our energy use is not in our food; we use way more than we need. The question of our era is do we have to be a mindless energy hungry super organism going forward? Do we want to be?

MYTH #15 – Overpopulation is the Root Cause of All Our Problems (1:10:58)

Population is the Root Cause of All Our Problems

MYTH

We have two population problems: 1) people 2) things. Both are symptoms of large energy surplus and economic growth

REALITY

We are approaching 8 billion people on this planet. It took from the origin of our species roughly 300,000 years ago, up until the year 1800, to reach 1 billion humans on Earth, 300,000 years. In fact, if you were a member of the species Homo sapiens, which you are, if you're watching this video, there's a roughly 1 in 12 chance that you are alive right now, given that 100 billion of us have ever lived.

We are now adding an extra billion humans to the planet about every decade, or roughly 30,000 times as fast as the average population growth of what was already one of the planet's most successful species. This is neither healthy nor sustainable. But is this the core problem? For at least two reasons I'll suggest it's a myth, or at least a red herring.

First of all, we really have two population problems. We have population of human beings, but also populations of laptops, cars, airplanes, cell phones, microwaves, refrigerators, air conditioners, etc. We are currently adding 80,000,000 8-pound organisms to the earth each year. We call them babies. We're also adding 100,000,000 3,000-pound carbon requiring and emitting vehicles every year. Is it fair or even viable for those in the first world to continue to consume at high levels, while asking developing nations to reduce population?

A new baby born in America under business's usual conditions, will use over 3 million pounds of minerals, metals, and fuels in their lifetime. Compared to an average Filipino, this is over 15 times as much. In contrast, previous sustainable cultures use tiny fractions of this. For instance, Native Hawaiians numbering in the hundreds of 1000s use no metals, few minerals, since they only had sand and lava, and only what wood can be sustainably taken from an island. From that culture, the spirit of aloha emerged and remains today. This highlights the interrelationship between population and consumption.

It's pretty clear in the long run 8 billion humans is not sustainable. There are ways we can humanely reduce humanity's bulging population. It's estimated that universal human rights, universally available contraceptives, and a global communications effort that popularizes small families could take us from plus 1.1% annual growth to minus 1.1% annual decline, leading to a drop in global population of about 1 billion per decade.

Reducing population via these methods makes sense but would be exactly opposed to our current institutions and democracy that require growth. With economic growth as a cultural goal, no prescribed reduction of population is possible because the imperative of material growth will require more diapers, toys, teachers, plumbers, computers, pensions, etc. In effect, we can't optimize for growth and reducing population at the same time.

Already, countries that have low population growth rates are taking extreme measures to increase their populations, not decrease them. Denmark has a do it for Denmark campaign, where parents of childless couples get stipends from government to send their adult children on vacations in romantic locations to increase the number of Danish babies. There was an article in The New York Times last week about Japan needing more babies to produce resources in order to care for the aging population. We live as part of a system, the way it's structured now a meaningful decline in births would crash the system.

To root for humane population reduction as a balm for our environment, misses the real culprit, that out-of-control, energy hungry super organism optimizing consumption. Because of this, rather than consciously reduced population we are probably headed for a higher number of humans, nine to ten billion globally, but a much larger percentage of them living in poverty than today. Humane population reductions might happen in a planned way if we were to jettison GDP and profits as a cultural goal. Otherwise, we'll be swimming upstream in a rushing river on this issue.

MYTH #14 – Technology and the Markets Will Solve Climate Change and Resource Depletion (1:15:24)



Most technology is a vector for more primary energy demand



#1

Resource/Energy Efficiency



#2

New Energy Tech



#2

Human Labor Replacement



#2

New resource Conversions

There now exists an almost religious faith in the ability of markets and technology to solve any physical challenge humanity comes across. We've solved things before, we will again. But with the backdrop of the multiple energy myths and misunderstandings just covered, can we count on markets and technology alone to be our saviors?

Okay, first of all, there are two general categories of technology. One is new inventions and processes that allow us to access energy itself, cheaper or more widely, like better solar PV conductivity, or making natural gas power plants more efficient. When we hear of energy technology, it's usually of this variety. The second category of technology is inventions that either replace tasks humans used to do manually or with animals, like cars, chainsaws and tractors, or new inventions humans never had before until very recently, like Facebook, airplanes, Xboxes. All of this technology uses energy. It's the second category that dominates our technology sector, we create and sell products that increase the baseline demand for energy in the next period. Look around your home and garage, how many gadgets devices, machines, and appliances do you have compared to your parents' baseline, or their parents' baseline?

The creation, maintenance or replacement of these devices, not to mention marketing their coolness and necessity to developing countries, leads to increasing demand for energy every single year.

When technology is combined with a growth imperative in the financial markets, there is no way to shrink energy use. Yes, in pursuit of profits, we have innovations that make devices and processes more efficient over time. But if things really are cheaper, we end up using more of them, or using our cost savings on other gadgets or other consumption. Think of air conditioners suddenly dropped in cost

by 90% because of some new clever innovation. What would be the energy and climate impact of that? This is really important. Technological improvements in a growing economy make us use more energy and stuff as opposed to simplifying our lives.

Aside from this rebound effect, efficiency improvements, economywide, have been small, typically around 0.5% a year. If energy costs in the future triple, in a decade, from 100 to 300, for example, a 20% efficiency improvement brings the new hire 300 costs only down to 240. Technology will have a hard time keeping up with depletion on the carbon downslope.

Technology, currently, is in thrall to the markets, so solar panels and other low carbon or future friendly materials don't really solve resource depletion or climate issues, because the entire institutional structure is based on surplus and growth.

Take solar, for example. 2018 was a great year for solar photovoltaic, but just the increase in global demand for electricity from 2017 to 2018, the height of the blue line here in 2018, was almost double the entire amount of solar photovoltaic installed since it was invented, which is the height of the yellow line in 2018.

Which is why new, viable, profitable inventions. that on the surface are what we need for a more sustainable future, are adding to the carbon and resource throughput not subtracting. As can be seen on the above panel showing growth in fossil energy sources on the left panel, compared to renewables on the right. There is no way to subtract the bad energy other than a depression or institutional change of incentives, rules, or taxes.

Renewables aren't replacing fossil fuels with low carbon alternatives. They are adding to fossil fuels and building a bigger human heat engine. Where can you notice the co2 reduction from the scaling of renewable energy in the above graph of total human emissions?

We've gotten really good at technology, but mostly it builds a bigger baseline need for energy next year, and a good portion of it turns billions of barrels of ancient sunlight into microliters of dopamine. But Wall Street firms, government energy agencies, and advocacy groups all show analyses supporting stories aligned with the red arrow above, which is continued growth. Analyzing how we might arrive at a smaller safer future isn't in most organizations job descriptions, because the market can't plan for that. Renewable tech has arrived but, even in tandem with fossil hydrocarbons, will not be able to power this civilization. What level this hybrid combination support is an urgent question.

In sum, technology plays an important role in human economies, but it's just a role. It's not the main or even the primary driver. The human enterprise is enabled by merging ideas and innovation with energy and materials into products and experiences that give us neural transmitters aligned with our ancestral wiring. The conventional thinking is that dollars drive everything followed by bytes, followed by jewels. But a biophysical hierarchy would turn that on its head and add the head neurotransmitters are greater than jewels are greater than bytes are greater than dollars. Technology and innovation are going to be vital to human systems in the coming 50 years, we have to recognize that for now, they are in service of the super organism both building a bigger heat engine and blind to a smaller economy ahead.

MYTH #13 – The Environment is a Subset of the Economy **(1:21:21)**

Economic theory, even environmental economics, teaches that the environment is a subset of the economy.

Most of us are just not taught about Earth ecology. We study inventions, procedures, profits, supply chains, computer networks, training and skills in order to get a job. And yet all of this human commerce rests on a living, breathing planet, the place we call Earth.

Earth's ecosystems provide oxygen water, temperature changes, photosynthesis, food production, as well as pollution filtration, regenerative healing, and other benefits to us continuously.

Contrary to economic textbooks, it is a truism that the economy is a fully owned subsidiary of Earth's environment. We can put dollar prices on all the services mankind gets from nature, but in the same way that food only accounts for 3% of our economy but GDP would fall to zero without food, an economy, without the services from nature, which we get for free by the way, would also cease to exist. In that sense, what we get from nature is priceless, yet it is not accounted for in our markets or our decisions.

Not only are we blind to our energy future on the downslope of the carbon pulse, but we also rarely appreciate that we will dearly need productive and healthy ecosystems in future generations. Two of the many issues in the United States today are water and soil. The Ogallala Aquifer that is used to irrigate America's breadbasket is depleting. This is a fossil aquifer, the youngest water in it is 3 million years old. These aquifers don't regenerate on human timescales. Similarly, we're drawing down topsoil 1000s of times faster than it regenerates. If soil degradation continues at the current pace, the USA topsoil will be completely gone in 60 years. We treat a great many things in the natural world as interest, but in reality, they are principle.

In doing so we have not only overshot the sustainable carrying capacity of Earth but are reducing the original carrying capacity in the process.

50 years ago, we created Earth Day and today, hopefully not too late, there is now a groundswell of awareness that nature is paramount amongst citizens and even corporations. Perhaps the myth that the environment is merely a subset of the economy is now only a myth to economists. Earth, its ecosystems, and its services enable our markets, our lives, and our futures.

MYTH #12 – The Natural World is Ours (1:24:11)

But it's not only the ecosystems, but also the millions of other species that share them with us. We have this myth, not only of human exceptionalism, but that because of it, the natural world is ours for the taking.

Perhaps this myth is a product of our tribal past, where we rallied passionately around in group cohesion, and ostracized out groups, usually other tribes or even predators. But now we're 8 million strong and in-group is the amalgamation of countries and populations that comprise the global economic system. The out group is the 10 million or so other species we share the planet with.

In addition to mining and burning ancient solar productivity 10 million times faster than it grew in the form of fossil fuels. We are also appropriating between 30 and 40% of current net primary

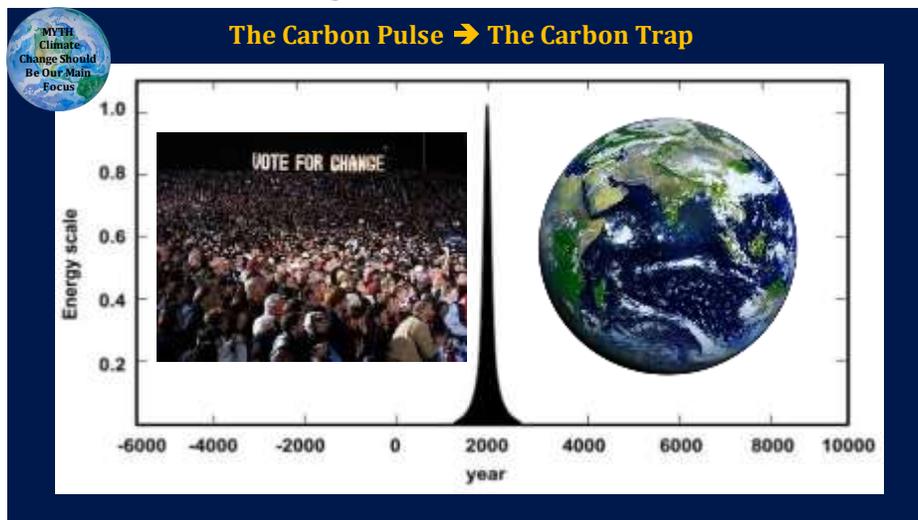
productivity, the total available plant growth in one from solar productivity on the entire planet and directing it to the human enterprise. The growth of the human economy and the resulting waste are crowding out other species or making them shrink to remnants of their former populations.

We are alive during and would be part of the cause of what could just be the sixth planetary mass extinction in the last 500 million years. Such an event is not yet complete nor irrevocable. Even greatly diminished, life still remains on earth in glorious profusion in the great migrations of herbivores, in the dance of Starling murmurations, in the mind-bending fractal complexity of the world's rain forests. There are still Giga tons of schooling fish, which react with the speed and nuance of a single organism like a living cloud of blue and silver, drawing sustenance from the cold oxygenated oceans, which comprise over 96% of Earth's living habitat. There are brains far larger and far older than our own, thinking entirely non-human thoughts and echoing each other songs in the darkness beneath polar ice. Do we ever wonder what they're saying?

We are now obsessed with finding life on other planets, when we've just begun to recognize and know the life on our own. Sending missions to outer space is good for profits, trying to talk to the ancient minds and the 250-year-old bowhead whales swimming under the Arctic, less profitable, but perhaps priceless.

The reality is that Earth is not ours. In a lonely universe, the species we share our planet with are treasures. We and our descendants will miss them when they're gone. But with an eye to the future, we might bring our cousins, nieces, nephews, and friends, and nature along with us. Ultimately, this is why I do this work.

MYTH #11 – Climate Change Should Be Our Main Focus (1:27:07)



There are many people currently, and many of my close friends and colleagues that state climate change should be our main focus. From a systems perspective, a more complex story emerges.

First, if a hypothetical benevolent alien scientists were to look down on earth situation, it would likely agree that climate change resulting from the carbon pulse writ large, is the single largest long-term risk to our species and life on Earth as we know it. But such a wise alien might offer two important caveats.

Firstly, climate is but one of many dire environmental impacts of current overshoot. Our society and media focus on the new highs in the financial stock market, while our real stock market is crashing.

Most of you know this by now, but it bears repeating. The carbon pulse has created a profound reshaping of the composition of living creatures on earth. I've long known that humans numbered in the billions but didn't learn until a few years ago that we and our livestock outweigh wild mammals 50 to one.

Populations of vertebrate animals are down over 50% since I was born. This relationship holds between domestic and wild birds as well. Around 70% of the birds on Earth are now chickens and turkeys, with only 30% being wild species. Yes, this is partially due to more people eating more chicken. But additionally, there have been significant declines in global bird populations over the past 50 years. Grassland species and insectivores have been particularly hard hit, which stands to reason because insect biomass is estimated to be falling by two and a half percent a year, eight times faster than the rate of decline for mammals, birds or reptiles. Earth's insects have no value in our economic or cultural system but are like trillions of tiny robots performing tasks for our ecosystems for which there is no replacement.

One possible contributing factor to insect loss is the global explosion of phthalates, which are petroleum-based chemicals in plastic products that break down and become airborne. Phthalates have been found in almost all ant population studies in remote areas of the Amazon, as well as in the Marianas Trench, suggesting that somehow atmospheric particles are being transported over long distances by wind.

It is still unknown if this is the reason that sperm counts in western countries have dropped over 50% in the last 40 years. Even after this drop, the median sperm count is over 47 million per milliliter. And we're not seeing drops in babies born as a result. But shouldn't we be wondering what else might be happening? How many other species that we don't have the funding to research are also being impacted by endocrine disruptors?

And it's not just endocrine disruption from microscopic chemical pollutants, but bigger plastics as well. Over 5 trillion pieces of plastic are estimated to float in the world's oceans today, which at the current pace, there will be more plastic than fish by weight by 2050.

The ocean often takes second billing in environmental discussions, but they comprise 96% of the living habitat on Earth. In addition to overfishing and plastics, there's already been a 25% increase in acidity and a 2% loss of oxygen in the oceans. As oceans are basically functioning as the main buffer for human emitted CO₂.

The alien might rightly then partition Earth's unfolding environmental tragedy into two categories. First, and most obviously in media, is the impact on the biosphere from the metabolism of human systems. CO₂ in the atmosphere and oceans and the future global heating potential and resulting impacts. But equally important are the impacts on Earth's creatures and ecosystems from what humans do with all this energy.

But the second main objection to climate being our main focus comes from a systems perspective. Our entire system of economic exchange is fully based on mining and distributing ancient energy dense carbon and other non-renewable minerals. Considering that societies are now compelled to grow, and this growth requires energy, and the energy requires carbon, expecting policies that advocate keeping fossil carbon in the ground to succeed will be about as effective as arguing with a forest fire. Physically, CO₂ may be our greatest risk in intermediate and long term, but behaviorally

information wars, real wars, financial chaos, mental health problems, and poverty, these will be the challenges our culture will continue to face and strive to overcome.

The alien observer might rightfully conclude that Earth's alpha species is caught smack between the carbon pulse and the carbon trap. Decisions that are best for the environment are going to be bad for human populations. Conversely, decisions that grow our economies are going to be bad for the environment.

Climate change poses huge risk for humanity and our planet. But it's merely one of the many environmental impacts downstream from a global economy. And perhaps more importantly, there are no direct ways of solving climate while keeping the economic system the same. In coming decades, we'll have multiple other risks that will have higher political and emotional priority, and so are unlikely to ever directly solve for climate.

MYTH #10 – The Billionaires and Politicians Are in Charge

(1:32:47)



Continuing on the truth theme, there is a granddaddy myth in our culture, that billionaires and politicians are in charge. And if we get them all the information, the best decisions will ensue.

This impulse did of course work in our past. Sharing information with high status people today is another carryover reflex from ancestral times. When our band of 100 humans encountered a challenge or a problem, collecting and sharing information with the tribal council was the most efficient way for informed decisions to be made.

But today, this impulse misfires for several reasons, including one very big one. Firstly, the current political situation in the USA and much of the world is very polarized. Just like the truth on Facebook is filtered by in group lenses by individual, so to do politicians and their staffs heavily filter

facts that align with the stances of their politics. Second, politicians are now perpetually playing whack a mole. They are so unbelievably strapped for time that only issues of immediate urgency get their attention. And also, importantly, the system has become so complex, that only simple solutions are palatable to politicians, because complex ones could never get pushed through. So, truth itself has a functional ceiling as it moves into our political discourse.

But there's a much larger reason, the global human economy is functioning as a single energy hungry super organism. Money, growth, and productivity that come from technology, and increasingly debt, allow nations to access more energy to do more things demanded by our populations, like healthcare, support for the unemployed, infrastructure plans, pensions, military budgets, it's a long list.

No world leader is likely to choose austerity to starve the super organism, because it would first trigger an avalanche of prior debts. In a world sized game of musical chairs, followed by massive poverty and social unrest. So, we keep kicking the can even though the road is almost full of cans.

Another way of looking at it is, we tend to think that billionaires and politicians are in charge the markets and institutions below them and us normal folk on the bottom. The reality is different other than us normal folk on the bottom. Our system through the momentum of the last 50 years has created a downward causation phenomenon, where the markets, optimizing profits on the backs of energy surplus, drives the economy and decisions. The actions at higher system levels constrain the behaviors at lower system levels. Said differently the superorganism dynamic of growth is currently drowning out the wishes and plans of politicians and elites. It's why people at Davos and DC are so concerned and feel powerless because the system, aka supporting financial markets that are optimized for growth, as growth is waning, this has taken on a life of its own.

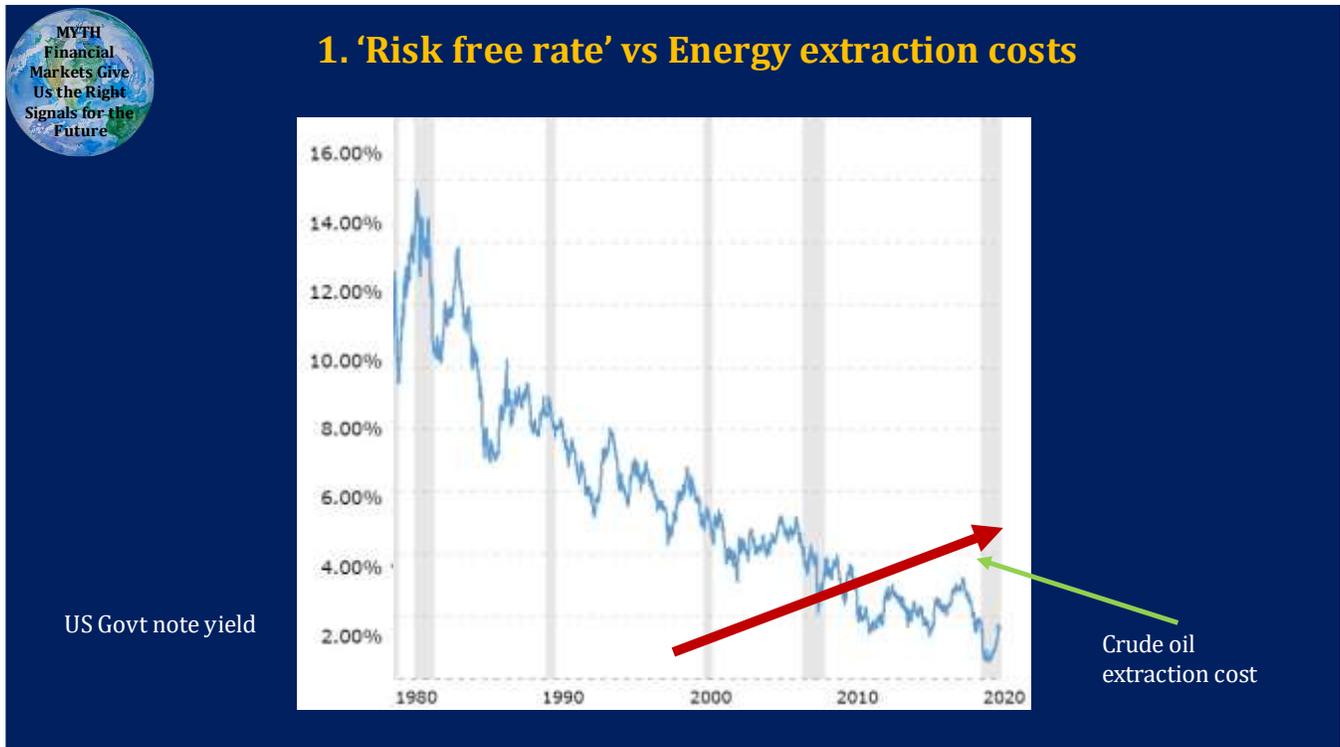
Metaphorically, the global economic system is a runaway train with an energy hungry Amoeba as the conductor, at least for now. We are now in a perfect storm of challenges which are bipartisan, systemic, abstract, complex, not imminent, until they are, and have no easy answers within current institutional, accepted policy frameworks. The minds of the people most capable of addressing them are retreating from this storm, not envisioning and building life rafts. In the same way that our individual minds have increasingly little overlap with the physical world, our political discourse has very little overlap with the real policies our nation is going to need. Because we have continually kicked the can on our longer-term problems, incremental tiny steps are the only things that are now politically acceptable. Simply put, the political world is even less ready for the systemic conversation than the general public.

Under this framing, what can be stated politically, are themes like net zero by 2050, we don't need oil anymore due to peak demand, hydrogen and renewables will replace fossil fuels, sustainable growth, and others. These stories maintain a socially acceptable conduit between politics and business, sharing popular societal goals, but lacking in biophysical reality.

I realized there may be some tough pills to swallow in this presentation, and that some may not agree with all these myths and realities. But just for a moment, imagine that everything I'm saying here is true. Can you further imagine a G7 or a G20 meeting where heads of state admit that growth is over and the only way to solve climate change is using considerable less energy and resources shifting to less material economies going forward, especially by rich nations, and that we are papering over our biophysical situation with unsustainable debt, and that oil peaked in 2018. These things cannot be stated, for if they were it would trigger a phase shift towards scarcity behavior. For similar reasons, I suspect the energy money growth story will never be spoken in congressional hearings or on Fox or on CNN, until it is well in the rearview mirror and obvious to everyone.

As individual human beings, politicians, billionaires, and civic leaders can understand the details of the human predicament, and over a few beers or whiskey muse on what might be possible as interventions. But as spokespeople, the intervention society will truly need cannot be voiced because the superorganism dynamic of simple goals aligned with growth stand between leaders and the public, at least for now.

MYTH #9 – Financial Markets Give Us the Right Signals for the Future (1:38:58)



In the last 50 years, we've increasingly looked to financial markets as arbiters of our wealth and success. We also look at them as a green light to the future. If Dow Jones Industrial Average is making new highs, well, there must be good things ahead. And we are really succeeding as a nation, and a culture, and the future, despite the pandemic and a bit of drama, will arrive brightly and shinier and richer than today. This is a myth for numerous reasons.

First of all, the most obvious reason that financial markets are not reflecting future success as a nation is becoming obvious to many more people after COVID. Stocks and bonds are mostly owned by rich humans. New highs in stock markets don't help most people because most people don't own any stocks. And no other species or ecosystems own any either. So trickle-down economics has morphed into a central bank transfer to the human food chain and to the top.

Second point, investment decisions are made on the cost of capital, which is typically the interest rate on risk free government bills or bonds. Since the great financial crisis in 2008, we've been offsetting physical world problems with increasing money creation. Simultaneously, we're laundering this stimulus by central banks monetizing new debt, while maintaining artificially low interest rates near all-time lows, in many cases negative. But from the biophysical perspective of this presentation, our real

cost of capital is the cost of the core energy inputs into society. And the most important input by far is crude oil. In the last 20 years, extraction costs have increased almost 300% to around \$60 per barrel, breakeven in the USA. Too expensive for the poorest consumers, but importantly, also too cheap for oil companies to drill. The cost of energy is much more important to the future than the price of money. And additionally, the value of energy is orders of magnitude higher than financial markets indicate.

Third point, in addition to the physical drawbacks of artificially low interest rates and high markets, there's a psychological effect as steep discount-rates, biological organisms we only really change our behaviors when we're suffering or there's a crisis. The ongoing sugar high brought about by 5 trillion in stimulus and 8 trillion in central bank balance sheet makes many otherwise pro future citizens and activists complacent about what is a dire situation. S&P 500 above 4000 acts as society wide valium, robbing us of the cultural gut check conversations we so desperately now need.

Expanding on that, not only are we emotionally lulled into stimulus complacency, on average, but the perception that stimulus will be permanent, focuses people on unrealistic futures. When temporarily flush we shop on Amazon, buy tech gadgets, trade Tesla options and Dogecoin. But we put off the hard work of learning skills, developing social capital, and planning for a post stimulus musical chairs world.

When I got my MBA at the University of Chicago 25 years ago, we were taught that financial people and companies functioned as cleaner fish, providing vital services of facilitating commerce, getting rid of the bad companies and supporting the good. But since then, finance, and insurance, real estate, and the resulting speculation, have now come to dominate our society. Finance perhaps unwittingly has become more of a barracuda than a helpful cleaner fish.

The creation of dollars parses everything from our rich ancestral experience into a single metric. And the creation of finance was the tool by which humans could turbocharge the pulling of resources from the future to consume today. We have financialized the human experience. Not only are we using monetary alchemy to temporarily maintain our current consumption by pulling resources forward in time, but also stimulus and high stock prices are spreading a psychic numbing through our population, leading to complacency about our real problems.

MYTH #8 – Stimulus is Permanent (1:43:23)



The COVID pandemic has required unprecedented support from governments and central banks around the world in order to stabilize our economies. Despite the fact that vaccines are now rapidly rolling out and businesses are starting to get back to normal, most people don't want to think about or plan for when stimulus and central bank support eventually ends. So, we behaviorally extrapolate today's sugar high forward in time.

Our economy runs on low entropy, finite resources coupled with modern, advanced technology. We use money as a marker for exchange of value and expectations. As economies increasingly struggle we paper over the holes in our system by creating new credit and money. All the while our underlying resource pool, while vast, is declining. At some point we pass an inflection point, point I, in the graphic where the disconnect gets suddenly wider. When that occurs is difficult to quantify. But the two underlying trends are unmistakable.

COVID has caused G20 debt levels to skyrocket to all-time highs, much higher even than World War Two. A main difference being that in the 1940s we still had 60 years of growing oil and resource production ahead of us. If you back out the extra debt and support from our government, the US economy stopped growing in 2005. This is true with many developed countries around the world. Governments and central banks are becoming much bigger enablers, and guarantors of current consumption levels. In fact, as of April 2021, the US government is now paying 36% of our national income via transfer payments and economic support. Despite the fire hose implementation, this has mostly been essential, as otherwise the unexpected COVID pandemic would have shattered our economy.

Since 2008, the Fed and other central banks have handled the various global financial crises masterfully. However, they are now facing the worst predicament yet, they have to simultaneously keep interest rates low, which is the only way governments can run extreme fiscal deficits, but also have to continue to prop up equity and bond markets at record valuations as inflation forces are building up. As nominal interest rates continue to rise and threaten the government funding situation, our policymakers

are again going to have to redirect their focus towards the debt problem. Just as we are energy blind, high and rising stock markets blind us to the reason why stock markets are high and rising because of 13 years and counting of central bank interventions and government's paying of our national salaries and wages. The rapidly expanding spending via borrowing and central banks functioning as safety nets for financial markets can continue for quite a while but ultimately has limits. Higher and higher debt loads both weigh on productivity, due to higher interest rates, as well as increased systemic risks.

Economic productivity, despite not properly including the contribution of energy, is the holy grail explaining the health of an economy. Even with the inclusion of debt, which is a sort of consume more today Time Machine, productivity has been gradually waning for 50 years.

It's easy to see the writing on the wall, we have consumed beyond our means for two generations, and an ecologist would argue much longer. But in order to maintain social cohesion, continued stimulus is what forestalls a great simplification. We will keep kicking the can until we can't. Our analysis suggests the road will be full of cans this decade and we need to prepare for that moment.

There are basically four possibilities. One we somehow regain historic productivity levels with new technology, perhaps via blockchain, or a high productivity energy resource, which will allow us to service our debt and continue growing. Our analysis considers this both the least likely and the least bad. Two, we continue government and central monetary support until the financial markets say, "no mas" and result in much higher rates crashing the system. We would reach a too-big-to-save moment, massive deflation, and defaults as musical chair participants search for the actual chairs. This would be bad. Third option, we have a continued series of bigger and bigger financial crisis, each needing bigger and bigger government bailouts until a major currency breaks, hyperinflation and systemic dislocations, this would be very bad. The fourth option is there's a series of relief valves, taxes, supports, cryptocurrencies, break glass in case of emergency plans that together midwife the inevitable shrinking of the economy in an unpleasant but manageable fashion. This won't be great, but it's worth working towards. Bend but not break.

Relative to our underlying productivity, we have a financial bill long overdue. But rather than pay it, we keep racking up new charges, all of which will eventually need energy to be paid back. The current support of economic and financial systems cannot be permanent at these levels.

MYTH #7 – “We Need to Crash the System to Get a Fresh Start”

(1:48:39)

We Need to Crash the System to Get a Fresh Start

MYTH

REALITY

Society needs to 'bend' and avoid 'breaking' at all costs

There is now understandable angst in populations that the system isn't working for an increasingly large percentage of our population. Hence the popularity of Bernie Sanders and Donald Trump. Paired with this is a growing sentiment that we need a system reset, that the system is so bad that it needs to break before we can rebuild it in a better way.

Liberals talk about the need for the great reset, conservatives like Steve Bannon, lean on ideas from the Holland Strauss book *The Fourth Turning*. While this sentiment is quite valid, it is also dangerously naive. The foundations of everyday life, food in the supermarket, clean water and sanitation, transport and communications, the resupplying of businesses and hospitals, the dispersal of money and credit to society is all broadly cooperative. Together, it all forms part of a dynamic, integrated, efficient and interdependent human system.

We now have globally connected supply chains. We've seen disruption cascades in the past, nearly a decade ago, Ford in the US had to stop truck production for want of a special black dye, whose supply was halted by the Fukushima Daiichi earthquake. But they've been rare enough not to matter too much. Critical infrastructure failures to have been rare, localized and transitory. This is now changing, the multi-dimensional impacts of COVID, the disruption to the Texas power supply in February, a fire at a Japanese chipmaker, and drought conditions affecting water supply in Taiwan have now led to a global semiconductor shortage that are causing cascading disruptions through multiple industries and economies across the world. The complexity, interdependence and speed of the human system mean that crises and catastrophe can emerge rapidly in increasingly vulnerable human systems, we just don't know how or when.

Looking at this figure, each element or keystone species of the human system is essential to the operation of the others. If you remove or incapacitate anyone, the others will all unravel, increasing systemic stress and disruption will amplify the rest of the whole system's integrity and integration. Yes, we can have defaults and deflation and resulting economic depression. And I think we likely will. But if we don't manage this, well, a catastrophic financial crisis could cause a reinforcing disintegration of the other supporting pillars of societal operation.

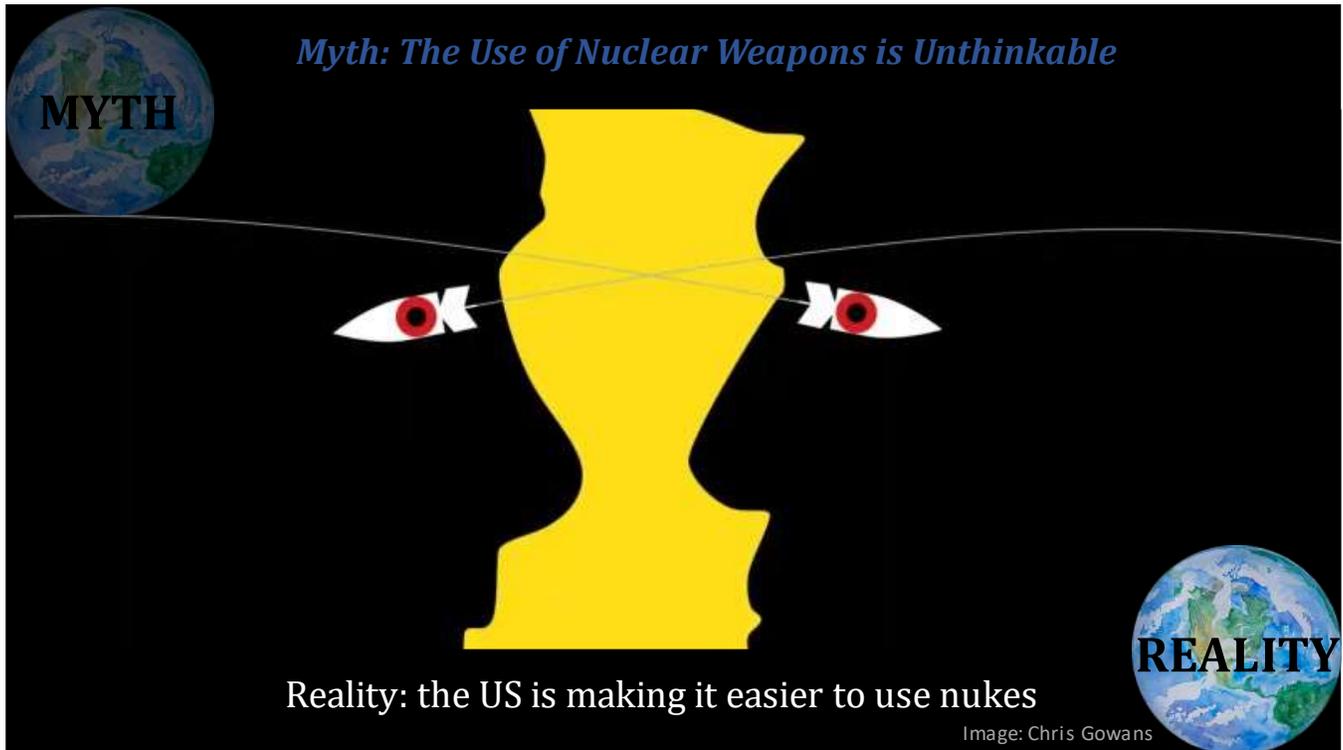
Humans started to have a global economy around 200 years ago, mostly self-reliant, but trading key goods with other countries who had different resources, skill sets, and products. Fast forward to today, and our entire system is interconnected. But because all these things have been very reliable, we've come to take them for granted. One can be angry at the system. But at the moment, it's what in the most fundamental way sustains our loved ones and our communities. Nor can we just pick out the things we don't like and assume there'll be no consequences. That's what interdependence and integration means.

Attempting to take down the system because it's not working for us is an example of an evolutionary game theory dynamic called spite. Since we can't directly access resources, we harm others because on a relative basis, harming others at a smaller cost to ourselves has worked out at times on our evolutionary past.

But today, this comes at a greater risk and a greater cost. One person's unnecessary Air Flight is another's income, debt service capacity and the city tax that might help pay for future flood resilience measures. Yes, a bend or a break moment is likely coming this decade. But it's imperative that we bend because a break would quickly become a disaster we don't recover from.

We need to understand, expect, prepare for, and adapt to a bend scenario in the US and global economy in the coming decade or so. We need to avoid a total reset from which there might be no recovery. Truly rooting for a full reset in the modern world is naive and dangerous.

MYTH #6 – The Use of Nuclear Weapons is Unthinkable (1:52:48)



I don't often talk about nuclear war for the same reason no one else does. It's depressing. Doesn't feel like we have agency hearing it makes us feel powerless. And well, it's never happened, so it probably won't. But the stakes are so unbelievably high that any synthesis of the human predicament must include this topic. People who study this kind of thing tell me it's much more likely than the average person or politician thinks. I guess that all that summarizes why it's a myth.

In the 1970s, there was serious societal discourse and anxiety about nuclear weapons. It's how Greenpeace started. Climate change wasn't on people's radar, even though scientists were starting to understand it as a serious problem.

Today, the opposite is true. People, rightly in my opinion, think the greatest risk to the environment in coming 100 years is climate and ocean impact from the historic and the ongoing metabolism of the human super organism. Yet the greatest risk to the environment in the next decade is arguably from a nuclear exchange, and new more dangerous weapons which are being developed and deployed as I speak.

Even a moderate exchange of around 100 warheads out of 13,000 currently in existence and growing would eject so much soot in the air that would block out the sun for decades, stop photosynthesis, and probably extinguished much of life. In addition to probably starving every terrestrial organism that didn't die of radiation or climate chaos first, this would probably usher in a glaciation. Even a smaller exchange of say 30 nuclear warheads would result in global food shortages, and massive political and socioeconomic disruptions.

What are the odds of such an exchange? Well, apparently the odds of a nuclear war during the long cold war were 80%. Of course, we perceive it as being 0% because it didn't happen. But that just means we avoided it not that the odds weren't legitimate and high.

There is a concept called risk homeostasis, which means we adjust our behavior to risks that didn't happen. Kind of like if you run a red light a dozen times with no ill effect you believe and then increasingly behave as if running red lights is pretty safe. Our culture is enjoying risk homeostasis on about a dozen big risks right now including nuclear war, financial overshoot, endocrine disruption, complexity, etc. But nuclear risks loom large.

The relevant and striking fact is the United States, the country where I was born, reside, and dearly love, is the only country in the world that has not yet agreed to refuse to use nuclear weapons in situations other than self-defense. This has led to the unbelievably dangerous change in US nuclear strategy that says the US can use nuclear weapons as part of discretionary overseas warfare, thinking it carries little risk of nuclear escalation or consequence to the US homeland. US Strategic Command, believe it or not, actually tweeted as much last week.

It's hard to believe anyone is delusional enough to believe they can win a nuclear war. But the United States has developed plans that key leaders in the military and State Department think will work. In the real world, however, logic and rationality are often outmaneuvered by misunderstanding, miscommunication, miscalculation, misfire, and malfunction. This is cognitive dissonance writ large. We need to urgently discuss this and arrive at collective coordination to avert these risks. In my opinion, this and the related risk are humanity's true Darwin moment. The reason I include this here is it's too important not to, and even if a big war is averted, the use of tactical nukes this decade is now very high, which puts all the other issues mentioned in this presentation, supply chains, credit complexity, global interconnectedness, all at heightened risk. I am extremely worried about Earth's ecosystems and other species, which is why I think we need way more discussion and action on the issue of nuclear risks, disarmament and governance.

MYTH #5 – It's the Fault of Fossil Fuel Companies (and Subsidies)

(1:57:09)



I have two friends who work at Shell Oil. I also have two friends who founded Greenpeace. All four of these humans cared deeply about planetary and human society futures. I share this because there's a growing theme in modern media and universities, that fossil fuel companies are evil. And a subtheme that if we politically stopped giving fossil fuel companies subsidies, we would quickly move to a green, clean future. This myth, comforting as it is, has to be addressed.

Okay, on Earth Day, especially, I have to point this out. From the human perspective, fossil fuels aren't bad, any more than deer or mice are bad. Humans are foraging for energy at a vast scale, using hydrocarbons to the detriment of nature. But these hydrocarbons, and the benefits they provide are also supporting vast goods and services and life for billions, described earlier.

Having said that, from a non-human perspective, say a dolphin alive now, or in 100 or 1000 years, fossil fuels are unequivocally bad. And if dolphins had a sound for evil, they would use it to describe fossil hydrocarbons. From the perspective of the natural world, it would have been better off, far better off, had humans never puzzled out how to add vertical farming, aka drilling of ancient sunlight to their repertoire of horizontal farming the land. But this myth is about fossil fuel companies and subsidies. Let's get back to that.

Facebook isn't inherently evil. It's how we're using Facebook and society that has deleterious impacts. There are many corporations, processes and things that aren't inherently bad. Fossil fuels are near the top of that list.

Fossil fuel companies are organizations of people following the same rules as other corporations that society, or some might say the super organism, created. The difference is they provide a highly polluting and increasingly dangerous to the biosphere product that people are starting to become aware of, not sandwiches, or computers, or furniture. However, their product, despite its

pollution, actually enables the sandwich, computer, and furniture companies to exist and to be profitable.

Okay, first of all, let's consider the myth that without subsidies, fossil fuels couldn't compete, and we'd gradually stopped using them. This myth has several layers. First, the IMF recently had a report stating the total subsidies to fossil fuels amounted to over \$5 trillion per year. This caused quite an uproar when it came out, because these subsidies would amount to 7% of global economic output. But it turns out there was a bit of semantic gimmick involved. Over 90% of what the IMF referred to as subsidies were actually externalities, or those impacts on humans in nature outside of the economic system. It's true, these impacts are real but if we internalized all externalities, there wouldn't be a single industry on Earth, that would remain profitable.

Okay, so of the 500 billion or so left of fossil fuel subsidies, over 90% of those are not to fossil fuel companies themselves, but rather to poor people, mostly in oil producing countries like Venezuela, Iran, Malaysia, for their citizens to be able to afford gasoline and diesel. Yes, these subsidies are real and lead to greenhouse gas emissions, but they are not being given to, for example, Exxon or Shell.

Most oil subsidies are tax credits and not subsidies. All industries, corporations, and most people get tax credits. If you go out and buy an electric vehicle today, you get a tax credit, not a subsidy. But it does promote more EV sales and manufacturer, same case with fossil energy. These tax credits for oil and gas came into being when 40 years ago when government realized how important energy was to our economies and put in tax laws to incentivize drilling. But these are in the 10 to 20 billion per year range not 5 trillion.

When compared to renewable technology, feed in tariffs and the like. These fossil fuel subsidies and tax credits are very small in comparison. The blue column are direct subsidies to fossil fuels in the USA, compared to the gray bars which are renewables, renewables get many more subsidies, apples to apples.

A final and most important point. At the height of the carbon pulse, for us to speak about the subsidies that governments provide fossil fuel companies is really inconsequential and energy blind. Compared to the power, affordability, and vast physical work 500 billion human laborers worth, that fossil carbon gives humans, the subsidies we give them is a rounding error.

Society is now acutely aware of the problems with too much pollution on our one and only planet. Despite the accounting sleight of hand, the core sentiment of the IMF report on fossil fuel subsidies is correct. And that is, we are vastly underpaying for fossil hydrocarbons, given what they do for us, and given what their widespread use is doing to the biosphere. Fossil hydrocarbons are the enablers, Exxon and Shell and the like are the distributors. We are the attics. Blaming oil and gas companies is easy but misguided. There is no possibility of a greener planet unless humanity in total consumes less of everything, not just fossil energy. Because fossil energy is in everything.

MYTH #4 – Capitalism is to Blame (2:03:02)



More and more people, especially young people, and some old people are increasingly throwing shade on capitalism and on humans ourselves as the cause of our planetary problems. While there is some truth to this, perspective is also critical.

First, briefly, blame itself is a carryover from our tribal in group out group dynamic. Blaming an out group was really good for group cohesion and rallying the troops so to speak. My sense is that modern Americans, especially, tend to cast blame quite easily. My experience with foreign colleagues, admittedly anecdotal, is when some bad shit happens, their initial reaction is to try to figure out how to fix the situation. Then after they can't fix it, they might get to blaming. Here in America, when bad shit happens, we immediately perceive it as an injustice. It's not fair, it's not right, and then we logically have to blame someone or something. I digress.

Okay, if capitalism is to blame, what is capitalism? Here's a definition from the IMF. Capitalism is an economic system where private actors own and control property in accord with their interests, and demand and supply freely set prices and markets in a way that can best serve the interests of society. The essential feature of capitalism is the motive to make a profit.

Okay, with this backdrop, the origins of capitalism can be found in biology, in nature. Via optimal foraging theory, organisms and animals optimize their energy return, versus their energy investment. This return is denominated in calories or jewels. Energy is the currency of life for all species and for us.

In this sense, our current predicament predates colonialism because it started with agriculture. for 290,000 years, our energy surplus was minimal. But all that changed when we started to care about an optimized surplus beyond what we could consume or carry with us. Hunter gatherers became agriculturalists and tribes became villages, then nation states, and on the backs of fossil armies

became a global super organism. The ancestral wiring of a social species, combined with a fully charged Earth battery, formed the hardware, capitalism was the software.

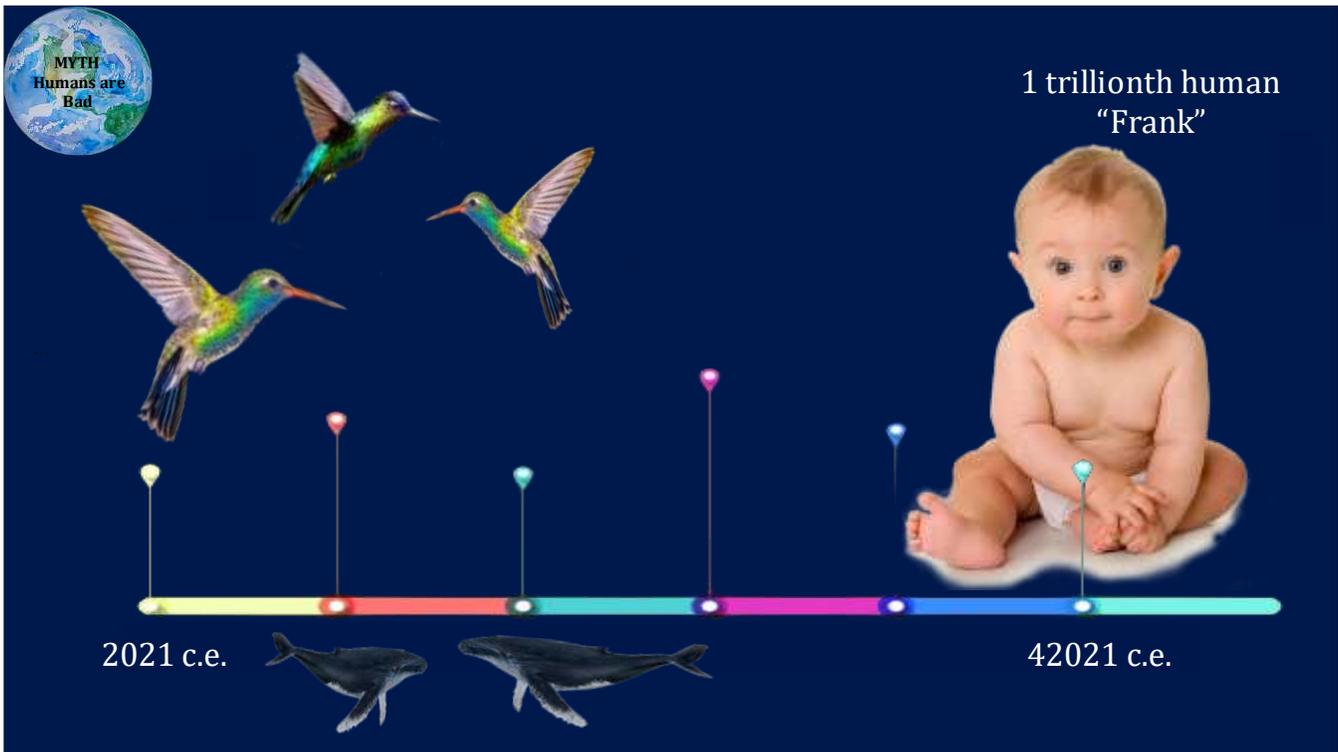
Capitalism, on the backs of fossil armies, brought billions of people out of poverty, allowed hundreds of millions of humans to live like kings and queens, and enabled billions of people to be born and live lives on Earth by turbocharging the food supply. It is too weighty and complex of an issue to label as simply bad or good. In some ways, complaining about capitalism is a luxury enabled by capitalism.

Capitalism itself isn't bad, the effects are bad. Many of the bad effects aren't about wealth itself, but wealth inequality, which has ebbed and flowed over thousands of years, but naturally will spike during the highest surplus or monetary surplus representations. The longest-term negative effects are of course on the environment and natural world, though there will be human intergenerational effects as well, given that future people won't have as much energy or stuff or riches, but they will face harsher environmental conditions. Any ism linked to a culture that extracts carbon 10 million times faster than it was sequestered by nature is going to have disastrous long-term effects.

Relative to other isms, capitalism did it faster. And because it was more efficient and more effective at motivating for profits at scale, will result in more long-term harm because many of the costs won't be recognized until capitalism has long since run its course. Even the founder of economics, Adam Smith said there would be a two-century limit to the dynamic of specialization and growth in the Theory of Moral Sentiments. With this operating system, we've effectively thrown a two-century party. The place is trashed. The booze is mostly gone. We burned a lot of the furniture and we, some of us, are going to have to wake up and act like adults and do responsible things given this new physical situation.

I am agnostic, or more accurately, clueless on what sort of operating system gets us out of this mess. But blaming everything on capitalism neglects biology, physics, and the current build-up of systemic risks. Capitalism is in service of the super organism. We have to collectively find a way out of this.

MYTH #3 – Humans are Bad (2:08:06)



Okay, well, I might as well go for broke. Another myth growing amongst young people, and I know this because I teach college, is that humans are bad. Given the breadth and intensity of the myths covered so far about the mess we're in, seeing the chaos around us, this actually is a reasonable first blush conclusion.

Modern humans are the sole survivor of a group of hominins that inhabited Earth during the last ice age, and that included among others homo Neanderthalensis homo Denisovan and homo Erectus, we won, or our ancestors did. On route to 8 billion, we conquered many dire challenges, including near extinction during the Toba volcano 80,000 years ago, when our population was reduced to perhaps a few dozen breeding pairs. And we've had significant and accelerating impact on Earth's other residents and ecosystems. But are we bad?

I like humans, we are mostly kind, clever, interesting, often giving and occasionally extremely funny. Most of my best friends are humans. When we talk about human beings being bad, we're usually referring to all of us collectively, not individually humans.

And this is an important distinction. All that matters going forward is what occurs as the effect of our individual and species actions. A person working at Exxon may have more positive effect on the future than a basket weaving vegetarian.

Typical species live a million years were 300,000 years in, 100 billion humans have ever lived and around 8 billion of us are alive right now. Could we see the day that the trillionth human is born? If so, humans would not only be good, we'd be great. But it matters not at all to the potential trillionth human or the hummingbirds or the whales, whether an individual today is good or bad or whether they have positive Karma or a small ecological footprint. All that matters is the aggregate impact.

I am a humanist. I believe humans can do better, much better than we have been. Just as the fossil fuel era ushered in a transition to growth, a post growth species level conversation could lead to a new cultural enlightenment. Humans, 8 billion of us, have to find different arrangements amongst ourselves and within planetary boundaries. We are the first generation that can have this conversation. Not only are we living this reality, but we've figured it out. Nobody is to blame. But we are all, or at least many of us, complicit.

Up until this point, we have followed evolution's prime directive to access energy and increase population, that has taken us to the present threshold. The overall human story could still just be beginning. All we have to do is not break the systems which sustain us such as bountiful oceans, living resources, and a predictable, livable climate. This century will be a life-or-death crossing for our species. It is a hero's journey. So far, we have acted more like homo colitis, clever man, or pan Ignis, Fire Ape, than homosapiens, Wise Man. Are humans bad? This can't be answered, because our story is still being written.

MYTH #2 – We Face a Shortage of Resources ([2:11:42](#))

MYTH We Face a Shortage of Resources

Current cultural goal

Plenty

Enough

Sufficiency

We don't have true resource scarcity but longage of expectations

Oil, and therefore growth, are likely peaking. Does this mean we as society will face a shortage of resources?

Hearing some of the inferences in this presentation that we're near the top of the carbon pulse may make it seem like we're losing something. It's natural to feel this way. Loss aversion is a well-studied phenomenon that people feel worse about losing something than they do about equivalent gains. In other words, the positive feelings from a windfall from an investment of 10,000 turning into 11,000 is more than offset by the negative feelings of the 11,000 then going back down to 10,000. Even though you're right back where you started, and still have 10 grand.

We are the richest generation in history, in terms of material wealth, at least. Our great grandcestors in the USA in the year 1800 lived with only 5% of the goods and services we have today. How much of this stuff is making us happy and healthy anyways?

It's important to consider that out of the 100 lightbulbs worth of energy used by the average American, day in and day out, the first couple of them provide amazing benefits. One to two of these light bulbs worth of power will charge a phone or a laptop, a few more will provide heat and light. By the time we get to the 20th or 30th light bulb, most of us are probably not getting huge incremental benefits. And this is ultimately good news for the future because it means we can reduce consumption as individuals and as a society without necessarily reducing happiness and well-being. Is the difference between scarcity and abundance mostly one of perception?

I ride my bike past a trailer park every weekend. The people living here are quite poor by average American standards. But I see laughing children, adults sitting around conversing, working on projects, fishing and other things. I also ride by some mansions, and often see stressed out people who look like zombies. This is a simplification of course. And I'm not glorifying poverty, because for many in our country making ends meet right now is a daily challenge. But one thing our research has shown worldwide is that after basic needs are met, if they're met, the best things in life are free.

Do we recognize the truth of that? At 100 to 1 exosomatic surplus, leading to substantial excess material wealth in America, we don't truly face a shortage of resources going forward. Our challenge might better be described as a longage of expectations.

MYTH #1 – “We are Doomed” (2:14:18)



At the other end of the belief spectrum from technology will save us there is a growing theme that we are doomed. And based on all the information in this presentation such an outcome might now

even see more plausible than it did before. But what I'm trying to point out here is that our current way of life and our expectations are not commensurate with our biophysical reality, and there's some adjustments that are on the way.

This doesn't mean we're doomed. However, most people are starting to realize the road is closed ahead of us on our current cultural expectations. But this intertwines two related issues, the road itself and various physical pathways still open to us and people's psychological reactions to the metaphorical road closed sign.

All possible futures exist as a probability distribution between bad and great futures and everything in between. We can't know what this distribution looks like. But science can inform and shift and refine the area and the boundaries and the tails of this distribution over time. Without knowing it, each of us as individuals has our own probability distribution in our heads about various aspects of the future. The size of the economy, our own life trajectory, the severity of climate change, etc. We change these distributions on the fly, when world events change, or we learn new things, or develop a wider understanding, etc. The above blue distribution is a proxy for how a dispassionate scientist might view a range of future possibilities.

Most people don't like uncertainty, being uncertain about something actually brings physical discomfort. If we believe something fully, it saves us from allocating working ram to think about it and makes us more effective at our basic daily tasks. Which is why most people convince themselves about some flavor of the future, become quite sure of it, and then stop thinking about it. The range of perceived outcomes is very small, because this reduces anxiety about an uncertain future.

This is usually resolved by moving towards one of the twin poles of fantasy, there's no problem, or doom, there's nothing we can do, we're screwed. Both of these, despite being unrealistic and unlikely obviate the need for personal change but remove discomfort. This creates several problems.

First, almost everyone has a different viewpoint. And everyone's confident, by definition, that the distribution of their own viewpoint is the correct one. Notice that very few of the distributions overlap, making it difficult to have conversations about that issue. In other words, the future. Completely utopian views not grounded in biophysical realities, are delaying societal efforts to meet the future rushing towards us halfway. But equally bad, if not worse, are the 100% certain dystopian views that humans are going extinct in the near term no matter what happens. That's not only wrong but shuts people down at this our greatest hour for creative acts, and aggressive, dedicated action. To the average person watching this presentation may have shifted the probability distribution in their head slightly to the left, leaving out a few of the fantasy options of net zero emissions or continued economic growth using low carbon sources. My purpose isn't to explain what's going to happen because I don't know. My purpose is to get more people's distributions to overlap. So, we can have the best and brightest and most pro future humans, speak the same language, and solve some of our issues.

We are starting to realize the road is closed ahead of us on our current cultural expectations. But instead of crafting a new path to the future in creative ways, most people are for valid emotional reasons, gravitating towards rapture ideologies, like colonizing outer space, technology will save us, or Mad Max is coming, let's eat, drink and be merry. Simply put, it feels better and resolves dissonance to be sure. Americans use 100 times the energy that our bodies need, Europeans 50 times. We have robust renewable technology, that in tandem with depleting fossil hydrocarbons can still support vibrant, meaningful, advanced societies, they will just look different than we have today. We need many more people designing alternative paths forward, informed, and yes, constrained by our biophysical reality. But spurred on by the love of nature, discovery, and a shared future.

Everyone watching this presentation is alive somewhere between the blue and red star on what can be described as the carbon pulse, where human economies are supercharged by mining to energy dense carbon from Earth's past. A young person today might reasonably live her life entirely above the green line in this graph. Yes, we're headed for a smaller, more chaotic economy. Things will not be easy. There will be some tragedies and disasters. But there will also be love beauty, discovery, cultural change, new visions, and different ways of living with each other and the planet. The future is not yet certain, but many benign and even wonderful futures are still on the table.

INTERVENTIONS and WILD IDEAS (2:19:59)



Okay, if you've made it this far, thank you, because it means you can about the future and are curious enough as to how things fit together and what role you might play. Now we're to the most important part, also the most elusive.

On Earth Day every year, I can openly admit that the things I care about most are the natural world now and in the future. In the next 100 and the next 1000 years, the highest risks our descendants and the living world face will be how humans manage the carbon pulse in coming decades. Will it lead to the sixth mass extinction of the last 500 million years?

HUMANITY AND EARTH - RISK CHOREOGRAPHY (2:20:46)

However, in contrast, in the next decade, we're going to face multiple other risks that will politically and socially be much higher on politicians and citizens agendas than any action on climate change or the environment.

The first category is our social fabric. We face a loss of trust in information, media, and each other. Populations are already stressed to the breaking point by social limits to growth, even before we hit actual limits to growth. The second big risk this decade is financial. We've created too many financial claims relative to what our productivity and low entropy resources can pay back in the future. A great recalibration is on the horizon. This is going to feel like 1930s USA, but keep in mind that when GDP drops, a big portion of it will be financial things that are now fake. If managed, it doesn't have to be a disaster. But few are preparing for this now as stock markets are giving the all clear signal, but only because of extreme unsustainable measures by governments and central banks. We also face a political crisis. Mitch McConnell just basically said he will vote against everything Biden will try to put through. Politicians, and their constituents, can't even have a conversation about small things, let alone big issues like climate change, energy depletion, growth. The way we're headed, now we're going towards minority rule. And if democracy breaks, many other things will too. Last but not least, and something most of us take for granted is geopolitical risk. We're in the closing hours of the end of the Bretton Woods arrangement. Something new will have to take its place, something that has not yet been born. This is another huge risk this decade, how countries respond to the energy, money, growth, Nexus.

So given all of that, for Earth Day, the things that many of you that have been following my talks for years, or even 12 years, the choreography is we need to work on all this stuff, to have a society, a governance system and a more sustainable physical infrastructure.

INTERVENTIONS (2:23:07)

So, what I have to offer today, briefly, is 12 categories for interventions, or at least the direction for interventions that will help us mitigate future risks and change our cultural conversation. For each category, I will also suggest a wild idea. What does it mean to be a wild idea, ideas are good or bad based on their merit, given the information, imagination and relevance to a situation? Whether they're wild or not, describes their Delta relative to the perception of the people hearing them. That said, I am merely an analyst who's been studying the human predicament. All I can do with confidence is describe what is happening today, not predict tomorrow. I am much more confident of what will not happen in coming decades than in what will. In that light, I offer these general suggestions that to me are challenging, but given my analysis, they're not wild at all. Okay, here we go.

ENERGY (2:23:56)



10/22/21 Energy Appreciation Day



I spent about 1/3 of this presentation discussing energy, which probably seems slow, or not so relevant for most people, because we don't see or feel the urgency or stress with respect to the issue of energy. But in the same way, I would feel obligated to point out that your hair is on fire, if your hair was on fire, I think it would be a good thing if the energy blindfolds of our cultural situation were pulled back. Having said that, I think the momentum of things like green hydrogen, net zero, peak demand, renewables will solve it narratives will not really be stopped. And in the near-term scaling of all those things probably helps GDP, maintain social stability, and does build out some infrastructure that will help in the future, even if it's misallocated. The intervention is that we need to understand, appreciate, and plan about energy much more widely in our culture.

So, my wild idea is every year midway between Earth Day is October 22. Let's make that Energy Appreciation Day. Spend time on that day acknowledging the myriad ways we benefit from energy services that we pay pennies for relative to their real value. Maybe do without or make plans for low energy substitutes in your own life. Or if you don't buy all this energy reality stuff, just freakin' appreciate life, as we are now like superheroes with supernormal powers living in advanced economies in the year 2021. Appreciate energy, and all that it does for us.

INFORMATION (2:25:34)



Pro-future exponential information tech

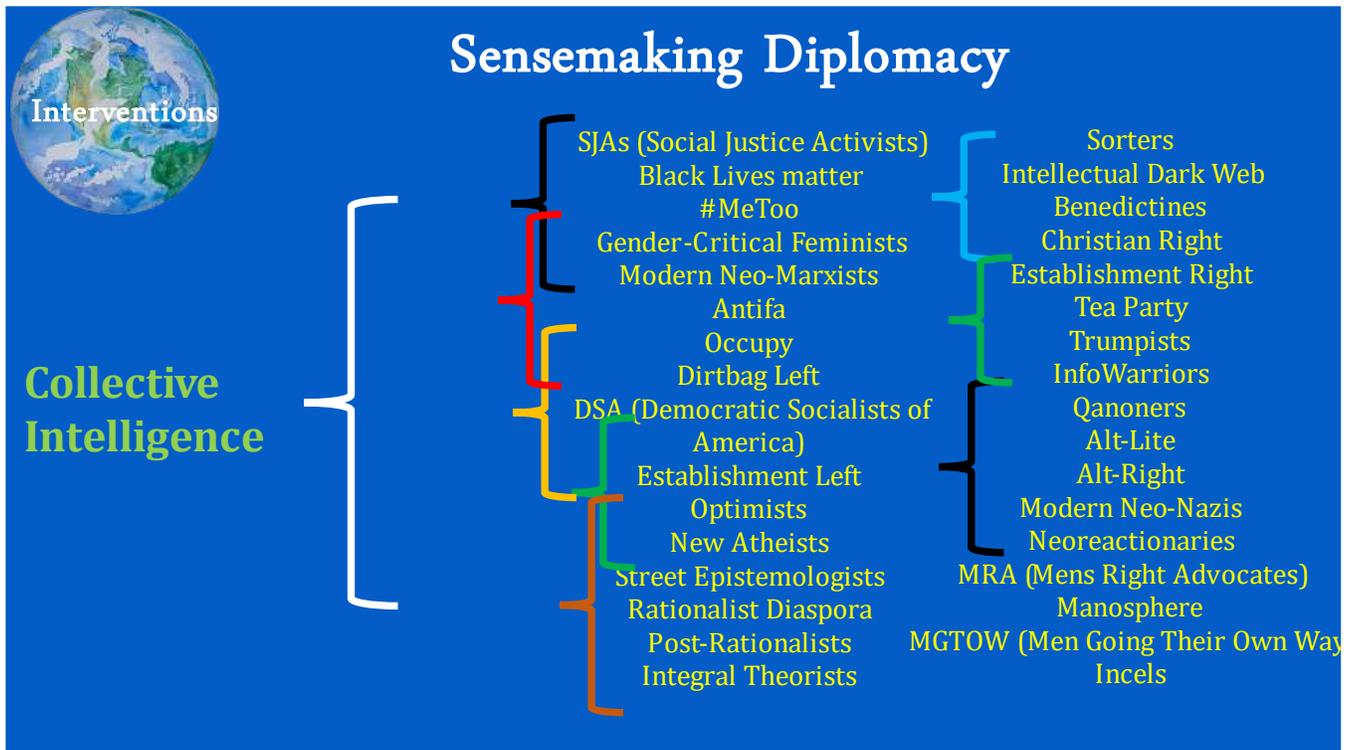


<https://consilienceproject.org/about/>

Currently, the quality of information in our world varies a lot. Additionally, this information is now a weapon on the one hand used by corporations to access power and profits, and on the other hand, used by authoritarian governments to maintain and grow control over populations. Exponential information technology, like Facebook, or facial recognition software in China, has gone from helping us to hurting us, we need a third way.

A wild idea would be to explore research and create new types of social information that not only preserve the principles of open society, but also bind and redirect the application of this growing exponential technology to avoid the catastrophic risks it is now enabling. Such a third rail effort nationally, and optimally globally, will symbiotically change how we access information, progressively increase a meaningful quality of life for all and ultimately inform and change global governance. Pro future exponential information tech, a wonky, clunky name idea, a critical project more people need to think about and contribute to.

SENSEMAKING (2:26:51)



There is a distinction between information and how we get and perceive the information. If we are able to use social technology to reduce weaponized information and disinformation, we're still left with a core problem. The current media is like a minefield, there are some paths for truth, but many fake news landmines. There's two aspects to this. One, we need information, truth and science shared and disseminated from the brightest human minds. Two, we need people to believe, except, understand, converse, and collaborate on this information. Even the most controversial findings, especially the most controversial findings. These are related but distinct problems. Humans and human groups receive and interpret the same information differently, or not at all. One group's signal is another group's noise and vice versa. How do we transform information and science to meaningful conversations, innovation, and the social midwifing our culture will require through the upcoming transition? We need collective sensemaking as a prerequisite toward collective coordination and action.

So, here's the idea. Without realizing it, consciously, we view information through the lenses of our in group shown here is one possible breakdown via Peter Limburg of the various tribes in modern us culture. We each belong to one or several of these groups. You can disagree with these categories, but the point is that there are many dozens of different lenses and perspectives with which society receives and interprets information. As such, we desperately need something like collective intelligence. But by collective we have to acknowledge there is no message that will be received by all demographics. Our neocortex recognizes that we live in a planet with 8 billion people, but our emotional brains still act as if we are in small bands of 150.

As such, we urgently need something like sensemaking diplomats, those individuals who can understand and synthesize information, but simultaneously empathize with other tribal perspectives. Without a common language and understanding to describe and plan for the future we are lost. To speak a common language we have to have shared information. Shared information will require diplomats who can merge conversations across tribes towards greater understanding that meets the

future halfway. Better information, combined with wisdom traditions, that mixes the best individual and collective responses is the goal. We somehow need to integrate tribalism, science, and the empathy of multiple lenses. Cleaner information, on route to better sensemaking, on route to collective intelligence. If we don't solve this, many of the other interventions I'm about to suggest are going to have short runways.

FORESIGHT (2:29:54)

Council of Elders (Advance Policy)



At the same time, our systemic situation is the perfect storm for politicians to ignore, set aside. We can increasingly envision both how these risks will manifest and what sort of interventions would mitigate them to put our nation on more stable, and perhaps even more desirable footing. The policies we're advocating now are important, but merely at the margin, tsunamis are coming. People need to know, plan for, and act on these.

A wild idea is advanced policy, some sort of council of elders, which would be policies and solutions that the world is not yet ready for, but we'll need to have or we're going to be in serious trouble. Current politicians, CEOs, etc, are unlikely, if not impossible, candidates to spearhead such a concept because their job description is focused on the now using existing conventions, assumptions, and even myths. However, retired politicians, civic and business leaders, philanthropists and the like, can play a key tribal of elders role in this systemic sensemaking that might inform advanced policy. This would include building awareness, understanding, blueprints, and break glass in case of XYZ emergency plans, where the x y z can be anticipated and spelled out ahead of time, and then can be credibly handed off when needed.

CENSURE (2:31:28)

Council of Contrarians

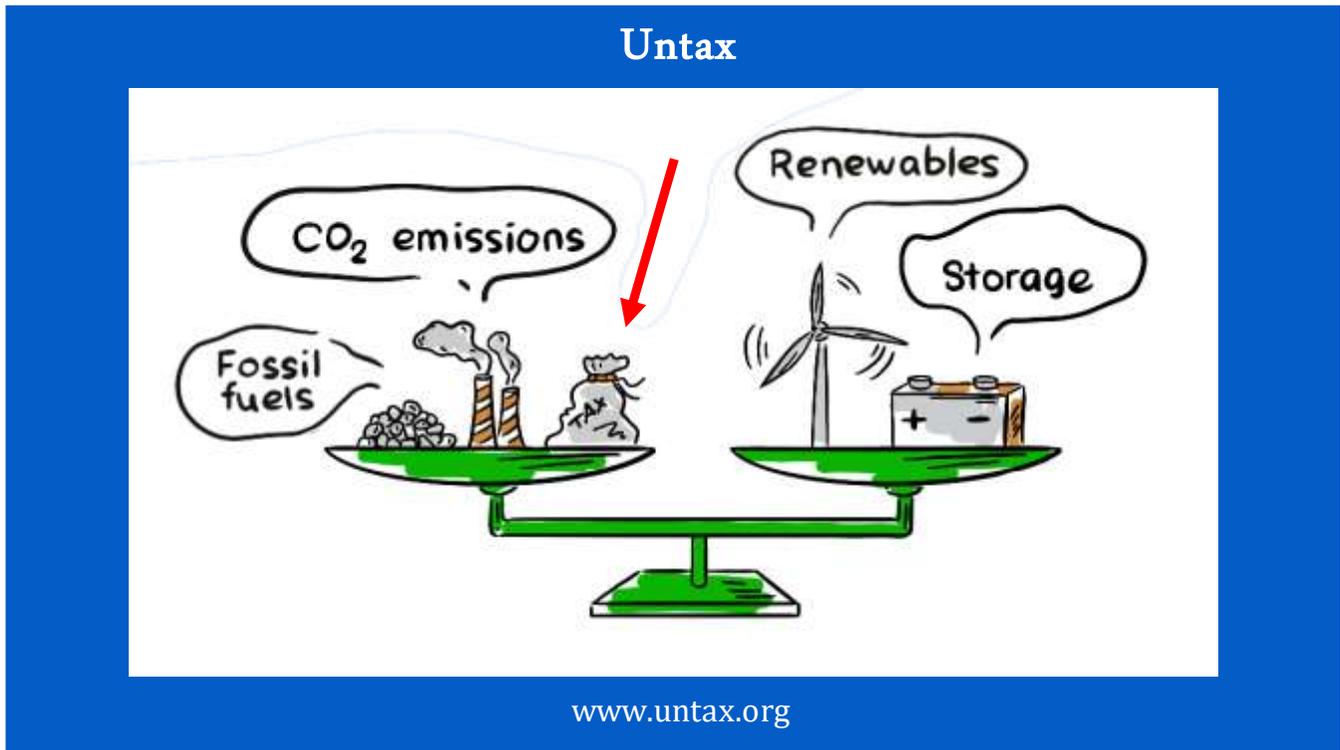


The human brain can imagine millions of more ideas and sentences than can exist in the real world. Like mercury, the more populist of these ideas, travel politically up the food chain, and get most concentrated at the top. Many of these ideas are well intended but tell people what they want to hear using half-truths or bio physically implausible logic. As our plight gets tougher, the delusions in our politics and media are likely to get grander. Rapture ideologies like the Rapture, also space colonization, net zero emissions, globally equality at higher incomes than today, oil is going to peak but due to lack of demand. You know, all these things are cultural coping mechanisms to avoid dealing with our biophysical reality. For the same reason these themes will be popular, explains why it'll be difficult for logic and presentations like this one to be taken seriously. I'm talking about stuff people don't want to believe. There needs to be a way to hone down all the wild, grammatically correct stories generated by human word storytelling to a realistic consideration of what can and can't happen in our real world.

Okay, here's a wild idea. In Rome, there was a council of elders specifically tasked with censure. They had no real political power and had no ability to decide what should be done, but they had negative authority. They could disbar a crooked politician or throw cold water on a bad idea. We are totally lacking something like this in today's governance. A filter for dumb scientifically implausible ideas or dangerous ones. The full committee would make one of three possible determinations. One, dangerous, if this determination were made and approved by a two thirds vote of the members, the policy or legislation would immediately be voided. Two, unworkable, the committee finds the policy or legislation flawed. Three, no opinion. Were we to create such a council of contrarians populated with

diverse bipartisan qualified men and women and confer on them only negative authority to cast out terrible ideas, this might go a long way for us keeping *Idiocracy* a movie rather than a documentary. Side note, in the Catholic Church, when exorcisms were more common, they had a devil's advocate who would try and prove that this was not a demon possession, just craziness.

INCENTIVE ([2:33:59](#))



Right now global society is functioning as an energy hungry, mindless super organism. Our goal of coordinating behavior towards profits is biological. But the vast majority of the profits are enabled by mining stored minerals and materials that are finite. We can't really change our behavior, on mass, unless we change our incentives. Said bluntly, we are vastly under paying for the magic which is supporting our lifestyles and populations. And this is leading to depletion, pollution, and waste. At the same time, 95% of our current taxes are on human labor, not on the fossil armies doing most of the work.

A wild idea, which we're working on, is to change the incentives and the prices of things to be more aligned with their real cost, implementing a tax on non-renewable resources, including fossil fuels, but also water from fossil aquifers, copper, neodymium, sand, and anything non-renewable on human timescales, this tax would be on the order of 50 to 90% and set roughly to the renewable, recyclable equivalent for that resource or service. This would make things much more expensive, so would be countered by a removal of all taxes on human labor, the net effect for government revenue would probably be a wash. We're researching that now. But human labor would be more competitive, and it would encourage both conservation and innovation aligned with more likely futures. This simple idea would do more for climate change in the environment than any action of the last 50 years. Quite simply, we are paying too little for the most precious input to our future, and not paying anything for its waste

impact. This can change with a change in prices. Bonus idea, I just described disincentives for bad behavior. We also need real incentives for good behavior.

Well-Being (2:36:10)



It's increasingly recognized that once basic needs are met, if they're met, that jobs and GDP aren't fulfilling the needs of our population. We've relied on national aggregates for too long on assessing how are we doing. How much stuff we burn only has moderate correlation to our happiness, health, meaning, and outlook to the future. In coming years and decades, we're going to need complimentary metrics of success, in addition to the national and global accounting metrics of GDP. Furthermore, there will come a time in the not-too-distant future where we can no longer grow our economies, materially. So, we're going to have to have alternative ways of measuring how we're doing.

Here's a wild idea. One project that we've initiated is called How Are We. We're getting bottom up, real data on how people are doing in their lives, on a wide variety of metrics, health, job, meaning, safety, community, etc. The goal is to get data in all counties in a state. And eventually many states or countries, so that policymakers and other stakeholders of all kinds can have a conversation about how we really are doing. This is not a top-down, econometric tool, nor one that includes macro environmental data. But it's a participatory project that hopes to gradually shift what we care about, what we value, and how our lives are distinct. From how much we're growing GDP and stock markets. How are we really doing?

Compromise (2:37:48)

Transition Triage



The narratives of the past 50 years will stay with us until it's undeniably obvious they are outdated. That will mean at some not-too-distant date in the future, we will have to undergo a sort of cultural triage, choosing what things to save and maintain and choosing what to jettison because it no longer makes economic, energetic, or ecological sense. We need to meet the future halfway, a compromise.

On this topic, I can't very well suggest triaging NASCAR or Miami, so I'll suggest something more benign and more believable. The single largest irrigated crop in the United States is, you guessed it, lawns. In addition to waste of water, productive soil, and a source of toxic chemicals. It's also a fake ecology relative to what came before and after it. Some of us are already revamping our lawns to be more like native ecosystems. Who knows, perhaps it could be a trend. We need to meet the future halfway. This is going to require a lot of really tough choices. This one - not so tough, be creative, get started.

Education – Knowledge – Ecology (2:39:02)

Civilian LandCorps



Images courtesy of <https://greenhorns.org/habitat-everywhere/>

The COVID pandemic gave us a glimpse that our education system is now failing. The 21st century will require sensemaking more than it will need memorization and traditional education. The gameboard is now wide open for bold new moves in this area. Here's one, at the intersection of education, knowledge, and ecology.

We just pass a \$1.9 trillion stimulus, and another big infrastructure plan is on the way. In total, the stimulus has been \$5 trillion. What if we allowed for a volunteer a year off for 17- to 25-year-olds to work on ecological and community restoration projects along the lines of FDR Civilian Conservation Corps in the 1930s. We want our young people to feel pride of place and confidence in the future, to be ready to strive and innovate. We can inspire them by reinvesting in ecological resilience, in beauty, on public lands, on private lands. Even on civic lands in towns and cities. Imagine the United States where vibrant parks and urban forests produce shade and food for communities. Where highway roadsides are beautifully vegetated, where rivers and waterways have healthy forested edges and well-maintained trails and trail heads. Where soil and wind erosion from intensive agricultural operations is now buffered by large scale hedgerows of native plants, protecting the nearby residents from dust and poisons. Imagine a nation that employs its best ecological thinkers, scientists, landscape architects, technologists and conservationists in joined together with young people to map the points of intervention with a program aimed at enhancing our green infrastructure, affirming the reality that a healthy functioning ecological system is our best homeland security for the longer term. Either paying these young Americans for a year or giving them free college or future tax relief would be one of the best possible uses of stimulus dollars, because they are helping our ecosystems and building networks of hope, meaning, and vitality. Is this really such a wild idea?

Sacred (2:41:21)



A Life Ethic, (and a Necessity)

- (1) Life existing is preferable to no life existing.
- (2) More kinds of life existing is preferable to fewer.
- (3) Vibrant, complex ecosystems are preferable to small fragmented brittle ecosystems.
- (4) Ecosystems with large complex life are preferable to ecosystems with only microscopic life
- (5) Ecosystems supporting conscious minds (virtual worlds) are preferable to ecosystems without them.
- (6) It is preferable to maximize existence, happiness, love and understanding and minimize the suffering of minds in the universe.
- (7) The future, both near and far, is real in the same sense that "now" is real, and via causality is determined by what is done now.
- (8) Things which are preferable by this definition may be considered good, things which are less preferable may be considered evil.
- (9) *we should maximize good and minimize evil, since the universe does not.*

In our interviews around the country, on people's well-being we're noticing two core trends. First, a lot of people are very worried about money and making ends meet. And second, people are starved for meaning. Our current culture, and pretty much our species, have two core objectives. Heaven and GDP, or profits. With everything else hitting us, most of us has lost the sense of the sacred in our lives. Our physical universe does not have meaning, morality, love, wonder, good or evil. These exist only in the domain of conscious thought. And they're hugely important because they enable us to determine what we should do. Our culture, ultimately, will need to decide what matters and base our decisions on that.

It should not be difficult because all one needs is a consistent ethic of life, which emerges from wanting life to continue. This ethic is so obvious and basic that we might expect it to occur on any life bearing planet in the universe, once a species became self-aware enough of the arc of their history. So here's a draft life ethic and maybe a necessity. Life existing is preferable to no life existing. More kinds of life existing is preferable to fewer. Vibrant, complex ecosystems are preferable to small, fragmented, brittle ecosystems. Ecosystems with large complex life, like elephants and whales and humans are preferable to ecosystems with only microscopic life. Ecosystem supporting conscious minds, the virtual worlds in human minds, or a gorillas or crows or dolphins, are preferable to ecosystems without them. It is preferable to maximize existence, happiness, love, and understanding and minimize the suffering of minds in the universe. The future both near and far is real, in the same sense that now is real and via causality, is determined by what is done now. Things which are preferable by this definition may be considered good, things which are less preferable may be considered evil. We should maximize good and minimize evil, since the universe does not.

Protect (2:43:47)

LifeBrigade

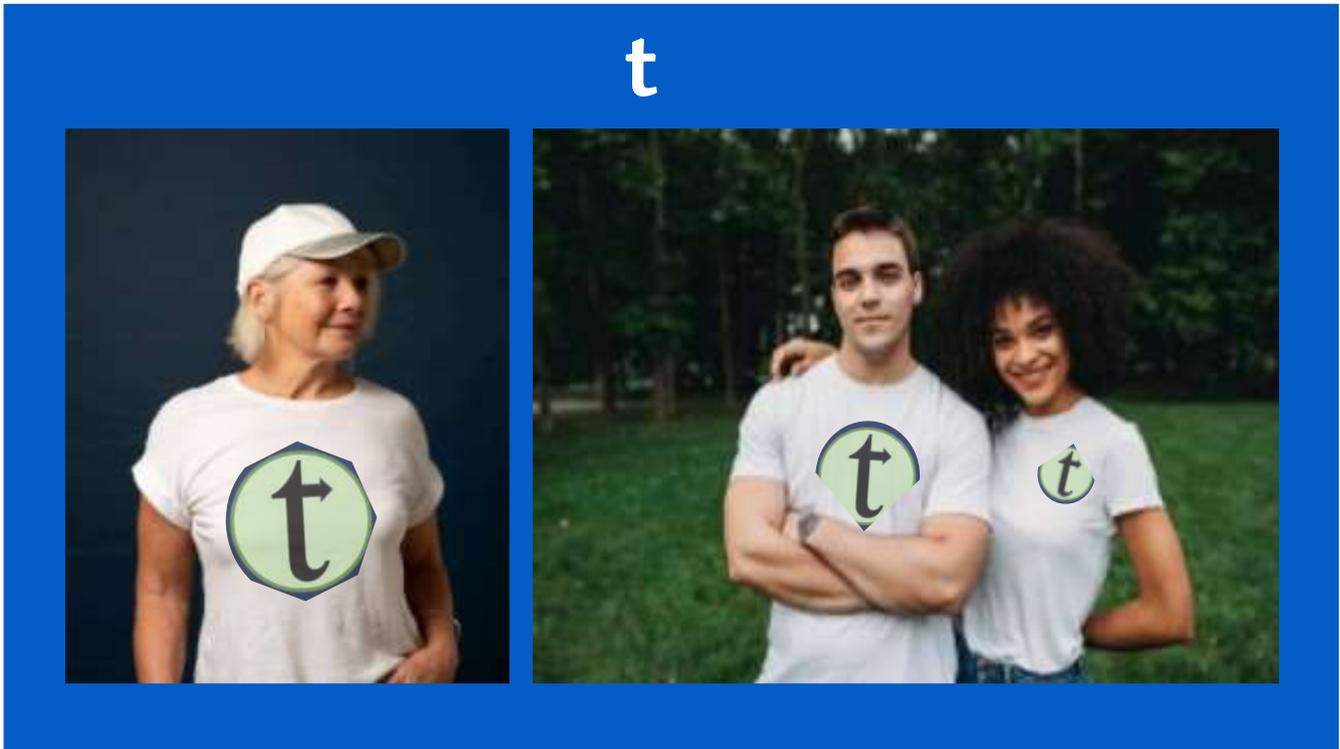


Earthtrust.org

Building on that, at this strange point in human and planetary history, we're traversing a bottleneck in which our species will grossly overpopulate and over consume before shrinking back to more sustainable levels in a century or so, one way or another. During that time, it is important to make sure we do not irreversibly break our world. This has to do with things like ecological tipping points, and also the loss of species and ecosystem complexity. There are many species facing extinction, with not a single human advocate. If you feel powerless, despite your education, and your access to the internet, just think how powerless an individual pangolin is, by comparison.

Every human is a potential superhero compared to any other member of any other species now. Compared even to entire species, individual humans can, in principle, save these other species to get them past the bottlenecks of the coming century and give them a chance of an open-ended future. This isn't going to be easy but compared to a sea turtle caught in a net or a monkey in a forest being burned, it's at least possible. We are individually far more powerful than those our action and inaction are affecting. So a possible wild idea is the concept of a life brigade. One can choose a species of plant or animal or more than one and make it part of their life's meaning to protect it. This might be a local species or population or habitat, but it need not be. A teenager in Minnesota could easily become the world's foremost advocate for a species in Bolivia, just by standing up and becoming an expert on it, using the resources and influence that a US citizen has, at this point in time. At this point in history. One can organize with others doing something similar locally, nationally, or worldwide, or one can do it entirely on their own, as a private person, a part of one's inner definition of success as a human being.

Tomorrow (2:45:59)



Our culture has thousands of emojis on our phones, but not one of them to represent the concept of the future.

Somewhere in the Bible, Isaiah, I believe, is a phrase, “they will not make themselves known to you”. How many people are out there in our towns, in our cities, in our countryside, that are deeply concerned about our collective future, but don't know what to do or where to go. The first thing is to create a movement where they can find each other. A tribe for tomorrow.

Community (2:46:33)



On a more practical note, one of the most critical risks to society is that as one of the richest nations in the history of the world, we no longer know, or need, our neighbors. We can order stuff on Amazon and seamlessly quit our Zoom calls and pop a pizza in the oven and watch Netflix without needing anyone. We don't need to do the hard work of sharing, facilitating, cooperating, with the people around us, especially if they don't agree with us. This is all about to change in the coming decade, when we're going to need people again.

There are increasing efforts to merge the blue and the red demographics into purple. A wild idea is to have a communications effort that could be heard and received by a large percentage of the population about the risks and choreography in this presentation and start local networks that begin conversations about it. It's unlikely these groups will immediately do the things that will be needed during the coming great simplification, because we're still getting the emotional signals of all time stock market highs and a future of abundance. The important part would be creating the local, social networks, so that communities in the future will have a higher chance of self-organizing when things get tougher. Social capital in your community is going to be vital. It's very difficult, but I think we have to try.

Wisdom (2:48:04)

4minutewomen.org



As mentioned several times in this talk as a culture we are often clever, but seldom wise. We are the idiot savant of the millennium, able to land rovers on Mars and create Oculus Rift virtual reality. But typically not knowing where our food comes from, or the importance of soil or ammonia fertilizer. Our culture, right now, needs wisdom more than we need new technology and inventions. In World War One, President Woodrow Wilson initiated an effort called four-minute men were 300,000 short speeches were given in public places to inform people about the war effort, and offer inspiration.

Here's a wild idea, have a communications effort on the core topics in this video broadly, organized, articulated, and run entirely by women. It could start with four-minute speeches by women scientists on the core topics in this video but branch out to get perspective, wisdom, ideas, and plans all by women. Biologically, women have shallower discount rates than men. In other words, they can visualize and care about the future more than men can. Culturally, women have too small of a voice. Given what we face, our culture could benefit from efforts to significantly grow the voices, idea, and wisdom of women.

[Living \(2:49:31\)](#)

Hitchhiker's Guide to being alive at this crazy time...



This has been a sledgehammer of a presentation. I'm exhausted, to be honest. Thank you for watching it all the way through, as long as it was, if you squint and look at it in its totality, the content will hold its shape in coming decades. I hope some of these intervention categories made sense or inspired you to modify something in your work or your worldview. But one category, I think, is glaringly missing.

How the heck do we live our lives during this crazy time? How do we cope, thrive, and engage with our challenges as individual humans? This is really an entirely different list of suggestions and recommendations, how to grieve and reflect and rage and be passionate and bold and thrive during these times. This video is already way longer than I anticipated. So I'm going to close here. And in the next month or so I'll follow this video up with another one on what to do as an individual. I'm perhaps not the best spokesperson for this, because I have many flaws, and I'm not doing everything I can or should be doing. But I've thought a lot about how our evolved brain intersects with our Star Wars culture, and I'm going to give it a shot.

Love (2:50:52)



Lastly, an idea I think is essential is love. I love my family. I love my friends. I love my dogs, my horses, the fields and the forests where I live. When I travel, I love the other species and ecosystems. Even today, when I go into Walmart or a brewery, I look around at the people differently than I did 10 years ago. These are the people that are on this planet traveling 70,000 miles an hour around the sun with me at this time. We need more love in our world. I don't have a project idea. But I think there are vast undercurrents of love in our culture that are socially suppressed. Love is the antidote to hate. But it's also the antidote to apathy. We need to love something to save it, and I love this world. And I think humans can do better. And I hope you can join me in playing a role in our collective future. Thank you for watching this.