

Re-imagining geoengineering and the world

Speech prepared for the Climate Engineering Conference (CEC17) by Oliver Morton, The Economist

To talk about climate geoengineering is to talk about humans and nature—and it is thus to join in with a conversation that has been going on for centuries, and will continue, if we are spared, for centuries to come. That conversation takes place in everyday life, it takes place in farms and in forests, it takes place in books and lecture halls, it takes place in churches and temples and—though not as much as it should—in parliaments. It takes place in science fiction and in the world of art. It takes place in curves, and lines, and landscapes.

Here is a part of the conversation: *The Oxbow*, by Thomas Cole, arguably the first masterpiece by undoubtedly America's first great landscape artist. On the left you have a wild nature, a windswept wilderness dominated by a signifier of nature's power that you find throughout Cole's work: the lightning-blasted tree. On the right, the almost-domesticity of Arcadia—a landscape that is conspicuously cared for. To many American settlers, the story of their progress was the story of this second landscape replacing the first—of the continent as a whole, specifically including its wild, un-European climate, being tamed by the spread of yeoman farmers and their transformation of the land. The presence of civilisation in and of itself was an act of geoengineering.

And yet Cole's picture is not as simple as that. There is humanity in the wilderness—the painter himself, a parasol cheekily piercing the painting's great divide, what might be an easel or might be a cross. And there is nature and its power for change in Acadia. [Slide: *Oxbow*, again] The extravagant sinuosity of the river constrains the settlement—the course of the river meandering through the lowlands will change, and change again. The lines and curves of history are not a simple matter of one half of the painting coming to dominate the other.

When you were kind enough to ask me to speak to you three years ago, I read a little of what was then a work in progress, and is now my book *The Planet Remade*. The passage was about the great black bowl of the stratosphere's sky, the bright curved rim of the Earth and the straight dark line of a wing – a human intervention that made imagining this strange part of world possible, and that thus also had to be part of that imagining. You can't paint the wilderness without going into it, parasol and all.

My purpose in talking about the stratosphere was, of course, to talk about aerosols and albedo modification – about deliberately creating a planetary parasol. Here is the veil of such particles thrown up by Mt Pinatubo in 1991. [Slide: *Cotopaxi*] In this painting of *Cotopaxi*, a volcano in Ecuador, Frederick Church captures the sublime natural power of such an event, and seems, to me, to beautifully evoke the poetry and peril of an occluded sun.

In talking not just about the stratosphere, but about the wings that let you experience it, I was trying, in part, to add a touch of the technological sublime—and in so doing to add a human element. You can't, I said, imagine the world changed without imagining the means of that change, and you can't imagine the means without the motive. One of the burdens of my book was to argue that to see the motive for climate geoengineering, by wings or any other means, as control was both unrealistic and dangerous. A better motive, I suggested, is care.

So let us look at ideas of a planet under constant care.

"The Scientific Adventures of Baron Munchausen" is a novel, of sorts, by Hugo Gernsback, who was in essence the inventor of science fiction in its 20th century American form. A radio enthusiast in Massachusetts picks up messages from beyond the Earth. They turn out to come from Baron Munchausen, who is travelling first to the moon, and then to Mars, and wants to describe the wonders that he sees.

Among the extraordinary things that Munchausen encounters on Mars are vast cubes of wire mesh hung above the surface; charged with unearthly currents, they glow with a startling purple light. These machines—not visible, alas, in the Martian vista behind me, which is just one of those run of the mill pictures that gets sent back across millions of kilometres by wandering robots these days—turn out to be the Martians' air-purifying plants. They scrub carbon dioxide from the planet's atmosphere and turn it into a precipitate which fulfills what the Baron takes to be the Martians' "special agricultural requirements". The Martians care for their planet, not piecemeal, like yeoman farmers taming the wilderness, but with a technological network that covers the whole globe. It seems strange, awe-inspiring and deeply alien: but as the Baron asks his interlocutor, in the last line of the book: "How long will it be, with your coal burning machinery, till the Earth's atmosphere will need cleaning plants?"

Gernsback's "Scientific Adventures", published in magazine form in 1915 did not make much of an impact, and it has not aged gracefully—in truth, it wasn't very good in the first place. It does not have grandeur of Percival Lowell's books on Mars as the abode of life—books which introduced the idea of Martians banding together to respond to their homeworld's desertification through the creation of great linear canals. [Slide: Lowell's Mars] I came across it by chance, browsing in a Minneapolis bookshop called, entirely uncoincidentally, "Uncle Hugo's". Those last lines jumped out at me. They still do. "How long will it be, with your coal burning machinery, till the Earth's atmosphere will need cleaning plants?"

In Paris, 100 years later, this forgotten bit of pulp fiction got its answer. A large body of technical opinion now sees—or hopes to see, or pretends to see—the atmospheric cleaning plants starting to come on line in about forty years. The vast body of popular opinion, meanwhile, has not yet caught on that these things are under serious discussion at all, or what their implementation might entail. They will not be grids of wire glowing in an unearthly purple, or, necessarily, lines across landscapes like the one behind me. They could be vast plantations

feeding power stations, or interventions into ocean ecosystems. And they could, then as now, remain stuck in our imaginations.

When Gernsback was writing his tall tales, the carbon dioxide level on Earth was 300ppm and the global mean surface temperature, according to Hadcrut4, was about one degree less than it was last year. We know these numbers: we need to appreciate them. The century that separates us from Gernsback—the fifth century of the transatlantic economy, the third century of the capitalist economy, the second century of industrial revolution and the first century of globalized fossil-fuel extraction—was also the first century in human history that was geophysically significant. The operational parameters of the earthsystem changed.

In situating our discussions, it is vital to remember that this change was clearly seen by the sort of people that Gernsback read—people like Svante Arrhenius, who calculated the greenhouse effect of rising carbon-dioxide levels, Alfred Lotka, who in 1925 provided what I still see as a remarkable encapsulation of humanity's new relationship with nature in the context of geological time and planetary scale:

“The process of fossilization...has...furnished the occasion for a phenomenon which, judged in a cosmic perspective, represents a purely ephemeral flare...but which to us, the human race in the 20th century, is of altogether transcendent importance... Biologically we are changing radically the complexion of our share in the carbon cycle by throwing into the atmosphere, from coal fires and metallurgical furnaces, ten times as much carbon dioxide as in the natural biological processes of breathing. ... These human agencies alone would, in the course of about five hundred years, double the amount of carbon dioxide in the entire atmosphere...” The time scale is wrong. The insight is right. When people look back on our conversations here in 100 years, will they say the same thing? Will the world continue to go faster? Or will it be checked?

Gernsback's ideas about the Martians engineering their carbon cycle with what we would now call direct-air capture were, I think, unique. But their thrust was not. The idea that there were Martians, that they were advanced beyond the inhabitants of the Earth, and that they were involved in engineering their planetary environment was widely speculated upon. Not all scientists believed in the Martians; nor was to talk as if you believed in them necessarily to take them seriously; they were, in large part, a rhetorical device. But though belief was not universal and came in various gradations, no one, I think, argued that, if there were Martians, they could not possibly be trying to care for their planet's failing climate through a global network of canals. It seemed a reasonable thing.

After all, had not the Earth been networked itself—by telegraphs, and by steam? Its own great canals were there to ease the passage of its steam ships from ocean to ocean. The continents were spanned by railways, from Berlin to Vladivostok, from Cairo to the Cape, from Santiago over the Andes to Montevideo, from Chicago over the Rockies to Oakland. Though by Gernsback's time it was electricity which illuminated the imagination, he and everyone else knew that he

great mover of progress had been steam—that it was steam which had ushered in—no, pounded in, driven home—modernity. As John Stuart Mill wrote in his review of De Tocqueville’s *Democracy in America*, the way in which the railroad allowed everyone to move changed everything, including government; society, history was given direction, the new and the next always a destination, the past always left behind.

As J M W Turner showed in *Rain, Steam and Speed*, the arrow of history now cut through the landscape, threatened to burst from the canvas. In the coming age there was no longer a sinuous line between the wilderness and the cultivated. Steam’s motive and emotive power was at one with the elements, a technology capable of competing with nature in the production of the sublime. Thermodynamics, the science of steam engines, was the science of the age, explaining the world and the cosmos to Arrhenius, Lotka and their like. Steam allowed men to be, if not like Gods, then at least like the Titans who fought with them. Listen to Lord Byron, writing the decade before Turner painted his picture:

“Where shall we set bounds to the power of steam? Who shall say, ‘Thus far shalt thou go, and no farther?’.... Might not the fable of Prometheus, and his stealing the fire ... be but traditions of steam and its machinery? Who knows whether, when a comet shall approach this globe to destroy it ... men will not tear rocks from their foundations by means of steam, and hurl mountains, as the giants are said to have done, against the flaming mass?—and then we shall have traditions of Titans again, and of wars with Heaven.”

And there we have it; the idea of Prometheus, reimagined from the past to the present, the great, doomed, well intentioned, careless gift-giver. Here he is a century later on the cover of one of the magazines edited by Gernsback. In the story being illustrated myth and science are being intertwined, with Prometheus seeking to bring the atomic fires of the sun back to the Earth.

To romantics, like Byron and Shelley, and to technophiles like Gernsback, Prometheus was a hero. But others saw things as more complex. The endeavours of the “Prometheus of modern times”, wrote Immanuel Kant “are proofs of the boldness of man, allied with a capacity which stands in a very modest relationship to it...Ultimately they lead him to the humbling reminder, which is where he ought properly to start, that he is never anything more than a human being.”

It is easy, and true, to say that that humbling reminder is something which all of us who think about climate geoengineering as a possible form of planetary care must take to our hearts. It is harder to say how, so reminded, to move forward. Perhaps it helps to know that the Prometheus Kant was writing of was Benjamin Franklin, who sought with his lightning rods to “disarm the thunder” by pulling fire from the sky. This technology was deeply controversial. At one level the debate was a technical one—about whether lightning rods should be nobbly-ended or pointy, about whether they reduced risks or increased them. At another level it was anything but: it was a debate about how, and when, humans might

challenge nature, and, if they did so, what else they might challenge, too. Shelley's Prometheus is a political, not a technological, hero. The Promethean Franklin took part in the overthrow of a king.

Today lightning conductors are for the most part a closed story. Pointiness and nobbliness are no longer issues; the risk calculus is well understood; concerns about lightning and buildings have, largely, been taken care of. Lightning can now be played with, even aestheticized; [Slide: Lightning field] Here is Walter La Maria's "Lightning Field", where lines in the landscape (strangely reminiscent, to me at least, of the grids of Martian wire that Gernsback imagined) draw arcs of fire from the sky for no reason but that they can.

As lightning conductors then, geoengineering today—a Promethean science in exactly that the historian Simon Schaffer—my teacher, mentor and friend—defines the term in an essay on the lightning conductor controversies: "an experimental enterprise that mixes a vaulting ambition to safeguard humanity...with the troubling hazards of following this science's recipes."

Some may take this in a rather positive way. What was Promethean becomes, in time, pragmatic; technical controversies are resolved, great questions are set aside. Maybe, in 100 years, that is how all this will look. But I want to focus on something that divides the two subjects and their time periods. That climate geoengineering is prey to hubris there is no doubt. But what of radicalism?

Concerns about geoengineering have an interesting divergence. In terms of the earthsystem, the risks are catastrophic—none more so, perhaps, than the much vaunted "termination shock" in which the stratospheric parasols are closed and the full weight of warming dropped down from the heavens. [Slide: Richter] It is, literally, an apocalyptic vision—in that the literal meaning of apocalypse is an unveiling; it reveals the truth below. Take away the veil—and see what happens. (This torn apocalypse by Gerhard Richter, "Rorate coeli desuper"—"Drop down ye heavens" —seems apposite.)

And yet politically, the critique of climate geoengineering is almost the reverse—not that it brings sudden change, but that it forestalls it. That its moral hazard hampers the drive to decarbonize; that it allows the world to continue as it is, even as the underlying reality shifts; that it buys doomed capitalism time. That it is, in a word we do not hear very much, but which seems very apt, "katakalyptic"—it draws up the veil, covering the sun, covering the need for change, covering the gulf humans are driving between themselves and some idea of nature. This, it seems to me, is a much deeper issue than the presumed apocalypse of termination—an idea which, like some of the rest of you, I feel to be overblown.

Let me put the sky back in its place.

I do not know what a radical geoengineering looks like. I do not know if one is

needed. But I worry that in our discussions too often we treat politics as fixed, and pro- or anti- geoengineering, while thinking of making the earthsystem increasingly labile. We do not stop to think of how geoengineering, as part of a wider response to climate change, might be part of something more broadly transformative; of how it could help bring about a caring world which we might, in time, trust with such Promethean power.

To end: two images throw Cole's Oxbow forward. New lines in the landscape. Michael Light's magnificent picture of the Snake river again draws the line between humanity—now suburban, not Arcadian—and nature. But it does so with far greater drama, far more foreboding. There are no curves here: the sky is gone. The wilderness is below, and hungry. There are, it seems, no compromises to be drawn. And yet: the landscape persists.

And here is Andreas Gursky's Rhine II. Here all hint of conflict has been purged. Nature is pure, untrammelled: sky, land and water are independent blocks of being. Progress is gone—the path does not rush into, or out of, the picture but crosses it as evenly as every other line. All other marks of humanity are expunged.

Except humanity is everywhere, in the editing, in the removal, in the covering up: Kataklypse Now! Gursky's humanity frames it all, providing from outside the picture a unique vision of stasis without claustrophobia, of a world beyond both energy and entropy.

I have rarely seen a photograph more beautiful. When first I saw it, in London's Tate Modern, I could only stop and stare. But it needs a contrast. [Slide: Weather project] Here is Olafur Eliason's "Weather Project", a vast installation actually created for the Tate Modern. A hall where fossil fires powered huge turbines is illuminated by an artificial sun. The palate could not be further from Gursky's. All lines are straight and closed; nothing natural persists. And yet it is inhabited, appreciated from within with a surprising joy. It is a work that people came to care for.

These two artworks may be fundamentally opposed. But maybe their closed and open visions are the same. I do not know. I want to think, and to ask, and to learn.

To talk about climate geoengineering is to talk about humans and nature. To join that conversation is not just to take a stand within it. It is to listen to as much of it as you can, in the here and now and in the past, to feel for the lines and curves along which it will carry on into the future, to respond to it and to be willing to play a role. It is to be aware, as Kant was, of our modest capacities; but it is also, when called upon, to be bold.

I hope we have a magnificent conference.