

The Role of Science and Scientists in Saving Our Planet and Ourselves

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ABSTRACT

We live in a time of unprecedented global change, and face a very near future of climate chaos, mass migration, and sociopolitical upheaval. We now have only about eight years to radically improve the ecological conditions on the planet to avoid mass extinctions, and at most twenty years to master the emerging field of geotechnical or planetary, engineering. If civilization is going to exist for our grandchildren, we must become very good at planetary-scale engineering, and quickly. How do we move whole cities? How do we radically regenerate ocean and atmospheric health? What should future civilizations look like, and does humanity have the strength, courage, and ingenuity to rise to these challenges, or have we doomed life on the planet to extinction? What role might physics and the material sciences play, and what special responsibilities does the research community have? What decisions should the EU and its nations make now to ensure their future survival? Are we as scientists acting rationally, and what should we do next?

INTRODUCTION

Though I am a scientist and a researcher, this is not a scientific paper. It is a subjective and hopefully honest account of my trying to understand why we as a scientific community have not been able to rise to the urgent challenges of climate change and ecological collapse. It is the basis for my invited talk, in which I explore the challenges scientists now face, and what emerging solutions might be.

DISCUSSION

To understand the present, we must understand the past. I was born in 1967 in upstate New York to Russian immigrant farm folk. My grandparents were only semi-literate and never spoke Russian at home because they did not want their children to have Russian accents. In their whole lives they never left their farm or had a bank account. My father's father was given the name *Wheeler* at Ellis Island, because his Russian name could not be written, and in those cases, it was the tradition that the immigration clerk handling the case assigned them their own name. My name is Wheeler because an immigration officer in 1910 was named Wheeler. No one in my family knows our original Russian surnames, they were considered shameful and hidden and lost to history, as we were Americans now.

Though my parents were not well educated, they were progressives, and believed in education. They were also very religious. *Progressive* at that time meant things would get better as society and civilization progressed. Diseases would lessen, people would live longer and be better educated. On the whole, society would become richer and smarter and less barbaric. *Less cruel.* It was a *Star Trek* styled cold-war dream of a future where technology advanced humankind beyond nationalism, tribalism, and ignorance.

For most people, it was not a socialist, capitalist, or political dream. This progressivism was rooted in the earlier tradition of *humanism*, and the enlightenment virtues of rational thought, discussion, and discourse. People all wanted the same thing, to have children and safe, normal lives. It was also a dream of hard work, and in my family, everyone always worked from a young age, there was never any *not working*. If you were awake, you worked. My father believed I would grow up to work in a factory. My mother believed I would go on a long journey, and so prepared me by teaching me to get along with almost no money, and to cook, sew, and build things for myself.

And I was the worst kind of progressive – a futurist. I believed that modernity would develop and create radical new environments for human living and civilization. Probably this was due to the fact that I grew up in one of America's poorest places, and had no exposure to art, literature, and science. Born with synesthesia and various other disorders, I found human society confusing, cruel, and alienating, and preferred the company of animals and machines (it is likely my childhood desire to be a robot and not human that led me to my career in artificial intelligence). I especially believed in the role of technology to create futuristic buildings and cities, like arcologies. Science and technology would eliminate disease, and society would become educated, enlightened, efficient, and equitable. The future would not be like *this**.

And science and research is, deep down, not about the present or the past, but an act of optimistic investment in the future. Many of us growing up in the post-war era believed that history's long arc was a one-way function away from barbarity and war and towards a *rational* and prosperous future. It was *inevitable*. The dissolution of the Soviet Union at the end of the 1980s seemed to confirm this. Looking back, I realise we misunderstood the role of rationality in the human animal, and we believed our own story about our worth, our abilities, and our motives. This obsession with progressivism, futurism, and modernism led me to leave the United States when I was 19 years old, in 1986, and never really to return.

And there was a calm period, the 1990s, when it was unclear what all of this history meant, what the new world order would look like. It was unclear what would happen next, what forces would prevail, but it was in many ways an optimistic time, when science seemed to be making breakthroughs every day that promised us a brighter future.

I was there, too, first as a literature teacher, and then as a technologist working in artificial intelligence. I thought the things I built would make humanity happier and healthier. While still a post-graduate I was hired by the World Health Organisation Headquarters in Geneva to do intelligent disease control. In 1994, much of AI was based on and developed according to the principle that human decision making was rational and could be broken down into steps. The birth of the internet and smaller and faster computers seemed like the final birth of the futurist dream, jet fuel for the progressive ideal. They would make everything better, smarter, more efficient, more rational, more equitable. They would slay the last monsters stalking humankind. Unfortunately there were no similar advances in the fields of philosophy, psychology, political science, and sociology, which perhaps were needed the most.

But ICT and the internet allowed all of us to partake in a collective dream. In this dream, technology and its CEOs and avatars would connect everyone in a newfound and mutual prosperity. Everything would equal out. I also believed this dream, and contributed to it in some

* Though complex, I see this now as related to Derrida's concept of *hauntology*, the tangled systems of perceptions, biases, and beliefs that lead us to misunderstand the future even when our perception of it is in the past. We can miss, and mourn, the futures we expected but that never arrived.

small ways. I helped design and build some of the early algorithms specifying how knowledge is represented, shared, and compared, now common in big platforms. I designed AI tools for teaching, and for international tuberculosis, malaria, and measles control.

And in this dream, advances in technology would address climate change with radically new solutions to be created when the extent of the problem become properly known. But climate change and ecological problems seemed very far away – 50 years, 100 years. Then, as now, it seemed absurd to think that people would stand around while the planet dies a sudden, foreseeable demise. And we felt like we were contributing to the systems that would eventually address it. We were all falling asleep.

*This dream lasted until one day in 2001. September 11th to be exact. Many things happened as a result of that day, but above all, it became apparent that there were people who would use any disaster, no matter how terrible, for personal power and gain. Those who thrive on chaos and fear built governments and industries around it. Morality and humanism was quickly replaced by economics and fear. Speaking of absolutist philosophy and moral theory, George Orwell once said that there is no meaningful definition of *evil* other than *the use of power against the powerless*. This is one of the key grounding points of the humanism then being dismissed.*

Indeed, the liberties, freedom, and relative prosperity we had enjoyed would in many ways be reversed as formal and informal wars without ends were declared. One remembers the phrase “there is only one type of war, the war of the rich on the poor.” At this time there was also a “war on poverty”, and wars on drugs, on the unions, and a hundred others. But we now understand these were all primarily wars on the poor, and have all since mostly merged and become professional endeavors.

*Overnight, countries seemed to turn to fear, paranoia, anti-intellectualism, and suspicion of rationality itself. The clock of history began to wind backwards. This was the start of the *sleep of reason*...*

And of course, the sleep of reason summons monsters of our own making...

*Through all of this, we scientists did what we always have done, keep to ourselves and other very educated people, and hope for the best. **This was not a good strategy for us.** Many scientists, myself included, consider politics vulgar and irrational, having no appropriate role in our lives. But politics, and more importantly, the sociocultural changes driving them, changed the world around us. But we stuck to our higher calling, or we tried.*

This caused me to make a sobering realisation: that there will always be those who will try to rule using fear and chaos. No amount of education or wealth can ever change that fact. And there will always be those who want to be led. When we create new things of value, new tools, new ideas, they enter the wild without us to be picked up and used according to the perceived needs of the day, for good or ill. We need to be careful where we lay them down.

*Meanwhile, artificial intelligence was advancing very quickly, and I was in the middle of it. The machines were getting smarter, but the people were not. We also began to recognise that humans, even experts, were not really making decisions based on rationality, but instinct. This made the creation of AI through the use of logic and formal reasoning (symbolic AI) seem ridiculous, and much of the field turned to focus on systems that just optimise prediction and categorisation (sub-symbolic AI) without having any intelligence or knowledge principle at all. This was called *deep learning* and now dominates the field.*

But the villains and monsters of the era to around 2010, terrible though they might be, were unlikely to destroy the planet. In fact, much of the problems of those years were imaginary, and born of fear and hysteria, with money to be made and power to be gained. But the biggest casualty for me was the death of the progressive dream, the humanist dream, that life for humanity was destined to always improve, that our research and discoveries would inherently make life better.

But then a new disaster began to emerge, that did threaten the whole planet: accelerating climate change and spiraling pollution and ecological degradation. It was there all along, but strangely we did not do much about it. Somehow, the entire Western world seemed to be distracted and obsessed with gadgets that told us we were the central point of every universe.

And then within a single decade, it was so obvious that it could not be ignored. Like all animals, humans, even those who do not believe in climate change, can sense disaster approaching. And that generates fear and crises and chaos, often unbound to the real threats and dangers. And crises can always be exploited.

2016 was a year of reckoning and realisation. There were people on Earth happy to see the planet destroyed, indeed even to accelerate its demise, as long as they were in charge. Those who would doom life on the planet to extinction to feed their egos were obviously mentally ill[†]. But strangely, they were usually in charge. In the 1970s and 1980s, mental illness was only perceived when it caused a complete loss of civic and social sense requiring intervention. But we now realise that many of the leaders of industry and government are obviously suffering from malignant narcissistic personality disorders, and sociopathy. It's now perfectly obvious.

At the same time, technology for addressing the impending disaster became available. I transitioned to working more in renewable and sustainable energy around 2006, and in the decade that followed wind and solar energy, and radical innovations in materials, chemistry, and physics, allowed us the chance to save the climate and ourselves. In Europe we have done better than most regions, but far from what is needed. Unfortunately, the rest of the world lags even further behind. But as the crisis accelerated, I noticed that those in the scientific community (outside of climate modelling), whose love of rationality and reasoning should have prompted them to refocus their work on sustainability issues, seemed oddly unbothered. In some ways I was also oddly unbothered. How could I recognise that we are facing mass extinction and ecological collapse and not be more bothered by that? Was I being rational, or irrational?

This led me to a realisation: human kind may not be physiologically equipped to contemplate our own extinction. Maybe this is part of why we invented God: so that our survival is someone else's responsibility.

And maybe the truth is that humanity does not have it in us to save the planet. The fear and chaos that comes from this realisation is likely to doom us all to a future of denial, authoritarianism, and war. Faced with extinction, we all become angry, cowering monkeys again. This is what it is to be human.

And so climate change, ecological degradation, and a number of other factors seem to be dooming us, especially in the West, to a replay of the 1930s. The authoritarianism, the blaming of immigrants, the denial of the obvious, the rejection of humanism, the refusal to value rationality and science. Above all, *the sleep of reason*, the ever-growing perception that truth is relative or cannot be known, and so the only things that matter are our opinions, our anger, our egos.

[†] Anyone doubting this should read Jon Ronson's *The Psychopath Test*

And worst of all, this growing anti-intellectualism, anti-science, and anti-rationality arrives exactly when we need them the most. These are the factors that will scale along with the fear and the scope of the disaster. **It is this, the loss of faith in science, which may doom life on the planet to extinction.**

And strangely, almost no leaders have emerged creating a counter-narrative. One would expect that having rejected rationality, the discussion might turn to morality, or that traditional religions would step forward to offer some guidance. But no.

I met a climatologist from Texas. I asked what her models showed we had left in terms of time. She said around 25 years before mass migration and severe climate change caused vast changes to civilisation including possible collapse. But, she said, she doesn't believe her own models.

Why, I asked? Why don't you believe your own models? Because God wouldn't do that to us, she said. *God wants life to continue on the planet.* This is the same denial most people, including many scientists, are in, it's just projected outwards through ignorance, fear, and primitivist religious culture. It is the human condition.

We spoke briefly about politics. I asked her why she had voted for George W. Bush a second time, after it was clear he had lied to launch the war in Iraq, constituting crimes against humanity. She said she voted for Bush again because he reminded her of her father. This is the human condition.

These are the forces at work that we need to understand, and they are at work in all of us. In the midst of all this, in around 2016, it became obvious that the internet that was meant to bring us all closer and promote equality and forward thinking was doing the opposite, pushing us all apart. And those champions of the technology knew it would end here, and engineered it to be so.

And those leading us into the future were more greedy and short-sighted than even the politicians helping them. They spoke of humanitarian values while robbing us and creating the conditions for mass unrest and ecological extinction.

This led me to a realisation: the enlightenment of human thought many of us believed would come with sufficient education, technology, and advancement in cognitive science, sociology, and psychology was never going to arrive. This part of the historical enlightenment, and the post-war humanist dream, was naïve and misguided. Perhaps it was we scientists and researchers who realised this *last*; as the leaders of industry and politicians never had a belief in rationality or human advancement to abandon, so they were way ahead of us.

Now after 2016 it seems things are continuing the other way quickly, towards ignorance, tribalism, cruelty, and barbarity. Many of us who express shock at the ignorance and cruelty of modern institutional and nationalist behaviour do so because the legacy of our belief in rationality and humanism keeps us from recognising that the cruelty and ignorance is the whole point; there is no other purpose to it. The acceptance of torture and concentration camps as part of modern political and social policy is fundamentally incompatible with our outlooks as rational actors. And of course, this is not new, we are just replaying the 1930s again, and our shock is the same shock as scientists and people of education and good faith expressed then. They did not know what to do then, either.

And this is all happening when humanity most needs to devote itself single-mindedly to saving the planet. And these things are closely related and cannot be considered separately. This legacy of rationalism, of humanism, is also keeping many scientists, myself included, in complex forms of denial. Events now unfolding are so irrational and ignorant, and climate change and ecological

collapse so vast and serious, that we *believe and disbelieve it all at the same time*. Ours is a unique denial of epistemology, a crisis of our perception and integration of truth; we accept the truth of our situation, but act as if it doesn't exist, and continue on with our work. I think we do not want to be implicated and admit the failure of our most cherished ideals and dreams. Anyway, that is how it is for me. Still, it's good to know.

So I have spent an entire year studying climate change and ecological collapse even though it is not my field. Actually, I have been told by climatologists that it is not really anybody's field, we are all amateurs in trying to save the planet and ourselves. After six months of studying technological and scientific solutions, I realised that the problem, even with scientists, is primarily psychological. So I began studying the psychology, sociology, and cultural anthropology of climate change and ecological collapse[‡]. I learned that when confronted with serious crises, humans respond with varying but common types of denial (which I knew), and submerged and subconscious grief (which was less obvious to me[§]), and that the seeming indifference I perceived in the scientific community's response to climate change is natural and must be understood and overcome. This is what it is to be human.

I set about to meet as many senior scientists and research leaders as I could to hunt for innovative ideas and solutions, and to find out how they saw the problem. Many of them were retired, and not able to engage psychologically with the problems of climate change. When asked their opinions and ideas for response and adaptation measures, many of them responded honestly, that they were just glad they would not be alive to see it. But they have children, grandchildren, why are they not more bothered? They feel helpless, and that the problem is beyond the horizon of their experience. And I understood this, and felt the same way. It is also a form of denial, of excluding myself from taking more action when I do not know what action to take. It may also simply be that after a certain age, animals stop thinking of the future and are in some ways overcome by the past. But it is also probably because there are institutional and economic actors who want us to feel confused and powerless and unable to act. This is hard to recognise and accept for many scientists.

*And then in the last year, 2018, children became the leaders of the climate change movement**.* Unlike the adults, unlike those of us who try to be as rational as possible, it is these children the world over who see the situation for the way it obviously is: a slow-motion mass extinction event, the likely end of humanity and maybe life on the planet, but certainly the end of western civilization as we've known it. And they are not in denial, and their futures are at stake, and what they say is true and obvious, and we who have tried to run the world these last 30 years should be humbled, and ashamed at our ignorance, our greed, our cruelty. Theirs is the generation that while still in school must reckon with the knowledge that they, and their children, may witness an unstoppable apocalypse that, curiously, no one over the age of 30 seems to be bothered enough to do much about unless it aligns well with our greed and egos.

This seems to be our situation as scientists and researchers and people of reason and rationality. We are entering unwillingly into a world war against climate change and mass extinction, and also against inequality, ignorance, greed, and chaos. And like the scientists in every other war, we are unclear on our roles and obligations. *War is not, and should not, be our business.* And so I have

[‡] The Climate Psychology Alliance is a great first stop: <https://www.climatepsychologyalliance.org/>

[§] Again, the concept of *hauntology* becomes relevant; part of my own grief is mourning for the loss of a better future that seemed all but inevitable, and in many ways shaped my personality. For many scientists, the ecological, climate, and socio-political catastrophes unfolding are also a loss of personal identity.

** In an interview Kurt Vonnegut said that all wars are started by adults and then decided by, and fought by, children, and that seems to be the case here. Perhaps it is normal for moral leadership in human societies to come from children and not adults.

come to a difficult but obvious realisation. If humanity is going to survive the next 100 years, we must become very good at engineering our built environment, and very fast^{††}. And there will be no great breakthroughs, and no sudden enlightenment. Future survival depends upon as many people as possible devoting themselves to every aspect of climate, ecological, and geotechnical, or planetary engineering. If we are going to be saved, it will be by science and engineering^{‡‡}. We must integrate it into our everyday lives and work, whether we think it will succeed or not. We must all devote ourselves according to our abilities and limitations, our beliefs and our consciences. Probably the best thing we senior researchers can do is try to understand the problems and create the tools needed for those now under 20 years old to save themselves and the planet. In some ways it is too late for us, but ironically, hopefully, not for them. As for me, I will devote myself to research and engineering to meet these challenges, because I am a scientist, because I am an engineer^{§§}.

But what we must not now do is allow ourselves to lapse into the sleep of reason, to fall into denial and indifference and frustration and inaction^{***}. Above all, we need to be honest with ourselves, about what we've done, what we're responsible for, and what we're now going to do about it. I am reminded of something the writer and aviator Antoine de Saint-Exupéry said after the invasion of France, that *we fight because we have no option not to fight*^{†††}. So, let's fight.

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^{††} A fantastic overview of the present situation and possible solutions and strategies is provided in the two UN documents here: <https://exponentialroadmap.org/>

^{‡‡} A good place to start thinking about emerging solutions is at <https://www.drawdown.org/>

^{§§} It's hard to draw conclusions about all of this, but I can try. First, the actual situation with climate change and ecological collapse is likely much worse than we think. The scientific community is mostly in denial and is not taking appropriate action, and we are all in different forms of denial. We can no longer enjoy the belief that we are above politics; the relationship between science, rationality, and the general public is being destroyed, and we need to be more engaged with the problems and challenges. We as scientists have special obligations to society and the planet that we are not living up to. We must all identify maximum points of intervention between our work and the problems now facing the planet, and no one is excluded, everyone is responsible, this is now everyone's main job for the rest of their lives. We must be much more mindful about the daily choices and decisions we make, especially about travel and consumption. We need to consider moral imperatives above economic ones, and stop accepting economic and practical arguments for moral issues. We must begin to measure our progress against long-term goals, and we must all speak out whenever possible about aligning our collective behaviour with these urgent challenges. We must not be afraid to propose and pursue big solutions matching the scale of the challenges we face. We must demand moral leadership from our leaders. Finally, we need to try to let go of our egos, this is not about us, this is about the fate of life on the planet and all future generations of life.

^{***} The roles and responsibilities of scientists, academics, and researchers during times of crisis and collective insanity is explored in Hermann Hesse's novel *The Glass Bead Game* which won him the Nobel Prize. I know of no better treatment of the links between morality, education, and human nature, than Albert Camus' *The Fall*.

^{†††} Anyone wanting to understand the role pacifism, humanism, and collective action have in responding to existential crises should read Saint-Exupéry's *Letter to a Hostage*.