

The Terraforming

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July 2019

For Sascha

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PREFACE: THE TERRAFORMING

This short book was written in July 2019. Each titled paragraph can be read by itself, but the sequence does matter. It is dense with ideas but each will be, I hope, expanded through The Terraforming urban design research program at Strelka Institute in Moscow. This book serves as its opening brief, manifesto, salvo. It is a polemic against dominant modes of planetarity and to inadequacies in how critical philosophy and design seek to confront them.

The title refers both to the terraforming that has taken place in recent centuries in the form of urbanization, and to the terraforming that must now be planned and conducted as the planetary design initiative of the next centuries. The term “terraforming” usually refers to transforming the ecosystems of other planets or moons to make them capable of supporting Earth-like life, but the looming ecological consequences of what is called the Anthropocene suggest that in the decades to come, we will need to terraform Earth if it is to remain a viable host for its own life. The next Strelka education program will explore the implications of this proposition for urbanism on a planetary scale, a venture that is full of risk: technical, philosophical, and biological. To do so means neither a blank-page reset nor risk-mitigating incrementalism, but a projective encounter with uncannily superfunctional necessity.

The research program will consider the past and future role of cities as a planetary network by which humans occupy the Earth’s surface. Planetarity itself comes into focus through orbiting imaging and terrestrial modeling media (satellites, sensors, servers in sync) that have made it possible to measure climate change with any confidence. We will explore a renewed Copernican turn, and how the technologically-mediated shift away from anthropocentric perspectives is crucial in both theory and practice. Any Copernican turn is also a trauma, as Freud once suggested, but this one demands from us more agency, not less.

The implications of this shift for urban planetarity are perhaps counter-intuitive. Instead of reviving ideas of nature, we will reclaim the artificial — not as in fake, but rather designed — as a foundation which links the mitigation of anthropogenic climate change to the geopolitics of automation. For this, urban-scale automation is seen as part of an expanded landscape of information, agency, labor, and energy that is part of a living ecology, not a substitute for one. As such, the focus of urban design research shifts toward the governance of infrastructures that operate on much longer timescales than our cultural narratives.

What kind of urbanism will the program propose? An urbanism that is pro-planning, pro-artificial, anti-collapse, pro-universalist, anti-anti-totality, pro-materialist, anti-anti-leviathan, anti-mythology, and pro-egalitarian distribution. It starts with a different set of assumptions: the planet is artificially sentient; climate collapse mitigation and pervasive automation can converge; the concept of “climate change” is an epistemological accomplishment of planetary-scale computation; automation is a general principle by which ecosystems work; necessary fundamental shifts in geotechnology are likely to precede necessary fundamental shifts in geo-politics; “surveillance” of carbon flows is a good thing; energy infrastructures based on long-term waste cycles are desirable; the ecological cost of “culture” is greater than that of science; planetarity requires philosophy in and of outer space; speculative design must focus on what is so deeply functional as to be unlikely; and that, finally, the future becomes something to be prevented as much as achieved.

Our research is prefigurative, but more so as simulation than symbolic performance. It aims to contribute to a viable plan, but also to the refusal of bad ones if necessary. That said, we bet that what may seem like the obvious and assuredly “good” position is, in fact, probably not. The program is based in Moscow and the vast and quickly changing expanse of Russia’s territory is our site condition. From here, we look out into space, and from space back down to Earth to orient what planetarity should mean. The questions

of geotechnology, geoeconomics, geonomos, and geoecology are situated between the world as it appears to us and how we appear to the world as it gazes back at us through the technologies we've made.

BLACK STAR

“The naive American contemplates the sky; the Russian, or at least that Russian, settles in the sky, and contemplates the Earth.”

— Chris Marker on Tarkovsky (1999)

BLACK STAR

Perhaps to our shame, there was no grassroots campaign asking the question: “Why haven’t we seen a photograph of a Black Hole?”¹ Nevertheless, one appeared in 2019 and immediately took its place among a small group of the most significant images made by human technology. But for what are these images significant, and how so? The darkness of a black hole is absolutely empty, so part of what makes this image significant is that it signifies true nothingness.

THE PLANET IS THE CAMERA

The thing we see as an “image” was constructed from data produced not by a conventional camera, but by Event Horizon, a network of telescopes harmonized to focus on the same location at the same time. The resolution of any image depends on the aperture of the camera, and this noncontiguous perception engine linked telescopes from Greenland to Antarctica — an aperture as wide as the Earth. To make this image, our planet itself became the camera, peering out and looking back in time at ancient light that traveled to Earth — indeed, in this case looked out at time. Locally, the eight sites of the Event Horizon array were locked into synchronization by a GPS time standard and after their scans, five petabytes of data were developed into the “image” of the black hole.² The mechanism is less a camera than a vast sensing surface: a different kind of difference engine.³ What we see in the resulting image is the orangey accretion disc of glowing gas being sucked into the void of M87*, outlined by all the non-void it is about to consume.⁴ It is 6.5 million times more massive than our sun and roughly 53 million light years away. The light that hit the Event Horizon telescopic sensing array was emitted during the early Eocene period here on Earth, a time of dramatic climate methane flux.⁵ Much closer by, there is a supermassive black hole in the center of our Milky Way. That’s right, we have always been circling an omnivorous void.⁶

FROM VERNADSKY TO LAVOCHKIN

The Black Hole image is part of a lineage of astronomic imaging, always based on the folding of minerals into sensory media that render for us stunning pictures of our planetary perch and others besides. Central among these are multispectral images of Earth’s biosphere and technosphere and thereby the computational profiles that constitute climate science.⁷ The first image of Earth from space was taken in 1946 by the United States using a captured V2 rocket — a sign of things to come. In the early- and mid-1960s, lunar orbiters sent back images of Earth as seen from the orbit of its moon. The Soviet Mars orbiters, Mars-2 and Mars-3, took images of the Red Planet in late 1971 and early 1972. The former crash-landed, becoming the first human artifact on Mars (the first human artifact on another planet was the Soviet Venera-3 probe, which crashed onto Venus in 1966). Mars-3 also sent down a probe which managed a soft landing and was able, perhaps, to transmit back an image of something. It is unclear as to whether the image received before the lander went offline is of the Martian horizon, a sandstorm, or simply an interesting smear of black and white noise. Such is the apophenia of astronomic remote vision. If it was a picture of Mars, then this would beat Viking 1’s very clear images from the surface of Mars by four years. If not, then Venera-9, having successfully landed on Venus in 1975, sent back what would still be the first images from the surface of another planet.

THE OVERVIEW EFFECT

The most literally iconic images of Earth from space come from the Apollo program: Earth Rise and Blue Marble. In 1972, astronaut Harrison Schmitt pointed his camera box out the window of his Apollo 17 spacecraft and took several images, one of which became Blue Marble — an image that would later adorn a billion t-shirts. In addition to providing a visual identity for the nascent ecological movement, it symbolized what Frank White would later term the “overview effect”: a numinous feeling of profound awareness felt by many who have experienced spaceflight and seen the entirety of our pale blue dot all at once.⁸ In 1948 (two years after that first V2 rocket picture of the horizon was taken, but before it had been made public), British astronomer Fred Hoyle surmised that “once a photograph of the Earth, taken from outside, is available, we shall, in an emotional sense, acquire an additional dimension [...] Once the sheer isolation of the Earth becomes plain to every man, whatever his nationality or creed, a new idea as powerful as any in history will be let loose.”⁹ The notion of perceiving the whole from the outside would motivate Stewart Brand’s campaign to show us “a photograph of a whole Earth,” what he called a “mirror” that might bring a cosmological shift for all who would gaze upon it and honestly seek its lesson.¹⁰ The geopolitical implications had been outlined in *Spaceship Earth*, Buckminster Fuller’s 1968 manifesto for a planetary planning regime (!), that would by 1982 lend its name to a tourist attraction at Disney World. And so it goes.

ABYSS OF ORIENTATION

It is well known that the original image taken by Schmitt had the South Pole positioned “above” Africa, but that the version publicly disseminated deliberately rotated the perspective to place the Southern Hemisphere below the Northern in accordance with mapping conventions and primitive hierarchies. But what orientation is true? The Mercator cartographic projection is a world picture drawn from a virtual perspective from “up” in space, and as such gave orientation to a global geopolitical era. To finally “decolonize” Blue Marble would, however, not be just to un-flip it, putting ‘up’ and ‘down’ back where they belong, but rather to affirm that all such orientations are arbitrary.¹¹ The tradition is feeble. All horizons are in this way false. As Sun Ra put it, “space is not only high, it’s low. It’s a bottomless pit.”¹²

BLUE MARBLE IS A FLAT EARTH

Schmitt himself went the other direction, spending his career back on ground and giving voice to his version of climate change denialism. Is this surprising? From his position as a United States senator, he held that the scientific consensus regarding the crisis was an excuse to implement a planetary management regime that he compared, without joking, to “national socialism.”¹³ So what kind of “overview effect” did he experience up there? How similar was it to the effect experienced by, William Anders who snapped the Earthrise image as the Apollo 8 crew orbited the moon? As they did, they took turns reading from the King James Version of the Book of Genesis to a worldwide television audience on Christmas Eve 1968, ceremonially dedicating humanity’s foray off its home planet to the principles of medieval creationism.¹⁴ Given this, is it such a surprise that despite the ubiquity of the globe-as-image, the solipsisms of flat-earth worldviews continue to persist? Wasn’t Blue Marble already an icon of geocentrism?

WHAT DISENCHANTMENT LOOKS LIKE

Decades earlier when, Edmund Husserl aimed to “overthrow the Copernican theory in the usual interpretation of a world view” because it upset “Man” from his early horizon, and because “the original ark [arche], Earth, does not move” — going so far as to say that “Galileo is not more true than Aristotle” — he testified to how deeply incomplete the Copernican turn was and is in philosophy.¹⁵ The lament of Husserl’s student, Martin Heidegger, heard in his 1938 lecture “The Age of the World Picture,”

in which he warns us against how modern mechanical abstraction turns the world itself into a picture, seems chillingly quaint when re-read in the context of planets now becoming the physical media by which they scan outward into the depths. In “Only A God Can Save Us”, a 1966 interview with Der Spiegel, Heidegger famously dictated, “I was certainly scared when I recently saw the photographs of the Earth taken from the moon. We don’t need an atom bomb at all; the uprooting of human beings is already taking place.” What kind of human does he mean, and what kind of roots are they supposed to have? He goes on to say, “We only have purely technological conditions left. It is no longer an Earth on which human beings live today.”¹⁶ Instead, we might put it differently by saying that only as humans are uprooted from geocentric intuition can they ever have a planet at all. The Earth that is lost for him is one that had appeared in the mystified aura of a world that is singular, original, and central, given by and for our being. Its horizons were grounding, up until the point at which we could look around and see the other side. Still, even as they might have alarmed some phenomenologists, images like Blue Marble are at best the work of a transitional humanism that did not and cannot decommission vestigial anthropocentric self-regard and self-representation nearly enough. For that, we would have to wait a few more years for Black Hole to appear, and probably a few more for its anti-significance to absorb us and uproot us.

FIRST SIGHT OF THE UNOPERATIONAL IMAGE

The Black Hole image is a kind of “world picture” that is crucially not a picture of our Earth, but rather a picture taken by the Earth of its surroundings—for which we served as essential enablers. Imagine the Earth wrapped in the Event Horizon telescope array as an amoeba-like creature, at long last opening its little eye to sense what is nearby. With its coordinated sensory cells, it sees not only that the space around it is empty, but also focuses in on a particular distant speck of hyperdense blackness, however unlikely that may be. The collected data is aggregated by tiny mammals who live inside the camera, and who render it into a visible figure that they can view and share. The image is the opposite of what they call a mirror, in that it shows them not themselves in the world, but the abyss in which they can never be reflected. True, the planet folded itself to make humans, who in turn fold the planet to turn it into an astronomic camera, and so much of the antecedent frameworks of cognition that the image implies are based on our way of looking, but that process reflected back in the image positions *homo sapiens* as a kind of auto-generated smart bacteria swarming around on the surface of that amoeba: a transitive enabling layer.¹⁷ In the sensory data rendered into an image, we see an abyss in which we cannot see ourselves as we now understand ourselves to be. The unconscious star-sucking void is blind and deaf to our orientations of horizon. Black Hole is, in the best possible sense, a terrifying image.

APEX MEDIATING RESIDUE

If Blue Marble signaled a revitalized alloy of humanism and creationism, made by a single human looking in the mirror and framing his sense of place looking down from above, then Black Hole reveals a far more powerful inhuman scope and condition that defies articulation, as it looks not only up but out. If Blue Marble implied a global village by putting apex creationists in charge of a mythical garden, Black Hole demands a different planetary regime by rendering humans as a privileged mediating residue that sets in motion further generalized cognition. The two worlds could not be more different. This is a new profile for us and one that will take some getting used to.

RETURNING TO THE COPERNICAN TURN

The incompleteness of the Copernican turn attests both to its difficulty and to its open-endedness.¹⁸ The first Copernican turn entailed at once a disorientation of individual perception and interpretation (an apparently traveling sun now seen to be still), a dismantling of anthropocentric cosmological architectures (heliocentrism as common sense), a disruptive shift in the geopolitical and geoeconomic architectures that draw legitimacy from such models (“E pur si muove”/ “and yet it moves”— uttered in defiance by Galileo

at his trial), followed by Kant's critiques dedicated, in principle, to this turn. Today, the Copernican turn also means the reorganization of the Earth not only as it "truly is," but as it may be.¹⁹ The traumatic difficulty of the turn comes from our own evolutionary accomplishments. Our intuition includes cunning and our cognitive models include narrative abstractions that motivate and mobilise extraordinary cooperation — even when obviously arbitrary — including the durability and coherence of institutions that mediate authority to enforce that cooperation. However, as our expanded cognition and agency developed coextensively with technologies, the new perceiving apparatuses would accomplish desired functions but would also sometimes reveal an utterly counter-intuitive reality in conflict with the model of the world that enabled them as technical innovations in the first place (models can imply the need for machines that, when used properly, prove that the model is false). This process is the basis of the Copernican turn in a nutshell: again, a conceptual model develops a technical system to extend how it understands the world, but what is revealed about the world by that technical system undermines the conceptual model that made way for the technical system. Resistance to this surprising revelation's implications in order to protect the integrity of the initial model is a tenacious adherence both to a familiar idea of the world and also to the primacy of representation as such. Representations can resist interference by the represented.

WHERE SHOULD THE CITIES GO?

As the Copernican turn puncture human "narcissism," as Freud suggested, this should be taken to mean not only a stubborn self-centering, but also a dangerous adherence to the reflected image. Is this what Blue Marble ended up doing? If so, this extends to the contemporary moment, in which representation is sometimes given a special status by which it is seen as more likely to cause the represented than to be caused by it. It extends to the notion that technologies always reflect, absorb, or otherwise discursively represent human culture more than they shape the context by which culture operates, and certainly more than any technology reveals any pre-discursive reality. Instead, as we look through the Black Hole image and back at ourselves, seen not in reflection but from an outside that would always precede us, the whole automated apparatus that we designed (and which designs us in turn) looks also back onto the Earth's surface and asks the question that drives the research of The Terraforming program: "where should the cities go?"

THE ARTIFICIAL PLAN

2030/2030

What does a date actually do? A recent Intergovernmental Panel on Climate Change report warned that unless radical steps are taken to decarbonize the infrastructures of human civilisation by the year 2030 — and remove tons of existing atmospheric CO₂ — then the self-amplifying effects of climate collapse may be irreversible, no matter what we may come around to doing in the years to follow. Meanwhile, economists warn that unless radical steps are taken by 2030 to address the consequences of pervasive artificial intelligence and automation at the infrastructural scale, the self-amplifying effects of AI-driven “social collapse” may be irreversible. The scenarios drawn out by each are well-known and both point to the same deadline, roughly one decade from now, but the forces they describe are related in more fundamental ways than this reason alone. They are not the same kind of “collapse”, but both loom because of similar failures to comprehend and compose viable planetary systems. To address the two crises directly will likely mean intellectual and mechanical responses that conjoin the two: they share the same deadline not by coincidence, but by cause. The response to climate collapse may depend on how we deal with the implications of more pervasive, algorithmically-governed automation of production and governance, while the response to crises of automation may depend on how we deal with the implications of decarbonization, molecular governance, and reversing diversity loss. The question of automation is inside the question of climate change and cannot be successfully engaged otherwise, while the question of climate change is inside the question of automation and cannot be addressed otherwise. As such, the response — the plan — entails a radical redeployment of geotechnical means toward the ends of ameliorating global geochemistry now in meltdown. Crucially, such a shift is more likely to be the cause of corresponding shifts in human culture than the result of one. Nevertheless, both shifts would embrace, almost by definition, what we now call “the artificial.”

THE ARTIFICIAL

The responses to anthropogenic climate change must be equally anthropogenic. To be successful, they must be adamantly and unapologetically artificial. They emerge from the recognition that the superstitions upon which pre-2030 pathological forms of planetary management depend are self-deceptions regarding the relation of the natural and the artificial as domains, definitions, qualities, and values. The nature/culture divide didn’t protect what it called nature, even as it elevated the notion to a transcendental ideal. Instead, the divide provided a flexible alibi with which to elevate human culture from geologic and biologic strata into a realm of self-accountable expressivity. Where does that leave us? As I’ve written, there is no actual “nature” of course. The very idea of an absolute outside of culture is discredited, but persistent — yet the inverse is even harder to swallow. Because there is no nature, there is also no culture. There is chemistry, abstraction and phase change, pattern and then collapse, and other things besides.²⁰ Biology returns — but so does geology. A resigned embrace of the artificial suggests an ontological turn of a different sort, not one based on the diverse social constructions of a relativistic pluriverse, but on recognizing our own cognition and industry as manifestations of a material world acting upon itself in regular intelligent patterns. In this sense, the artificiality that concerns us is not the fake versus the authentic, but the artificial as the trace of intention and design within patterns of emergence and vice versa. It is a way to recognize agency by measuring the regularity of its consequential traces.

ANOMALOUS REGULARITY

The artificial is “anomalous regularity.” It is the order that exceeds what could normally be expected or possible without deliberate intervention.²¹ Should astronomers listen closely to the noise coming from deep space and find passages of information that are statistically speaking “too structured” to have

occurred only by chance, then this signal is artificial. When archaeologists examine two stones and conclude that one of them is just a rock, but that the other, based on the anomalous regularity of the patterns of chipped-away edges, is a three-million-year-old stone axe fashioned by an antecedent hominid, they are tracing the artificial. Of all the artificial effects and patterns that really matter, the impossible-to-sort absolute boundaries between what is and is not anthropogenic climate change are the most consequential encounter with the artificial.²² However, to ask who is responsible for a hurricane is to be tricked by language and to misrecognize how agency can and cannot ever be personified. Diagnosing how climate change is anthropogenically artificial is not to redraw borders between human culture and nature, but to recognize that technical intelligence is what makes anomalously regular patterns regular. Climate change's epistemic challenge to everyone is that the entire world has become an exercise in interpreting artificiality. The implication is that our response must also be resolutely anthropogenic. The plan is and must be artificial.

WHY WE CAN'T HAVE NICE THINGS

The climate crisis arrives not just through to the subordination of what is called nature by what is called culture; it is caused as well by protecting ideas of the natural as an innocent, original, and exterior backdrop for human tragedies and comedies. The framing of nature as a vital source, by definition never artificial itself but only later molested by culture, is a reactionary notion not opposed to modernity, but one which remains a persistent theme in how industrial culture tries to account for what its industry means.²³ Pastoralism is more than a comforting alibi; it can also be a passive attack on reality itself. Nature so conceived underwrites the general violence of the Anthropocene in that it understands the cultural dynamics of the epoch less as a pilotless geochemical explosion of our own making, and more as a legacy of moral and immoral narratives and semiotics without mass. Downstream, naturalistic fallacies choreograph everything from agriculture to architecture, offering a palliative aesthetic of rehabilitation and reconnection with the lost intuitive horizon of Husserl's anti-Copernican anxiety. Waiting impatiently as these melodramas play out is the pressing serious assignment of designing a viable artificial planetarity. Climate change denial (of all varieties) is symptomatic of a folk humanism that will not allow a dynamic Earth-as-planet to replace the subjective sense of a fixed ground on which interior experience is given form, and on which arbitrary cultural occupations are honorably fixed and perhaps even arranged by sovereign spirits. The illusory stability of the ground given for our signification is elevated to a first principle, even as the Earth's crust continues to bend, break, and shift in tempos too slow and fast for us to notice. Paradoxically, despite its stubborn anthropocentrism, some expressions of this humanism refute that human signification affects world-scale change beyond the boundary of what is called culture, even while keeping humans positioned centrally within a divine narrative. When design trespasses across that boundary into nature, it is sometimes accused of playing God, and thus the distinction is reinforced by announcing the transgression. Climate change denial is based in part on a persistent refusal to include humanity inside the deep flux of artificial planetarity so as to protect a worldview that gives our culture a particular meaning. The conviction that worlds cannot be altered is what allows the idea that we are not now altering the planet (because we can't) — or in another variation, that if it is being altered, then any transfiguration of the properly timeless homeland is a perversion (the problem is that change is artificial at all).²⁴ Importantly, the inverse of this association is equally true.²⁵ Not only is the denial a refusal, but the refusal is also a denial. Put directly, the anti-Copernican sentiment that denigrates abstraction, alienation, and materiality so as to venerate an organic dwelling on essential cultural ground, in sight of an experientially intuitive horizon, is not just what leads to climate change denial; it is climate change denial.

THE STACK LITERALLY INVENTED "CLIMATE CHANGE"

If asked in isolation, the question of how planetary-scale computation can contribute to conceptual shifts and applied interventions in and against climate change fails to see that "climate change" itself, as an idea, is an epistemological accomplishment of planetary-scale computation. In its embryonic form, this

accidental megastructure was used for global weather modeling; in its mature form, it has been employed in and as Earth Science. The notion of “climate change” is an empirically validated pattern drawn from a comprehensive, planetary-scale biopolitical sensing, surveillance, modeling, and calculating apparatus. That most artificial of innovations, The Stack, is what has made this most significant artificial abstraction — climate change — into a legible and communicable concept.²⁶ A shift in infrastructural-scale technical cognition that allows us to conceive the world in a more direct but counter-intuitive way is not only a means to mitigate climate change, it is how we know its happening at all. Once again, “climate change” is a concept produced by such a shift and one that now demands a new accounting — and a corresponding shift in the geopolitics that reflects its implications. As suggested, those implications should force further transformations in how the interlocking chain reactions of agency and assembly that we humbly call “automation” organize economies of carbon and heat, which may have far more direct influence on successful mitigation than the strictly political revamping of legal representation ever could. Quite clearly, the artificiality of it all doesn’t disqualify deliberate design or intervention. On the contrary, it calls for a plan.

THE PLAN

The planned economy never went away, and neither, for better and worse, did the planned ecology. Both evolved into the architectures of contemporary platforms (Amazon, Samsung, Huawei, Walmart, etc.) that generate price signals, logistical imperatives, material assembly, extraction markets, distribution rationales, and planned and unplanned plans.²⁷ As The Terraforming, our research program, is aligned with the artificial, it is also aligned with planning. One can exist without the other, but here they coincide. Today, however, the planned economies and ecologies have been optimised for different goals than what qualifies as a viable planetarity, and so the project is for a different plan: a 10-year plan to take us up to the artificial cusp of 2030, or a hundred-year plan that would seek to revert the entropy brought on by the last century, and so on. Things will never go entirely to plan — which is part of the plan — but now the operant mythologies of acephalic emergence (first, that spontaneity is always better than planning, and second, that what we have now is not planned) need to give way to more deliberately composed planetarity. If that means top-down as well as bottom-up, then it also reopens the meaning of those positions and who — or better, what — occupies them. Nobody panics when things go according to plan, like the funny nurse said, but now we should be panicking that to the extent that there even is a plan, the plans we have are not the plans we need.²⁸

EMERGENCY AND EMERGENCE

In modern political theory after Carl Schmitt, sovereignty is understood by political theory to be held finally not by the formal executive in the normal organization chart but by he, she or it that can declare a state of emergency and suspend the normal organization and such charts. For us now, not only does the sovereign declare the emergency, but the emergency can produce sovereign positions and actors in its own image: emergency powers declare emergencies, but emergencies also configure original emergency powers. For the variety of planetary emergencies at play, we may see the emergence of multiple partial sovereigns — capital, computation, and carbon platforms — that may also represent causal agents of the emergencies that nominate them. Depending on who or what maps the emergency, the emergence of a corresponding last-instance governing limit takes weird new forms. For the planetarity needed, it would be extremely unlikely that the best alternatives would be predicated on the inviolability of individual voice, property, settlement, language, identity, and consumptive desire as the metaphysical sources of commanding will. More likely, emphasis will shift from technologies that allow for negative liberty (“some people can do what they like”) to technologies that ensure positive liberty (“future devastation will be prevented”). The observational tenacity of biopolitics will shift from human bodies, action, and opinions as disciplined vessels of sovereign voice to flows of biochemistry and energy as the geopolitical referents to be given form and qualities. As this comes to pass, the governing vernacular traditions of the

so-called West would give way to a more pragmatic universalist materialism. If only it were so.

EXCEPTIONS TO THE EXCEPTION

Even as we see the political and the technological converge at scale, the principle by which “the political” is defined in relation to decision and exception remains, but is twisted. If the sovereign is not only that which can proclaim that a moment of emergency has arrived, but also that which the emergency produces its own image, what sovereigns will climate change emergencies bring forth? Is any position within what is currently recognized as the political even capable of declaring that emergency — and if so, why has it not done so already? Or if it has, why has it not mattered? Perhaps no such position exists! We have the means (financial means, logistical means, etc.) to meaningfully address climate change, but absent is the functioning governing mechanism to enforce those means. The geopolitics that the emergency may eventually declare may look quite different than what Schmitt or others could have recognized. Instead of the chain of determining representation flowing from a legal declaration, which is then reflected in the form of a technical apparatus, perhaps the sovereign that emerges from the emergency and is created by the emergency will look more like a technical apparatus, one which is subsequently indexed in legal symbolization as another new normal takes shape.

THE MEDIA THEORY OF GEOPOLITY

Just as any technology emerges in ecological and geological context — as a folding of the planet into particular forms that do particular things — “Polity” emerges from a particular technical arrangement and scope of available media. Included in our assignment then is to contribute to a revision of the history of “the political” so that it is more literate of its own technological conditions of possibility. Many models of the political on both the left and right can’t approach this without tying themselves in knots. The political is not just what excludes us from them, or ours from theirs, by drawing a contested field of difference. When the political is made distinct, it is because of a fortified exclusion of polity from economics, polity from technics, technics from mythos, etc. The first decision, before the decision of the exception, is the decision of what is and is not inside the polity at all — and of course that decision is itself always technically mediated and thereby constrained. In practice, if not in theory, politics has named not only ways to subdivide the surface of the Earth into jurisdictional units, but also a regularization of how, when, and where unexceptional decision is located, allowing for others to organize their interests in anticipation of a reliable chain of command, supply, and relay. Its standard models are construed not only by available media technology, but also by arbitrating mythologies of where the power of decision should properly sit, divine or secular, human or not. These may be informed indirectly by a cosmological validation, which is itself directly informed by the technical instruments that disclose realities of the cosmos, just as they may inform how and why those instruments are deployed in the first place.²⁹ How all those entanglements work includes was that may or may not be recognizably “political.” These models in turn set local limits on how the political is thought to be linked to or separate from the non-political, which may be extremely different than the way that the relationships actually work. Decision may be hardwired into a chain of mediated relays that would work the same regardless of whether the first domino is toppled by a king, priest, or people’s assembly. This, of course, does not stop us from exhausting our energies on debating the necessary qualities of the proper domino pusher, even if it is at the expense of conceiving better relays. Instead, the plan entails the simultaneous emergence of an artificial politics that resembles what we would today recognise as a planetary-scale geotechnology, and an artificial technologies that resembles what we would today recognise as a planetary-scale geopolitics.³⁰

AUTOMATION AS ECOLOGY

“Civilization advances by extending the number of important operations which we can perform without thinking.”

Alfred North Whitehead.[31](#)

AUTOMATION AUTOMATES AUTONOMY

By sundial, abacus, sextant, telescope, microscope, or TPU, technologies alienate us — thankfully — from direct perceptual reckoning by enabling the conjuring of novel abstractions of the worldly processes in which we are embedded. Sometimes, these abstractions are inseparable from the technologies that enable them, but sometimes the two go their separate ways. In turn, abstractions themselves become tools. Technologies beget abstractions, and abstractions beget technologies, or become a different kind of technology in and of themselves.[32](#) Which causes which is never really about first-mover agency. In the densest city or jungle, determination is everywhere, but abstractions, technologies, and technical abstractions are themselves indeterminate. It is dominos toppling into dominos all the way down, including all those who tip them over. These cascading relays may be choreographed by planned abstractions of the whole sequence of sequences, just as they may imprint particular improvisational decisions along the way, learning as they go, and bending that choreography in new ways. As chain reactions aggregate at the infrastructural scale, they encode not only abstraction, but also decisions that can be repeated into their media — such that it can be repeated again and again, without the trouble of new deliberation. Over and over it goes. What at first glance looks autonomous (self-governing, set apart, able to decide on its own) is, upon closer inspection, always also decided in advance by remote ancestral agents and relays, and is thus automated as well. The apparent autonomy of the robot is based on what it has been taught, has learned, or has adapted to do, and now repeats in combination without deciding anew from scratch. In this sense, autonomy is less about free will than what aspects of action can be done without full deliberation or even without choice: breathing, driving, making, molding, remembering, blooming, pollinating, writing, and so on.[33](#) If moments of crucial choice depend on everything that is already routinized then “the political” would refer not only to those rare self-conscious executive choices, but even more so to all those choreographies of technically entrenched pathways. Once again, the geotechnical takes the geopolitical within its embrace, and as far as a 10-year plan is concerned, the political (if defined as discursive dissensus and consensus, and based on the positions of articulation allowed by a given field of power) loses some footing as reference model. The general grounding ecology of automation allows previous cognition, abstractions, and decisions to take root in the urban environment as part of a given niche that will be put to use by an unforeseeable future. Because infrastructure automates decision, it is sometimes said to be “depoliticizing” if it works without new deliberation, and more often than not, that is exactly the point.[34](#) A political decision like “where should the water come from, and for whom should it now come” becomes the infrastructural axiom of turning on a faucet. The meeting of the people’s assembly for water provision can adjourn and go home.

TECHNOLOGIES OF DISENCHANTMENT

This is not to suggest that this circuit of cognitive abstraction and technological automation tends only to stable equilibria or anything like ideal plans and plots. Some ways by which a technology encodes abstraction and automates decision are quite durable (a language, calendar, formula, etc.) whereas others may be fleeting (a particular word, event, flavor, etc.). Even the fleeting forms may be transformational to the worlds they organize before they are supplanted by something else. Sometimes technologies emerge

for one purpose, but in fulfilling that purpose, they come to reveal not only that the purpose is not what we thought it was, but that the world in which that purpose exists is also different too.³⁵ Some of these, designed as narrow-purpose instruments, come to persist through generations, evolving and speciating, because what they revealed about the world has become normalized, such that the original alienating surprise is forgotten and it seems to have always been that way. The world revealed is one of many possible, and the path by which a technology evolves is then used to enforce that emergence. Such paths are always both remedy and poison, often more of one than the other. While anxiety about new technology is expressed in accounts of its pernicious effects and affordances, that unease is rooted not in what a new technology may do, but, once more, in what it reveals that was always there all along. Microscopes do not cause microbes, but now that we know they are there, we can never see surfaces the same way again. Such unrequested demystifications are disturbing, especially when they demote us from a place of presumed privilege in some way.³⁶ Many of the supposedly revolutionary promises of “fourth industrial revolution” technologies (AI, robotics, synthetic biology, machine vision and sensing, additive manufacturing, etc.) will do both good and harm — and we won’t always be able to tell which is which. However, their deeper implications lie in how they will demand new understandings of our relation to the world based on what they demonstrate by surprise: namely, how things have always automated one another.³⁷

AMALGAMATION AND ASSEMBLAGE

While such technologies may surely be capable of reorganizing personal and planetary economies in new ways, the more durable impact may be based on what they reveal that is not new. For example, AI reveals that intelligence is an emergent effect of arranged matter (including inorganic minerals); robotics reveals that autonomy is an effect of the automation of decision, not its absence; synthetic biology reveals that the living chemistry within us is as mutable as that which is outside us; machine vision reveals that the boundary between information sensing and processing is blurred and contingent; nanotechnology reveals that the table of elements is as much an interface as a map; additive manufacturing reveals that previous modes of industrial assembly were far too rooted in place; and more. Cities are actual ecologies, and actual ecologies are theaters of mutualising automation. It is not that humans and technologies are only now merging as part of some new cyborg innovation, but that the species is the result of its co-evolution with its ancient automated landscapes. It’s always been true. Some technologies make this more clear than others, but is this how these are discussed at Davos? Of course not. Instead, what is presented are simplistic parables about how they can offer seamless empowerment of self-transparent human subjects and societies. For the understanding needed, these are often worse than saying nothing.

A COPERNICAN TURN IN DESIGN

A renewed Copernican turn is needed everywhere, including in the philosophy of design. There it begins with the unsettling implications of our century’s circumstances, technologies, and deadlines. In practice, it shifts the balance from experiences to outcomes, from users to systems, from aesthetics to access, from intuition to abstraction, from expedience to ideals. The direct implications for design are fundamental, but habits are hard to change. From the Vitruvian Man to Facebook profiles, centuries of “human-centered design” (HCD) have brought more usable tools, but in many important domains design is far too psychologizing, individuating, and anthropocentric without being nearly humane enough. When raised to a universal principle, HCD also brought landfills of consumer goods, social media sophistry, and an inability to articulate futures beyond narrow clichés. In the name of amplifying the individual’s fertile desires, we’ve made a desert. Maximizing usability came at the expense of a deeper reason. The Copernican shift in the philosophy of design includes a rotation away from human-centered design and toward a fuller understanding of designing the human and the world. I don’t mean this in some transhumanist sort of way, but rather that the design of physical media is more than composing augmentations of a given subject, agent, and form. In Beatriz Colomina and Mark Wigley’s concise archaeology of design’s history, the practice is always ultimately about designing the human itself through

designing its various exoskeletons, afterimages and anaesthetics.[38](#)

THE ARTIFICIAL INDETERMINATE

The Copernican shift presumes design's artificiality, but not its inflated sense of mastery. It doesn't imagine putting technology "back under control" because among the things that these technologies reveal is that it was never under our control in the first place, making both technological determinism and social reductionism obsolete. The latter would include critiques that limit their analysis of technologies to identifying precedent human social relations that originate those technologies and forever haunt them. This view of technology as a mere "sociomorphic" artifact reflecting its conditions of appearance is sometimes also a kind of defence mechanism with which we reposition ourselves back at the center of a story when the implications of that technology's revelation suggest otherwise. This perspective might say that a machine that challenges our self image was nevertheless made by our history. Despite what it reveals, it is still our mirror! Reductive social determinism is another pervasive anthropocentrism and, perhaps paradoxically, works against the acceptance of the artificial even as it manages to see our fingerprints and agency everywhere. Conservative humanism is too quick to conclude that for human culture to move out of a center position of supervisory mastery over subservient machinery it must imply either an equally crude technological determinism or a relativistic vitalism.[39](#) Sometimes this conservatism draws from an explicit or implicit anti-secularism, for which anthropocentric sovereignty is divine, and/or from strongly social and cultural constructivist commitments that underwrite an ontological egalitarianism. As the former would have it, technology should be an organic reflection of cultural tradition, but after modernity, such order was upended and so must be properly restored. For the latter, technology can only ever be a vessel of human discourse, cosmology, power, and knowledge, and so must be resisted or defended on those terms. But in the design of planetary-scale sociotechnical assemblages, planning means putting the inter-evolutionary dynamics of what are called society and technology along an artificially coordinated path, not subordinating one side of a simple equation to the determination of the other. The planned ecologies and economies at hand are not only transformed through old or new technologies that reflect human intention, because these too are also newly revealed, reformed, and reconfigured in turn. In this way, the alternative planetary to come consists of geoeconomics that are geopolitics that are geotechnologies that are themselves geophysical processes, such that economics and physics are inevitably entangled. That is, there is only determination, but this determination itself is artificially indeterminate.

THE CRITIQUE OF CULTURE

The Terraforming project includes a suspicion of the notions that what is called "culture" represents a unique good in itself, one to be protected from merely functional symbolization, and that culture is a qualitatively different domain, elevated from general biosemiotics.[40](#) The program offers not just cultural critique, but a critique of culture itself as a pursuit of transcendental value. The Copernican turn would acknowledge and appreciate human cultural accomplishment as a marvellous, astronomically unlikely career of matter signaling to matter about the world through fleshly abstraction and physical expression. Is saying so any more degrading than to say that we do not possess literal souls or that the complex beauty of the world was not created in a week? To the contrary, it makes all of these more wondrous, even if it intensifies suspicion about a geopolitics predicated on the primacy of inter-human performance.[41](#) Through a more radical materialist frame, that cognition and those performed expressions are seen as emergent effects of matter organized by adaptation, and which, while available to artificial design, is never exclusive to any one particular material substrate, organic or inorganic. The symbols expressions are meaningful specifically, not generally. Accordingly, we define automation not just as the synthetic transference of natural human agency into external technical systems, but as the condition by which action and abstraction are codified into complex adaptive relays through living bodies and non-living media. It is both a direct physical ripple and an association of semiotic signaling with its reception; it includes

language as well as mechanical information storage and communication. This more ecological conception of automation is one of the conditions revealed by the contemporary intensification of artificial algorithmic intelligence today. It speaks to the already entangled condition of our species, agency, industry, and cultural dramas more than it does to the contemporary concern of proper humans being improperly replaced by machines. Given that feminist theory of technology places such emphasis on the mutualist symbiosis of cyborgian bodies, we note that the “replacement” trope regarding automation is a more intense worry for folk theories that stress instead personal mastery and control over technology. As for automated trucking, the replacement scenario hits hardest for men and for the fragile masculinities of the machine.[42](#)

(ALMOST) EVERYTHING IS OUTSIDE THE TEXT

As I wrote earlier regarding anthropomorphic AI, “[a]rguably the Anthropocene itself is due less to technology run amok than to the humanist legacy that understands the world as having been given for our needs and created in our image.”[43](#) This means not just logging and mining, but also the theories that sees the world, the planet and the politico-geological phenomena called “the Anthropocene” as generated foremost by particular cultural narratives and so most essentially vulnerable to cultural critique. The projects for which the representation of the world causes the world more than the other way around, or that the co-planetary of organisms and machines and ecologies are really characters in a big contested “Text”, are an ineffectual expression of 21st century, first-world Animism. It’s hard for me not to wonder if this is how the aftermath of post-structuralism has hamstrung how the humanities address planetarity today — and if so, how can we unmake this? Is this another way that the self-regard of the now-convalescening boomer ‘68 generation refuses to let go and let us get on with cleaning up the layers of its mess? If so, the 2030 deadline(s) for an artificial climate and automation plan demands something different and decisive.

THE AUTOMATION OF AGENCY IN ALGEBRAIC CASCADES

How else to make sense of it, then? Where do we fit in? Human bodies in these algebraic cascades can occupy positions of first mover, intermediate mediator, labouring cog, imprinted surface, and so on. Each demands its own variance and invariance and its own disclosures, enclosures and disenchantments. In this, automation and ecology are co-extensive. Automation can be a form of artificial embodiment, but only in relative terms by which it is never fully autonomous. In the regional cascade of biotechnical semiotics at an economic scale, any action that transforms the world can be absorbed into a technical process that no longer demands subjective volition for every operation. Not only is the action automated, the volition is as well. Agency seems here more like an illusion of how subjectivity imagines itself in verbs, nouns, causes, and effects than a fundamental executive in these distributed loops. The pervasiveness of automated machinery (both in reality and in projective planning) demonstrates not that animated machines are clearly separate from humans, but that the entanglements of mutual prostheticization between them operate in diverse and various ratios and asymmetrically distributed agencies and counter-agencies. Their position in the “user” layer shifts from moment to moment.[44](#) AI (and software more generally) allows for relatively automated technologies to occupy positions that have traditionally been held by humans and vice versa, in principle allowing us to move into other areas of active labor — or not. The automation of action also transforms it from something that may require deliberation and decision into something that is merely given as a durable aspect of a dynamic but predictable habitat. Again, the world is made and re-made not just by political decision, but by its dissolving of decision into automatic and prosthetic systems. What is most important for the plan is the difficult understanding of how our own physical embodiment and urbanism not only makes use of these automated prostheses, but are also themselves the effects and outcomes of those systems. We are the creature at the end of the tether.

SUPERNAUT

Close your eyes and imagine an image of a cosmonaut/astronaut/taikonaut/supernaut on a spacewalk. We can interpret this image in different ways. Here is a figure radiating agency, appearing as the executive agent incarnate, especially perhaps to himself. But instead of the ultimate frontier-puncturing space cowboy, I see instead a fragile animal in a shell, a pink putty sculpture unable to leave its home without bringing an artificial atmosphere with it as it toddles outward. It is tethered to multiple umbilical cords, re-encased in an inorganic placenta without which the creature would instantly die, and in a flash we understand that its condition is not some superhuman exception, but the same as ours here down on the surface.⁴⁵ We too would die without our automated life support systems. Floating in zero-gravity, this human degree zero demonstrates this irreducible technological entanglement under harsh experimental conditions. It's not just that we use technologies to survive, but that we evolved in symbiotic relationship with the technical cascades that shaped us, and we are nothing without them. As Disability Studies shows, "disability" is less a special state of particular bodies than a general and relative condition that we all share. We can sit here now because of general technologies for disability accommodation, such as architecture, agriculture, and antibiotics.⁴⁶ At this moment we are located in the gradient cascades of mutual automation of which our immediate and long-term survival is the outcome. As for the spacewalker, any migration off-planet traces these long lines, a slide across and eventually out of the atmosphere into the deep void: these astronauts and cosmonauts, all migrating waves of African descendants in orbit.

EXCLUSION AND AMALGAMATION

The dynamic is irregular, and this is what allows for its composability as an economic-ecological urban infrastructure. As humans and machines are functionally amalgamated by automated synthetic cognition, they are also simultaneously separated by new zones, partitions, and exclusions.⁴⁷ From architectural corridors inside factories to bioregional preserves, the spatial typology of human exclusion zones is an explicit, formal, and widespread strategy. It demonstrates a strategic measure in the artificial organization of automation cascades, one that deliberately removes human intervention from the local loop. It may do this to protect humans from machine accidents or, as is likely more important, to protect ecological niches from our consumption. For The Terraforming, we may consider these strategies of direct exclusion of humans as one end of a spectrum of possible designed arrangements, with complete human-machine amalgamation at the other end. For the field of possible animal and machinic entanglements, full exclusion represents a pattern of all black filtered from all white. However, the actual ecologies we see before us every day are instead multichromatic hue cycles of different possible combinations. In short, as ecologies are already nested fields of often mutual prostheticisation, then automation is a core design medium for economic-ecological planning. It can't be otherwise.

DARK FACTORIES

The differentiated urban-to-regional zoning of automation, and the ratio of amalgamation to separation is an economic-ecological design strategy central to The Terraforming. Even as we manage what is outside of cities, according to our own absence, we must also concentrate and intensify human-machinic amalgamation inside of them. As computational automation delinks material assemblage from certain social relations of wage labor while instantiating others, it makes use of existing footprints, previous patterns of urbanization, and also forces others that generate quite different geographies. New niches emerge, while others go quiet. The semiotics of such niches, even ones very close to home, may be utterly unavailable to us — not only illegible, but unlegible. Visualize dark factories in which complex manufacturing and assembly carries on in cacophonous clamor, but without illumination because robots do not require visible light to sense and move and make. In concert with materialist media theory, this underscores how the ecological chain of automation depends on particular adaptive forms of sensing and signaling in the context of specific niches. The chain reactions, from closed loops to dissipative waves, depend on each successive mediation to sense and register or resist and deflect the forces of

transformation that come in contact. Whereas for a well-orchestrated Rube Goldberg machine, the direction of force is linear, if also delightfully agnostic as to what medium it may affect next, outside the factory walls the processes are non-linear trophic cascades. These are powerful indirect interactions by which the introduction or subtraction of one entity (such as, for instance, humans) has dramatic consequences up or down the relay chain, which in turn can alter an entire population and landscape. Put directly, the scope of the geopolitics that looks like a geotechnology and geotechnology that looks like geopolitics is the planning and governance of automated trophic cascades. That is what climate change mitigation looks like.

REGIME: ALL YOUR BASE

REGIME: ALL YOUR BASE

The Copernican turn we consider and its attendant geopolitics/geotechnology require institutional means of enforcement operating at the scale of the reactions, events, and processes that they are asked to govern. The sovereignties that may emerge are probably not another open-mic forum by which all conceptive beliefs are spoken into the public record and fused into a temporary consensus. Vox populi is a means, not an end in itself, and once again, we already have the means but not the governance mechanism to enforce and automate the decisions. The innovation platforms we have are tuned less for disruption than for the indefinite deferment of structural transformation, but still the ones to come may be less a new Leviathan issuing alien commands than something capable of enforcing existing expertise.⁴⁸ If so, this may shift or even invert the normal chain of political representation by which voice becomes policy. This isn't a way to transcend politics and its uncertain messiness, but rather to actualize it by calling its bluff. The pressing assignments of geopolitics and geotechnology are now to directly transform planetary biochemistry, including but not limited to greenhouse gases. Therefore, while the necessary geotechnology and geopolitics may look like one another, the necessary transformations in our artificial planetarity may be less the outcome of some big cultural shift than its cause. Base precedes superstructure, but it may be base all the way down. The geonomos of that governing structure emerges not just from lines on maps but from automated assemblages situated in space.

THE AVATAR MODEL OF POLITICAL REPRESENTATION

If the successful deployment of governing geotechnology were to affect geopolitical change more than the inverse, then it would unsettle what we call the “avatar model” of political representation. The avatar model is the binding script of many political systems, including parliaments, monarchies, central party commands, and more. It is a symbolic supply chain of transitive interest articulation and wish fulfillment. The chain of symbolization would seem to go something like this. First, name an evil that does bad things to people, and then imagine the inverse of the bad thing which now becomes the good thing. Identify with the good. Next, find human avatars of this good thing: people who personify this identification and its proper articulation. Hone and define the avatars, testing them and their exact personifications for errors. Collectively invest a plurality of avatars with official agency to articulate their various personifications within a sovereign forum in which potential policies are represented. There, the gathering of avatars will contest various symbolizations and then codify consensus declarations into decrees. These policies are text-based model simulations of future transformations that seek to ensure that the good is realized. Financial means are allocated to actualize the decree simulation in the real world. Technical means are, in principle, deployed such that means and ends are in direct correspondence with the qualities of avatars' performances of the original identification of the good. The employment of the technical means hopefully defeats the bad things. If the process does not work, and there is not less of the bad thing, then return to the phase where avatars are honed and filtered for the purity of their personification with the good. Repeat. Versions of this procedure are ancient and responsible for many of the most difficult and most treasured accomplishments of what is called “the political.” The precedence of the symbolic before the technical is, however, not the only way that geopolitics and geoeconomics have worked and is certainly not the only way it can or should work. The recursive intensification of the political defined as perforative symbolization can also delink ideation from effect, and public forum from actual progress. It animates both occasional and regular rallies around generic chromatic signifiers — Orange Revolution, Yellow Vest, black bloc, flags and brands — that gain energy because they signify everything and dissipate because they therefore mean nothing. Along the way, they absorb and broadcast hope, pain, agency, joy, and anger. In the meantime, planetary bio-chemistry remains unmoved.

ONCE GRETA THUNBERG BEGAN MANIFESTING STIGMATA

The current response to climate and automation is probably too beholden to this avatar cycle, and the more that it is, the more it will collapse into increasingly desperate shadow play. The more it fails, the more likely catastrophic developments will be. The more persistent the delay in strong governing action regarding the geoeconomics of climate and the geocologies of automation, the more likely that “governance” will amount to nothing but a mess of cruel, stupid, defensive, and inequitable reactionary measures.⁴⁹ Planning can fail catastrophically, as the present situation demonstrates. But as said, it is not that the world doesn’t operate with planned economies and ecologies, it’s that it does so in bad faith, having convinced itself that more abstract forces are really at work: will, invisible emergence, capital, destiny, and strategy. In China, the relation to plan and planning is different than in the West, for extreme good and ill. In Russia, nervous exhaustion at the very idea weighs heavy — and rightly so. But whether the resistance to planning emerges from a conservative individualism, historical memory, legal corporatism, direct frustration, simple ignorance, or a reflexive suspicion of authority doesn’t matter as much as the damage brought by operating an artificial planetarity without a plan. Meanwhile, what is called “the left” is re-confronting the fact that its traditional base may be among the least reliable of constituencies for carbon restrictive economics. Or, it may still be a multitudinous vanguard. But instead of only looking at how political change may authorize shifts in climate policy, the focus must also be on the inverse: how abrupt climate-forced changes in human geography may in turn change the fundamental architectures of institutional governance. For example, instead of casting climate refugees as some substitute political class whose sacrifice allows wealthy biennale-goers to “bear witness,” will the growing wave of people occupying new lands push the legitimacy of “citizenship” past its breaking point? If so, will this collapse the patchwork pockets of Westphalian jurisdictions with it, or expand them into a smaller group of mega-regional blocs? Would either outcome allow for policies like carbon taxes that operate at the scale of the events that they govern? If not, why not? The reality must drive the reformation. The visionary child who stands before the congregation and proclaims the sins of the elders may represent for them all those with no choice but to live unthinkable lives, but the actual future is deaf to penitence and salvation.

TOP TEN WEIRD SURVEILLANCE CAPITALISM TRICKS

In order to govern geobiopolitical flows, emergent geopolitics requires good and sufficient information about what it governs so as to identify and enforce the broad outlines of any plan. The liberal model, in both its left and right versions, presumes that this means data about individual people and the governance thereof, but it does not necessarily. Many critiques of algorithmic governance, both populist and academic, replicate and reinforce the presumption that the most relevant data is about individuals. The outcome is that the positive, necessary, complex applications of algorithmic governance as an essential layer of artificial planetarity governance remain stillborn. Once more, the issue is not the same in the hemispherical stacks of Russia, the North Atlantic, Africa, the EU, China, the Gulf, and so on, but the stakes are very widely shared as we move forward. It is a very serious problem that the vector of the information society is one in which the largest holders of relevant data include shareholder-beholden advertising platforms and/ or authoritarian states. This weighs on both the pernicious harms that such entities may visit with this power, including those that are intrinsic to their explicit business models and political functions, but also on the absence of necessary and positive programs that would have been developed, achieved, and normalized had different institutions held the reins. By example, in many democracies these platforms became advertising companies, whereas in an alternate reality, they could have been “public” in some way. But in what way exactly? We don’t have the vocabulary to easily define the typological options beyond state or corporation, and this itself is stark evidence of the poverty of our political theory. Still, the path that prioritizes the privacy of individuated citizens as the single critical question is a far more limited and parochial vision than it sometimes imagines itself to be. While it is certain that the privacy of individual persons can and does enable many essential social systems to

function, and that it is quite obviously true that privacy has real and non-negotiable benefits for everyone, the fact that the battle is being fought there is exactly the problem. The individual human should not be the center of geotechnics/geoeconomics any more than it is at the center of the world. A Copernican turn is required here as well. The mechanisms of algorithmic governance itself need to be far less anthropocentric, far less mobilized around individual wishes and wants, and far less fixated on micromanaging human culture. Instead, they need to take as the subject and purpose of their project the material transformation of planetary biochemistry, regional ecosystems including cities, viable ecological heterogeneity – both given and artificial – and more.

THE ESTABLISHMENT LEGAL THEORY OF TARGETED INDIVIDUAL SYNDROME

In addition to the problem of improperly designing the role and profile of individual humans within algorithmic governance, a perhaps deeper problem looms insofar as this has become the overriding design problem at all. This has not stopped some wise critics from doubling and tripling down. Some exposés on surveillance capitalism provide interesting and important outlines of how individual profiles form the basis of opaque prediction markets that seem to lock users into funhouse worlds tuned to direct responses, from consumer desire and manipulation to real-time policing. How truly sad that this is what planetary-scale computation is trained on. At the same time, it is hard not to read many of these books, some even written by Harvard Law School professors, as being concerned both that the technology is being used this way but also — and perhaps on a deeper level — that computational platforms are organizing society in ways that formal legal political forums imagined themselves to have exclusive right.⁵⁰ I can't help but feel that this is exactly the perspective we would expect from Harvard Law School faculty. As *de jure* legal sovereignty loses ground to *de facto* platform sovereignty, as the law loses ground to technology, and as words lose ground to numbers, would we not expect this particular establishment to mobilize around the formal, liberal, legal, individual, and the sanctity of an explicitly contractual scandal? They may say, “Goddamn it, the lawyers are supposed to compose sovereignty, not the infrastructure itself; it's supposed to merely reflect the original signification that authorizes it.” Isn't this exactly what we'd assume the cultural center of Atlantic legal discourse would offer as house policy? It is an establishment theory of over-individualized data that is in direct concert with populist outcry, and instead of steering the mechanism away from individuation and toward where it should be instead, it reinforces the core logic it purports to criticize.

SURVEILLANCE AND INFLATION

In critical art and design circles, the theme of surveillance is now canonical and has its own genres and sub-genres of works. Most revolve around ways to unmask, unsettle, overthrow, and/ or defeat surveillance technologies in all their guises, and to define a great many technologies that sense and order the world as being tools of “surveillance”, and therefore are part of a greater apparatus that should be opposed. Much of this work is brilliant, but some of it is dumb or obnoxious. The latter may extend a notion of surveillance learned from cursory readings of Foucault via WikiLeaks to include almost any platform based on artificial sensors as part of the Oedipal overwatch. I recall a lecture by a colleague on smart cities that included a slide with two adjacent images meant to demonstrate an equivalence in how technoscientific capitalism disciplines bodies with surveillance: an RFID supermarket loyalty card next to a diagram of bodies arranged on a trans-Atlantic slave trade ship. These kinds of flattening analogies draw inference based on superficial visual similarity, flimsy correlation, circular reasoning, and grievously ahistorical thinking. This example is extreme, but the overinflation of the concept of “surveillance” (and thus the overinflation of the supposed remedies explored by art and design) is too pervasive and in many ways politically self-defeating. Some works, both excellent and otherwise, explore how generalized surveillance can be defeated by masks and camouflage, a presentation of self to the apparatus that is not who you are, who you imagine yourself to be, or who the apparatus might see you to be without the mask. In some ways, the gesture may speak to defending oneself against the predatory gaze of weaponized

machine vision and decision systems, and sometimes it is more about controlling the right of self-identification in itself. Sometimes, it deals with both. The latter is close to the traditional interests of artists who work with the plasticity of identity and a performative concept of the political and for whom an infrastructure that literally automates the identification of people, places, and events is, almost by definition, an existential danger. But in relation to the 2030 deadline and the very pressing artificial plan, a different approach is necessary.

GEOTECHNOLOGY AFTER OVERINDIVIDUATION

It's not that the crisis is so big that now it's OK to acquiesce to the big panopticon, but that the form and content of the crisis makes clear that to envelope all planetary-scale sensing, indexing, and calculation technologies into a general bad category of surveillance is both intellectually lethargic and politically reactionary. In the shift from the overindividuated user toward the systems to which geogovernance should pay attention instead, the movement to prevent the work of sensing infrastructure takes on a different tone. What does it mean, for example, for a very large industrial platform to mask and distort reporting data and fool the system trying to identify what's going on? Corporations are not people — but that's my point. To hack the surveillance governance was Volkswagen's plan for dealing with vehicle emissions! To mask the location and identity of a private transaction is Apple's tax strategy (in essence, a giant VPN that locates them in Ireland). The ugly connotations of "surveillance" as representing all data sensing, modeling, and recursive feedback immediately foreclose and disqualify all positive uses and pre-frames them with crippling suspicion. For the 2030 deadline, are climate change data and modeling really just "surveillance science?" Should we encrypt all of our emissions, or should we use encryption to make emissions absolutely accountable (as some blockchain projects imagine it)? One worries that seeing the larger, difficult issues through the trope of the "panopticon" means establishing a baseline common-sense that the politically progressive stack geopolitics is foremost about preventing the widespread use of sensing and big data. If so, this makes the development of a 21st/22nd-century model for a rational, equitable application of planetary-scale computation more difficult. We will all be poorer if the prevention of perceived harm sabotages the blossoming of what is needed. "Take Back Our Data!" Great. Then what?

[51](#) First of all, data about individual desire patterns may not be that useful. The first next step is to rotate the mechanism, not toward a more personalized and less restrictive medium for more precise human self-expression, nor recalibrating platform models back to familiar legal ideals, nor toward systemic blindness, nor toward state capture, but toward the mediation, composition, and governance of the geoeconomic and geoeconomic flows in which we are embedded.

THE WEIGHT OF SYMBOLS

What are those applications? When considering the enormous physical appetite of planetary scale computation, it is important to differentiate uses, priorities, and applications. The footprint of Earth Science's sensors, satellites, and servers is insignificant compared to the true carbon and energy costs of computing human self-expression. It wasn't climate science that broke the internet: it was the semiotics of celebrity bodies. The hot heaving cloud engine is stoked in pursuit of moments of apparently meaningful performance and fleeting significance. This same distortion of investments drives our politics. Remarking that The Stack takes so much energy is a true but blunt and lo-res observation. What we use computation for is the issue, and today it is the performance and contestation of the subjective identity of individual people. What is the best use of the teraflops? Today, planetary self-sensing does not cause climate change. In essence, culture does.

THE BATTERY THEORY OF VALUE

The implications for infrastructural design are profound. How might the physical substrate of computational platforms (mineral, carbon, energy, etc.) be not only a bottleneck to growth, but the

infrastructural media for the planetary-scale infrastructures of alternative valuation and exchange itself? A conservative philosophy of technology may see machines primarily, or even exclusively, as mere “batteries of value.” Nothing more. They merely reflect, absorb, and contain the energy of human labor which is where all value is thought to originate (how to interpret actual batteries according to that view is a bit trickier). I don’t hold to the battery theory of technology, but I do see a direct link between the value (what money is supposed to represent) and energy (how things in the world are made active). It’s hard not to. But value is not only about energy storage; it also speaks to the application of cognitive abstraction onto and into the world. In transferences of abstraction down the relay layers of automation, value is produced and added by motoring, writing, ploughing, drawing, coding, or lifting wordly weights. From our Copernican turn, in which cognition makes use of whatever material is available, the strong “sociomorphic” theory of automation (that technologies and ecologies primarily reflect our investments in culture, historical adventures, legacies, and violence, and not the other way around) appears fragile and translucent.

AN ENGINE BECAUSE A CAMERA

How to govern? There is not one planetary-scale sensing and calculation infrastructure, but several, each directing a different present and bending it toward a different future according to different models of what is sensed, indexed, stored, and transmitted. The global financial system is one of these. Currently, it identifies, enumerates, tabulates, defends, and makes big bets on the store of value that exists in the world and as the world. Its ontology of the value is, of course, open to dispute. The financial system works not only as a medium for the circulation of value as construed, but also as a platform for the formulation of models of the present that inform models of the future on which predictive bets are made, which in turn bend markets toward their rationales (“an engine not a camera,” per Donald McKenzie).⁵² However, it would be more precise to say “an engine because a camera.” Only because the accumulation of transactions made by and with abstracted units of value is sensed and organized by the sprawling interfaces of global financial media (ledgers, points-of-sale, statements, accounts, etc.) can predictive models have the perceptual scope of data necessary to work. Moreover, because those media infrastructures are themselves read-write platforms, the models’ steering influence can bend back into those financial flows directly. The recursivity of the event and its medium gives the model a seat of governance that is also dependent on all that it can see from there.

READ-WRITE MEDIA

Another mode of planetary-scale sensing and calculation infrastructure is climate modeling and Earth systems sciences, which have their own related history of sensing, indexing, storing, and transmitting media, and which also attempt, in a way, to be “an engine because a camera” through their models of the future, albeit with less authority and success than financial markets. The two projects of planetary simulation are fighting it out for pre-dominance in real ways, and literally everything is at stake. The “vast machine” is not only the planet so conceived, but also the construction of its instrumental sensing media — sub-oceanic nerves, terrestrial epidermis, atmospheric, orbital antennae, etc. — and, more importantly, the amalgamation of both vast machines into a recursive rhythm of artificial feedback loops. Whereas the financial model senses trillions of entities and interactions according to instances of abstracted value, the climatic apparatus senses and construes a diverse range of physical facts and seeks to correlate interrelations between them. The latter is more difficult primarily because molecular interactions at planetary scale are so difficult to trace, but also because their indifferent and un-negotiable reality presents an objective standard that economic models do not need to meet as they parse what is or isn’t valuable. In addition, because the sensing media of Earth Systems are not read-write in the same way that financial media are, their models of the future may be much more precise but have less capacity to recursively act back upon the ecological events that they model.

ENFORCE THE MODEL

I realize that for many good-hearted people, this sketches out a nightmare, but in important ways, this recursion is exactly what we want. We want our climate models that demonstrate looming systemic risk to have the kind of capacity for granular-level feedback on the ecology itself that financial models of risk have on the transactions they observe and indirectly administer. This is a different kind of geopolitics and geoeconomics. I don't see this as a "biopolitical enclosure of a natural outside," but as the means to artificially organise artificial cognitive abstraction to predict the effects of fundamentally entangled waves of production, metabolism, and mediation. At stake is the ability of Earth's existing ecosystems to survive the evolutionary fact of our sapience.

INCLUSION AND RECURSION

Whereas someone like the late Paul Virilio might have seen this recursion as a capture of the molecular realm by military supervision, and others might see it as the subsumption of the climate modeling infrastructure by the extrinsic economic logic of financial sensing and modeling, I would instead emphasize the inverse relation between these two models. We want to design for the subordination and inclusion of the financial media into a planetary geoeconomics whose models attend to the abstraction of matter and interchange: economics as a subroutine of ecology. In this way, we consider not only how the geotechnics of Earth systems can be made into recursive media through which future models of risk and collapse can enforce themselves into the present, but also how our climatic models can use the media of the now-internalized financial apparatus to steer the sensing, indexing, and storing of value according to different definitions, ontologies, and relations between living beings and processes. The implication for our program is not only to imagine these, but also to identify where they already exist and to draw out the implications of their maturation and development. What is our own function in this cascade? We sit at the point where the cascade produces abstractions about itself. This assumes, of course, that the energy and resource intensive development of planetary-scale computation for other, less useful purposes does not overwhelm and finally collapse the ecology and economy that such a system would ever hope to model and steer. It may. Instead, the apparatus should be put to a far better purpose over the coming years, and planned on behalf of a very different terraforming project. The geopolitics, geoeconomics, and geotechnologies that would emerge would do so in adaptive relationship with one another: base upon base upon base.

ARTIFICIAL METABOLISM

ARTIFICIAL METABOLISM: ENERGY AFTER EXTERNALITY

The Terraforming program at Strelka is not anti-anthropogenic climate change in the specific sense that it is pro-anthropogenic intervention into the circumstances of existing anthropogenic climate change. The goal is not to not change, but change away from crash and toward viability. In the face of apparent collapse, the impulse to withdraw is a response as impotent as it is understandable and predictable. To the extent that withdrawal is possible and necessary, it is always partial and artificial. Regional preserves are ringed by artificially delineated boundaries between city and park, but the preserve ecosystem still functions as part of a larger metabolism of energy flow, storage, digestion, and expenditure contained as always by layered atmospheric skins. Any spatial separation between the internal and external is to be planned so that the metabolic flows that move between them as well as those that do not cross the threshold may be better aligned. It's never an absolute outside, physically or metaphysically, though today, many areas are used as landfills precisely because the culture/nature divide allows some to believe that the outside really is external. Among the governable planetary flows that require serious reckoning are those not reabsorbed into the big metabolism — what we call waste.[53](#)

10,000-YEAR BASELINE

Quite obviously, we have a hard time grasping the temporal scope of such cycles and so we try to tame them with ethics in very strange ways. Sometimes, however, we do try to conceive the whole scope of the artificial metabolism at work and how to design it. For example, in the 1980-90's, during construction planning for the Waste Isolation Pilot Plant in Carlsbad, New Mexico, where nuclear waste would be put in long-term isolation, multiple scenarios were written to plan for possible accidental intrusion into the chambers over the next 10,000 years, during which stored radioactive matter could still be dangerous. These scenarios were composed by scientists, fiction authors, architects, and others to anticipate a world we can't directly imagine, but with which the anthropogenic trace of our present industry could come in direct contact.[54](#) Among the artifacts of the project were inventive “nuclear semiotics,” warning future visitors away from the site. Their recommendations did directly impact the design of the site, though the plan itself and the need for safe long-term disposal of waste could not overcome political resistance to construction. I wonder if we should commission similarly farsighted plans for all the ways that anthropogenic impacts cross millennia, and give them a greater force of authority? What geopolitics would that give shape to? What planetarity would it constrain? If nation-building was often a terraforming initiative (especially in Russia), such that the nation is what the engineering finally built, what sort of geopolity/geoeconomics/geotechnology would emerge from terraforming at planetary scale with millennium-scale impacts? I ask this in the least visionary and most practical way possible. As climate change is quite literally a deterritorializing force, it puts strong pressure on institutional architectures and, for better and for worse, pushes the way through to new possibilities and to restructuring according to different relations and geographies. Among these may be more “circular” chemical chains by which industrial metabolisms of extraction, circulation, ingestion, and waste are less chaotically open-ended, and are instead designed as part of a deliberately artificial terraforming. To even approach such a plan would mean investing as much attention and capital into technologies of energy capture and subtraction as we have for energy extraction and production. Indeed, that entire pipeline must be put in reverse.

NEGATIVE EMISSIONS TECHNOLOGIES

In addition to rapid decarbonization of the real economy, it is categorically essential to develop and protect Negative Emissions Technologies (NET) of different and diverse kinds, including natural infrastructures such as green carbon sinks. IPCC reports are clear that there is likely no way to keep

temperatures at or below a 2°C or probably 3°C rise without “climate-significant” removal of carbon from the atmosphere — on the order of hundreds of billions of tons.⁵⁵ Given this, our failure to invest more in research of capture technologies (and in building policies that force energy companies to do so) is a glaring failure of what contemporary governance is and does. Climate activism is similarly too silent on this, sometimes out of caution that such research will be used as a path to avoid decarbonization of production. But there is no way around artificial intervention. Reforestation (“plant a trillion trees”) is lovely, but far from clean and simple: there are land requisition issues, for instance, and what happens when warming continues, the new forests catch fire and all that stored carbon is suddenly released? Still, this is the scale of the anthropogenic counter-intervention and thinking that it’s needed. Protecting existing natural ecological services is even more essential, but natural negative emissions technologies have limits to their scalability. Once full, they can’t hold more carbon. We need to capture and remove the carbon already accumulated within the atmospheric shell. There is no way around it. The scope of potential NETs must include “passive” methods, like letting the Amazon rainforest recover its pre-industrial footprint, and “active” methods, like direct air carbon capture. Overall, we need to consider entire “waste-carbon conveyor” systems at the scale of today’s oil production infrastructure. In fact, by carrot or stick, we should transform oil companies into concerns that now instead absorb and store the carbon they have already liberated — and if not them, then organizations of similar engineering expertise, scale, and capacity. Where shall we find them?

“GEOENGINEERING”

As part of the particular way that we would puncture the nature/culture divide, the term “geoengineering” needs to be appropriated and redefined to include much more than strange new schemes for cloud-seeding. It should refer to a scale of design and, more specifically, to a scale of design effect, including planting carbon sinks and preventing carbon sinks from being destroyed. These are “geoengineering,” too. The term has earned disrepute, and features now in chemtrail conspiracies and earlier in seemingly maniacal schemes, such as Atlantropa, a 1929 proposal by German architect Herman Sörgel to build a dam across the Strait of Gibraltar, providing energy while also merging Africa into European Lebensraum (in his 1950 novel *The Flying Station*, Soviet sci-fi author Grigory Grebnev imagines the dam having been built by socialists under threat of Nazi sabotage).⁵⁶ However, many of those making the case for a more clear-eyed assessment of the reality of carbon budgets see that even radical emissions cuts are very unlikely to prevent catastrophic changes on their own, and give their qualified but strenuous support for a program of massive carbon removal from the atmosphere.⁵⁷ The program of geoengineering needs to be framed not as an omniscient, reductive control of ecological mechanisms, but as a sober, practical, geotechnically-minded, and geopolitically sensitive coming-to-grips with anthropogenic ecological effects, without the will to innocence or spiritual indulgence.⁵⁸ The program is not to secure a status quo with pat solutions, but to ensure that a viable future is literally, physically possible.⁵⁹ It may appear mostly as geotechnology because the transformation of planetary biochemistry is itself a technological undertaking, but it is impossible to untangle those relays from those of geoeconomics. Probably as an effect of this, the geopolitical architecture necessary to properly administer such an infrastructure needs to emerge to suit the scope of the condition. The program is not for a geoengineering that scales down the complexity of the problem space to suit the simplicity of a given technique, but for a geopolitics that may scale up to meet the complexity of its own responsibilities. This would radically expand the range of techniques available, which would alter the very notion of geopolitics in the image of the terraforming project that it assumes.

THOSE IMPATIENT FOR THE RECKONING

There is a disjuncture between ways of talking about geotechnology: one type is too heavy on diagnosis and deconstruction and too light on putting one brick on top of another according to plan, while another type has solutions but is naive about their implications. On the humanities side of the room, this may be less an accident than something built into the comfort of the critical reflex that is harder to avoid than it

should be. The paths toward a more viable planetarity will be imperfect and will leave no one with clean hands. The plan and the project is not utopian, but it would be anti-anti-utopian and certainly anti-dystopian.⁶⁰ This should not be a very controversial position, but within art, design, philosophy, and theory circles, it is sometimes harder than it may seem to discern how much a colleague actually does wish to prevent collapse, as opposed to even hastening it or simply cultivating prestige by evangelizing the end times. For some, Cormac McCarthy's *The Road* is less a dystopian parable than a prophecy of an end of the world that may actually be: a welcome return to a natural primitivist equilibrium, a deserved final judgment for a culture devoid of value, a feral playground for sociopathic survivalists, a chance for your local Thanos to cull the herd, or some combination of the above. There are preppers, and then there are preppers, and not everyone who speaks loudly of apocalypse is deep down trying to prevent one. Many positions may seem aligned at first impression, but are actually very different. Some are close to our own and some more distant. For some, the conjunction of capital and carbon is a force of absolute disintegration and deterritorialization. The meltdown is very much the plan. For some, a large-scale technical transformation can only happen if an equally decisive political and economic reformation happens first. For others, the political and economic shift can only take place if a technological shift first gives it structure. With myriad qualifications, my position is closer to the latter than the former. For some, such a geotechnical shift simply cannot work unless there is a corresponding geopolitical shift to ensure that it doesn't introduce even worse conditions; for others, the inverse is true. Some, however, hold that the geotechnical shift is possible independent of any geopolitical shift, and that it very well could work to prevent the worst ecological scenarios. For some of that some, that is reason enough to see the geopolitical itself as perhaps even irrelevant, while others draw the opposite conclusion. For the latter, even if a geotechnological intervention would have such effects, it is all but tangential without a fundamental transformation in global social structure — or even worse, would serve to depressurize the crisis and to strengthen an unjust state of affairs. Of course, even for this perspective, there are divergent implications. Some may work to ensure that the geotechnological intervention does realize a corresponding transformation of governing systems, while others instead would do everything possible to exclude geotechnological plans from the conversation under the symbolic rubric of climate justice. When pressed on the implications of their position, a few of the latter are actually among the most comfortable with gigadeath scenarios so long as they target the destruction of the temples of Babylon. I am not among them.

WHOSE ALGEBRA?

Recently, someone who is duly and properly well-respected in the world of software art and activism told me straight up, "I would rather have climate change do its damage than to let those people get away with it." In this case, "those people" are those who, per capita, have consumed the vast majority of land, carbon, and energy resources at everyone else's expense. He has since deleted and disavowed the post, but the statement is perhaps emblematic of a certain line of thought implicit or explicit in many critical discourses.⁶¹ I do understand the rage behind the sentiment, but it should go without saying that the billions of people now living and yet to be born in the Global South, whose lives may depend on geotechnical intervention "succeeding," may calculate the ethical algebra differently. As Kim Stanley Robinson imagines it, direct geoengineering schemes (risky as hell) may first be deployed not by Dr. Evil but by an equator-adjacent government which has just seen hundreds of thousands of its people die in a heat wave. They may look to the North and say, "You have no moral standing to tell us not to attempt this." The North's nervous counter-argument — that the secondary and tertiary effects of transforming planetary geochemistry affects everyone and requires a planetary scale planning and regulatory platform — is true and valid. It should heed its own words today. That is what we should be doing right now, as well as figuring out how to prevent outcomes such as these. It is another way that the implementation of geotechnology may hasten the formation of the geopolitics in its image.

A PLANET IS NOT A STORY

It does matter whether the contemporary is called the “anthropocene”, “capitalocene”, “petrocene”, “chthulucene”, or anything else, because different frames capture a different diagnosis, each of which implies a different course of action. It matters how much the contemporary is understood as part of a two-hundred-year measure of industrial expansion, ten thousand years of agricultural societies, or a hundred-thousand-year arc of human migration and ecosystem transformation. At the same time, to reduce that practical course of action to merely discourse (as if the role of design should be bound by contributions from the humanities defined largely by the resistance to and debunking of every possible plan, program and platform that could defend its own authority of enforcement, especially those that would operate at the scale of a permanent planetary entanglement) is to tilt not to justice, but toward a kind of comforting nihilism. We end up stuck with flimsy teleologies and tricks of language: namely, that the response to climate collapse is, necessarily and obviously, the symmetrical opposite of the cause (i.e. if industrialization caused climate change, then de-industrialization will solve it, and so on). As for all prefigurative politics, the confusion of cause-effect and means-ends correspondence can be a crippling illusion.⁶² The same goes for the deep well of self-congratulation that pours forth through those Global Northern souls who manage to reduce climate collapse to crises of personal agency, intense emotional experiences, and quantified-self moral accounting. As ever, planetary biochemistry is indifferent to these kinds of affectations of nature settling personal scores, however righteous the cause. It is too late to deal with the planet as a big story, and it was never a good plan to begin with.

MODEL IMPLICATIONS

That said, it bears repeating that the necessary plan is neither a fortification of the status quo nor plodding bet-hedging incrementalism. Quite the opposite. The emergencies not only imply a notional possibility of scrambling, resorting and replanting human infrastructural systems at planetary scale, but — if couched as an approach for urban, landscape, and geographic design — that is in fact the goal. The rejoinder that we never have true control over the effects of a plan is both obviously true and quite different than concluding that we have no capacity to accurately model the effects of our artificial agency. That is what climate science does, and that is how planetary-scale computation revealed climate change as a coherent concept from its data models. To conclude that the true implication of these precise models of anthropogenic effects is that it is impossible to have precise models of anthropogenic effects is dubious, and to claim that we have no capacity to intervene is also to defer responsibility for the agency we do continue to recognize.

PLANNING THE PARKS

None of this implies complete amalgamation of all ecologies into some total entropic sprawl. Among the most reliable and effective strategies for geographic intervention at a governing scale is to decisively prohibit interventions of settlement, commerce, and extraction in certain areas. For the ecological framing of automation, ratios of intensification of human-machine intermingling versus separation and exclusion presuppose one another, and both represent essential ends of the planning spectrum. When nature parks began to appear in greater numbers during the Industrial Revolution, they were an artificial territory, set aside at first for the elite and then popular recreation, national heritage, and eventually ecological resource management. They arise from an understanding that nothing will kill nature faster than trying to live off it as if it were an unlimited bounty. Parks are, in other words, an artificial enclosure: not just of the unmolested landscape, but equally of the human footprint within set boundaries. Parks encompass cities as much as cities encompass parks. As artificial “geoengineering,” this strategy of self-enclosure has proven to be very effective and must be extended and amplified within the plan of planetary territorial design. While the particular history of the park enclosure parallels the maturation of particular, vernacular nature-versus-culture divisions made explicit by real demarcating borders, it also helped to make the secular artificiality of human agency into a preoccupying and disenchanting philosophical conundrum.⁶³ In 1818, Mary Shelley’s Dr. Frankenstein is menaced by the insights, contradictions, confusions, and eventual monstrosities of anthropogenic agency within a nature that is no longer innocent. That the monster would

speak back and make demands of its own put the whole enterprise in question. Today, such artificiality should be seen as a given, rather than as some Promethean quest. Enclosure and exclusion between urban and uninhabited zones may be more a matter of ensuring survival and the continuance of viable ecosystems and inhabitants — including us. As we investigated in *The New Normal*, the territorial typology of human exclusion zones scales from factory interiors up to biologist E.O. Wilson's call to concentrate human industry into denser mega-cities and set aside half of the Earth for remediation, rewilding, and recovery. As this geopolitics scales, the planet as we know it will survive because half of it will be a park, while half will be a dense automated amalgamation of human-machinic entanglements — both equally artificial.

DEEP TIME INFRASTRUCTURE

The question of energy systems and artificial geographies are deeply linked, and would become even more so through geotechnologies and corresponding geopolitics attentive to the durational cycles really at work. That such systems would operate over centuries — not decades — is a starting point, not a scandal. We want deeper time energy infrastructures, defined by how we absorb, produce, distribute, store, value, meter, capture, restore, recycle and dissipate the energy used to power everything within our cities according to time scales closer to the ecological and geological resources they draw from. This includes a geopolitics that is capable of composing the capture and storage of the exhaust from those energy systems: heat, minerals, radiation, prosaic plastics, etc. Given the unusually long-term commitment necessary for the proper storage of its waste products, opponents of nuclear energy often raise the ethical dilemma of making decisions about land use (and indeed contamination) for future generations who will have to administer these without consultation or consent. However, the current condition, in which exhaust gases are expelled haphazardly into the atmosphere where they will remain for dozens of generations, is quite plainly not appreciably better, especially as its pervasiveness and invisibility makes any one less directly unaccountable for it. By comparison, nuclear waste is discrete, dense, and tangible, so the actions necessary in order to deal with its disposal should be harder to pass along to the commons, deferred elsewhere and into another time.⁶⁴ Perhaps perversely, as it stands now, the weight of intergenerational ethics seems to work against its own implications. Direct accountability for discrete and dense waste invites people to believe that they would be keeping their own hands clean by refusing it and thereby not signing their name to a decision with implications for the future that may prove problematic. Ultimately, the dynamic is not dissimilar to how we don't govern. The waste and exhaust of other energy sources, and the cultural problematics around negative emissions technologies such as carbon capture and storage end up having similar blind spots and confusions as those of nuclear waste storage and disposal. The positions claimed on ethical or economic grounds — that dealing with systemic waste is morally compromising, unprofitable, unseemly, or hazardous — are not principled stances, but massive failures of responsibility. For a viable artificial metabolism, the geotechnologies required are ones of responsible capture, transport, and sequestration, and the geopolitics needed are ones of long-term planning, precise modeling of the right things, equitable distribution of risk, and the suspension of ethics and economics predicated on the disdainful deferral of unseen ecological externalities.

The history of human energy technology is the passage from materials with high volume and low energy density (like wood) to low volume/high energy density matter (like coal) and should move to the smallest volume/highest energy density elements possible, from which energy is released at the atomic level and used to power regional-scale steam engines.⁶⁵ Instead of being broadcast into the atmosphere — as is the case with fossil fuel plants, where it is stored up there for generations, warming the planet all the while — energy production waste could instead be captured in an equally dense form and administered according to the scope of our commitment. If successfully planned and executed, and not treated as a series of unwanted half-measures, this would do much to prevent the runaway energy waste we now accept as normal.

CONTAGION OF PERCEIVED RISK DILEMMAS

Considering the geotechnology and geopolitics required, nuclear energy is like a Rorschach ink blot. It invites highly creative readings that say more about the ideas of the observer than the reality of the observed. Many smart people are not sure what to think, which is not surprising given the cultural connotations. Chernobyl, the TV series, fictionalized the catastrophic politicization of infrastructure management that led to a deadly explosion and the contamination of a 30km “involuntary park” in and around Pripjat, Ukraine. Viewers were led to believe, among other amazing things, that radiation exposure is literally contagious from person to person by touch.[66](#) With zombie movie tropes in mind, we have to ask what kind of politicization of infrastructure is entailed, represented, and implied by anti-nuclear energy populism? By no means are all anti-nuclear positions populist or invalid, but we still ask about the costs of closing this path toward a very low carbon baseload-scale form of energy for reasons that don’t always withstand scrutiny. Given the stakes of infrastructural decarbonization, in what ways are fears more dangerous than the dangers they seek to prevent? Consider that when the Strelka program took a bus through the Fukushima exclusion zones, we had possibly received more radiation on the flight from Moscow to Japan, especially for those of us who ate bananas along the way.[67](#) But what about all the people who died from nuclear energy accidents? Well, zero people died from radiation at Three Mile Island, one person died from radiation (at last count) at Fukushima, and, officially, 50 or so at Chernobyl (with some estimates of another 1,000–4,000 to come in the long-term).[68](#) By comparison, the number of people who died in the evacuation from Fukushima was over 2,000. As for the number of people who die prematurely because of coal and other fossil fuels, conclusions range from 3 million to 4.5 million people per year.[69](#) According to NASA Goddard, the mean net deaths prevented by nuclear power is already roughly 80,000 per year.[70](#) After Germany cut its nuclear draw by half in 2011, the total energy it generated by coal and natural gas stayed much the same even as so many more new gigawatts of renewables came online.[71](#) The well-meaning but misguided policy response will probably lead to unnecessary deaths. It’s counter-intuitive, but in the cuttngly direct measure of deaths per kWh, nuclear power is at least four times safer than solar. Look it up.[72](#)

“NUKES”

The issues preventing viable geotechnologies and geoeconomics, such as “deeper time” energy economy infrastructures, are cultural, psychological and political as much as, if not more than, technological or ecological. Energy sources have ideological associations. Wind and solar energy are very strongly preferable to coal, natural gas, wood, and dung burning, but they are likely not a stand-alone solution and present their own problems of material sourcing and recycling, land use, e-waste, intermittent yield, etc. The present skirmish between nuclear and renewables, such as whether nuclear should be included or excluded from various Green New Deals, is a culture war in the worst sense at the worst time. The reconsideration of nuclear energy is emblematic of what is and is not an acceptable geotechnology within current political and cultural constraints, and an example of why such constraints cannot hold. One political objection to nuclear power from the left is that it would centralize energy production and distribution, but I would argue that energy in the form of electricity is, like transportation, water, and education, something that should be a platform utility, widely available as an automated artificial resource for all. There is a reasonable debate as to the relative pros and cons of energy centralization and decentralization and where risk is felt most acutely by the most vulnerable. However, more broadly, how much are symbolic allegiances dressed as policy commitments responsible for the aesthetics of resistance and fear that surround nuclear power, seen by some as the military-industrial complex of energy infrastructures? Some? A lot? In some circles, an anti-nuclear creed is beyond question; it goes to the essence of what is evil and good. Civilian nuclear power still carries a kind of post-’68 association with bomb-dropping, DDT-spraying, Watergate-covering-up white men with crew cuts, Gee Vaucher collages of Reagan and Thatcher — and in Japan, Ukraine and Russia, even deeper nerves are touched that go to the suspicious heart of intergenerational dramas as well as real and severe institutional neglect. These are

powerful, but if the cultural commitment to these associations is more powerful than clearing the path for long-term infrastructural decarbonization, then they also exemplify how the traditional Green Left, despite their good deeds, falls dangerously short in seriously addressing the challenges of composing and governing a viable geotechnology, geopolitics, and geoeconomics, and thus a viable planetarity.[73](#)

THE ANTHROPOCENE AS NIMBYISM

Again, nuclear power is emblematic of the disjuncture between the geotechnical systems we may need to consider and compose versus the current cultural and geopolitical norms that are unable to approach them on their own terms. Perhaps the single most difficult disjuncture is temporal, between the rhythms of cultural necessity and the ecologic and geologic time scales on which they depend for energy and material support. The Terraforming may come down to reforming the former to fit the reality of the latter. To be sure, nuclear waste disposal is a serious and difficult conundrum.[74](#) But because the stuff lasts a very long time, we should understand that its administration is a deep time problematic, not disqualify it from the plan. The story is complex, but consider the proposed Yucca Mountain waste storage site in Nevada as a counter-parable. It was a good plan, as far as it was able to develop. Of the available options, the ancient salt cavities under the Nevada desert are among the most rational locations to sequester the exhaust materials of nuclear energy production, but the project was cancelled because it became politically toxic within the chain by which political voice is represented. No one wanted to deal with it and risk losing their job. People said they did not want the responsibility of having been the ancestor generation to have buried it. Instead, fossil fuels now assume the percentage of the energy mix that renewals and nuclear could have provided, dumping waste exhaust up into the atmosphere instead, where it is much more difficult to observe, control, weigh, capture, dispose of, and channel back into the artificial metabolism. Out of sight, clean hands. Today the unaccounted plumbing discharges of our planetary artificial energy system means atrocious ecological injustices dumped on the Global South. Instead of being buried in deep caverns, radioactive waste mostly just sits there on-site at power plants. The situation is both insane and unnecessary. In an ungenerous mood, one wonders if the Global North is willing to let the whole climate literally explode because several thousand activists in a desert state have a deeply negative association between atomic decay and their own mortality. Is the parable of Yucca Mountain one of continent-scale NIMBYism gone berserk, as the heckler's veto proves sovereign up to and beyond the point of collapse? If so, it means that the critical misapprehensions of a tiny percentage of the global human population rains hell on everyone else due to their incredibly expensive notions costumed in ethical certainty.

But maybe the lesson is instead that the difficult confrontations of waste will force different geotechnologies, which will in turn force a very different geopolitics. The confounding problems of nuclear waste are that it lasts so long and that you can't just let it plume into the atmospheric commons like the waste from other energy sources. It is discrete, dense, and irrefutable. But because it lasts a very long time, the geopolitics of its administration is forced to conceive an entire energy system in ecological timescales (as it should) and unlike fossil fuel emissions or solar panel e-waste, it cannot be excised and excommunicated as an externality, but must be managed as an unflushable remainder (as it should be). You can't escape it, but you can deal with it. In this way, we may prefer to consider the politics of energy infrastructure not only in terms of how geopolitics may administer it, but also by how the emergence and proper administration of viable energy geotechnologies will bring about the geopolitical and geoeconomic institutions that they imply, demand, and entail.

THE PROBLEM WITH VOICE WHEN THERE IS NO EXIT[75](#)

According to many different ideals, a democratic consensus should predicate, author and authorize the necessary geotechnical shift, as without one, any such shift might be unjust. From what and for whom this consensus (or even authoritative dissensus) might emerge is an unclear and stubbornly open question. The

question itself is asked in the context of popular movements demanding action on climate change, but also in the context of possibly more popular sentiments against carbon caps, carbon taxes, emissions control, public urban planning, scientific expertise in Earth sciences, longer-term land use regulation, sustainable food policies, etc.⁷⁶ If the barriers to viable planetary governance are themselves cultural and political, are these dilemmas even soluble on those terms or not?⁷⁷ Today's revanchist and recidivist populism is also a deeply destructive global anti-ecological movement, whether it wants to understand itself in those terms or not. It is also a symptom of the crisis in establishing political and cultural institutions to even model the problems intelligently, let alone cohere policies and plans in response. If popular will cannot or does not authorize the necessary material shifts in planetary biochemistry required, then what? Is there still time? Is it even realistic to wait? What if the answer to both is "no"? Pick your own preferred climate change action intervention. I am sure it's a good one. If it is not possible to convince a plurality of people to change their minds, authorize the investments, and implement the changes in time, whether because of myth or incomprehension or self-interest or anything else, do you forego the intervention or do you find another way? When we say that the admiration of cultural expression as an intrinsic good is too expensive, and that the avatar theory of political representation may be too roundabout, this is why.⁷⁸ Instead, we must allow that the geotechnical necessity may drive geopolitical institutionalization more than the inverse, both for the plan and the planetarity.

PLANETARNOST

PLANETARNOST: SPACE IS THE PLACE⁷⁹

Returning to the Black Hole image and the hemispherical scale artificial sensory system that brought it forth, The Terraforming is ultimately couched in the priceless alienations of “outer space.” The plan is for an alternative artificial planetarity, one that is geographic because it is geopolitical and geoeconomical because it is geotechnological. We define “planetarity” as inclusive of what is called the technosphere and all its artificiality, rather than what is left after subtracting all that from the metaphysical ground. With the Event Horizon telescope array in mind, we contrast a static geocentric image of the Global with a multi-scalar and polytemporal model of dynamic planetarity as a way to describe both the continuous condition in which anthropogenic design takes place and also to name what that design must properly bring about.⁸⁰ The polyscalarity of the planetarity means that we can’t park ourselves within a very large and very wide perspective and presume to resolve the whole, and so the urban design brief relates to the very small equally as much, such as the accumulating molecules trapped within the atmospheric rim and their cascading effects on what city settlements are even possible. None of these can be seen without extensive artificial sensing and modeling media, and in their plurality, planetarity exceeds final perceptual closure in ways that the cartographic heritage of the Global does not. As I wrote in an essay on the geopolitical schisms within planetary-scaled computational infrastructure, “Despite the integrity of mutual integration, planetarity cannot be imagined in opposition to plurality, especially as the latter term is now over-associated with the grounded, the local, the vernacular, and with unique experiences of historical past(s). [...] That is, while we may look back on separate pasts that may also set our relations, we will inhabit conjoined futures. That binding includes a universal history, but not one formulated by the local idioms of Europe, or China, or America, or Russia, nor by a viewpoint collage of reified traditions and perspectives, but by the difficult coordination of a common planetary interior. Once more [...] It is not that planetary-scale computation brought the disappearance of the outside; it helped reveal — again — that there never was an outside to begin with.”⁸¹

KONSTANTIN TSIOLKOVSKY AND SUN RA WALK INTO A BAR

What would Tsiolkovsky have made of Sun Ra’s music? We may have some idea what Sun Ra thought of Tsiolkovsky, and it’s quite obvious how much he thought of the quilted legacies of Tsiolkovsky’s life’s work, from rocketry to alien communion. The two share a driving preoccupation with space as a path toward liberations. For Tsiolkovsky, it was for man to assume the gift from the Creator, to conquer death itself, to reunite the whole body of ancestors, and to graduate from Earth into the stars. Toward this, he pioneered the whole Russian field of advanced rocketry, making the Soviet space program possible. For Sun Ra’s meta-futurism, it was to evacuate a colonized Earth, to venture beyond this perch toward the reunion of the African diaspora.⁸² To the extent that the migrations of archaic humans from areas around what is now Ethiopia mean that the entirety of human design and settlements are the artifacts of a primordial diaspora, Sun Ra’s experimental symphonies are also universalist. If for Sun Ra space was, in fact, the place where “society, culture, and systems are reimagined to give power to the oppressed,” then its status as an outside is always in question. Outside of what? Space as escape, or even as pure “space” (Cartesian, astronomic, Euclidean, etc.) gives way to space as place, not the absence of place. Now that Earth has sent out animals and probes, and detected exoplanets in our galaxy, the sites and surfaces of other astronomic bodies inform a comparative anthropology of place, as described by Lisa Messeri in her *In Placing Outer Space: An Earthly Ethnography of Other Worlds*. Because space is a place, its outsideness is relational, and the overview effect it may provide can always be seen within another overview of the overview. This infinite regress, both real and imagined, is a home to which we must always return, no matter how far we venture.

REGIME CHANGE

The projective displacement of society into “outer space” as literary projection or scientific speculation is a way that the scope of sociotechnical possibilities can be reconceived in a literal and metaphorical vacuum. Previously, some writers would locate their experiments on far away islands or in long-ago times, as well on distant stars, but the Anthropocene-era preference is to go off-planet, building out mini-society prototypes on the fraternal surfaces of Mars or our Moon, inside the managed encapsulation of a spaceship, or perhaps on planets beyond our present knowledge.⁸³ In the late 20th century, some were realized in the form of Russia’s or the United States’ ventures into orbit or to the moon as Russia or as the USA: with flags waving, but also somehow on behalf of Earth as a whole. In some ways, to establish this metaphorical interchangeability by which the country can stand for the whole planet may have been the key geopolitical point of the space programs.⁸⁴ Somehow, asking how we might govern ourselves and in what kinds of cities, is, despite the crushing ecological and atmospheric constraints, a seemingly more open question with more possible answers when it is asked “out there” rather than “down here”. But why wait? We are already, as the man said, floating in space right now. Fuller was not wrong on this point, but the radical implications of his meme have been domesticated. First of all, in actual outer space, the “climate” is a very real and pressing emergency. The “governance” of the ship or the settlement extends foremost to life support within the atmospheric totality, and any breach is an emergency that makes way (hopefully very quickly) for a de facto sovereign mitigation. Is the final definition of design only that which ensures the continuance of organic life in an extended network of cyborgian skins and tethers that keep its essential cellular and cognitive processes going? As above, so below.

SPACE THEORY IN PLACE

For reasons that are both clear and unclear, philosophy seemed to lose interest in outer space in the last decades of the 20th century. After Sputnik and then Apollo, the story went cold, even if the discovery process was only just beginning. Earlier on, Martin Heidegger and Hannah Arendt expressed their alarm, then the French derided the hyperreal accident of it all, but until recently, there has been something closer to indifference, even though since that era we have figured out much of what we now know about the chemistry of other planets, sent probes outside our solar system, deduced a more confident map of the local galaxy, fixed the positions of exoplanets, determined the existence of dark matter and dark energy, and much more.⁸⁵ Regarding all that, philosophy has had less to say than about some less obviously profound matters. But perhaps this is not entirely true. Perhaps “space” was folded into other conversations about satellites, minimum-viable closed-loop architectures, geographic sensing and imaging, the truly alien and the productive qualities of alienation, corporeal prostheses, the geologic condition of culture, planetary logistics, the cognitive aesthetics of deep time, and indeed climate change and the Anthropocene, among other things. Instead of an external frontier, these consider being “in space” as our present home condition — which it certainly is. What if we were to link these inquiries more explicitly to an unofficial genealogy of the philosophy of outer space?⁸⁶ How would these contemporary inquiries congeal differently if framed in this way and connected not only with Heidegger or Werner von Braun but also with Bogdanov’s Red Star, Lucian’s True History, Olaf Stapledon’s Last and First Men, Semyon Bobrov’s Ancient Night of the Universe, the Vimana machines of Ramayana, and so on? The significance of insights may be less isolated if seen as part of a more inclusive theory and practice of planetarity. Now, after several visits and flybys, from Europa to Pluto, and long-term robot inhabitants on Mars, debating “planetarity” should also be seen as the subject matter of a more general inquiry of comparative planetology.⁸⁷ The comparison to be made, looking back at Earth as another planet among them, should train our line of sight and line of inquiry on things like the Duga Radar system in Ukraine, the ultra-rapid densification of urban populations in Asia, the Thule Air Base in Greenland, the geopolitics of low orbital satellite paths, China’s plans for Huawei-outfitted bases in the moon’s icy craters, the framing of Masdar as a “spaceship in the desert,” the eventual submersion of coastal metropolises, and on and on. It would be from site conditions such as these that we might assemble the programs of urban

design relevant to any looming 2030s.[88](#) It's not the only way, but this is the theory and practice dynamic of the research we will undertake over the next three years in the Strelka program. Still, even in asking "Who will build the ark?" to reformulate a different, viable planetary urban society, the questions asked by the Black Hole image, as we look back through it to the Earth's surface, subsume even the widely drawn frame of this project.[89](#) The questions contain the project — it doesn't contain them.

WE ARE ALL SPACE DOGS

At the Ukrainian Academy of Sciences in Kiev, a biologist named Irina Prokofievna Kharitonova keeps glass jars in which moss and orchids have lived for 13 years in their artificial environment of carbon dioxide. The original plan was for these jars to be sent into space so that she and other scientists could examine the impact of extra-terrestrial existence on miniature ecosystems of living organisms and soils. Today, they sit on her work bench waiting for their turn to be our scouts.[90](#) These organisms, not flags, would go on our behalf. Recall again that Diogenes' cosmopolitanism was based on the glorious dog-like community that humans share, and so it was that the first cosmonauts were drafted from a platoon of winter-hardened Muscovite stray dogs. From Dezik and Tsygan to Laika, Strelka and Belka to Zvyozdochka, these mammals took their hero's journey in arcs up and around and down again. Some could not and thus did not escape. Like them, we cannot either (and remain human). Today, most of the Earthlings that venture off-planet are not humans, or even mammals, but robots with names like Luna 2, Voyager 1, Curiosity, Spidernaut, Cassini, Hayabusa 2, and Yutu 2. What would it take to appreciate these not only as equipment in the sky, but as part of an expanded community of Earthly assemblages, of which we are powerful parts and upon which we depend for our completely non-autonomous lives? If we can identify with Laika, can we also identify with Yutu 2, and if not by our common dogness, what cosmopolitanism might engender it?[91](#) Would they be less like remote vehicles and more like the ancient god-like robots, Talos, Golem, or Galatea? They don't need to be. They can be, like us, just Earthlings.

GALAXY BRAIN

The term "world" can mean both the coherency of perceptual and cognitive experience (as in *umwelt*) as well as an astronomic body (as in *planet*). The conflation seems naive or wise depending on the direction of association. To suggest that the astronomic world is a background given for the phenomenological world (closer perhaps to Husserl's complaint against Copernican trauma) can veer towards the false comfort zone where solipsism and narcissism converge. However, if the astronomic world is what is folded into the perceptual organs and cognitive bodies that produce, mediate, and remember rich sensations, such that a liveable consistency emerges as a given world, then we are closer to where the renewed Copernican turn should take us. What is called culture is located inside a general biosemiotics, and in turn inside a general ecology that can connect our ideas and lives to the world more closely and durably than any romantic gnosticism or metaphysics of affect can bear. Again, the apparent paradox of the Copernican turn is that by puncturing the illusions of human cultural exceptionalism and the attendant fictions of its "natural" exterior, the "artificiality" of agency and automation means that the planetary-to-come will be more anthropogenic. It implies a more deliberate terraforming, not a release of liability through a renunciation of rationality. The dethroning of self-illusions also undermines the alibis that allow us to remain innocent as to how our planet has folded itself into fragile, transitive human forms through which it acts upon itself and enables its own perceptual organs, such as the Event Horizon telescope. The disenchantment of anthropocentrism includes, one hopes, the disappearance of a creationist "mastery" over a world that is no longer external, but also a re-evaluation of paths of withdrawal into symbolic interiors, for which the most local "world" takes precedence over the material planet that gave rise to it.

KEEPING UP WITH THE KARDASHEVS[92](#)

In 1964, the late Nikolai Kardashev, Russian astronomer, posited the Scale of Civilisations. (We had

hoped to host Kardashev at The Terraforming announcement event in August 2019, but he passed away just days before.) Level 1 planetary civilizations can use (or store if needed) all the energy of their home planet; Level 2 stellar civilization can use all the energy of their host star; and Level 3 galactic civilization can use all the energy of their host galaxy.⁹³ In 1973, Carl Sagan guessed that we are at about Level 0.8. (The Last Camera, the one that is wide enough to see as far and far back into the darkness of time as it is possible to view, might be constructed by a Level 1 or 2 crew by distributing the networked telescopes in different prudent locations throughout their solar system and synchronizing their focus and exposure as they peer back to the beginning). In the meantime, however, would even a Level 1 civilization, capable of releasing the energy of any terrestrial atom on command (including those that make up living organisms), constitute an unthinkable beyond-Lovecraftian horror? And yet, even if it were an unthinkable horror to us — who scavenge fossil fuels and set them on fire so as to power pictures on screens — does not mean that it is really unthinkable or horrific in any ultimate sense. I wonder.

RUSSIAN ARK, RUSSIAN PARK

RUSSIAN ARK, RUSSIAN PARK

As throughout the history of the Russian space program, as well as the vanguardist era of the Soviet Union, Russia would sometimes stand in for the whole of the world, either as a universally typical or uniquely advanced society (the United States played the same script by planting its flag on the moon on behalf of “mankind”). Today, marking what is and isn’t specific about Russia’s future as a cause, site and effect of The Terraforming project sketched above is not so simple to determine. What may seem at first like an idiosyncratic local quirk may prove to be the fate of us all. What declares itself as the most comprehensive and ecumenical of gestures may collapse quickly upon translation or export. Still, Russia’s history of nation building as terraforming has many lessons to offer for what must and must not come next.⁹⁴ A legacy of amazing triumphs (the Salyut and Mir orbital stations, for example) and catastrophic failures (Lakes Baikal and Karachay) are both precedents that are equally at hand. Russia’s local forecast for the coming years could be as bad, or not as bad, or worse than other regions. Its distance from the equator, seemingly endless landscapes of carbon dioxide-hungry trees, defensible northern settlements, newly agriculturally-viable land, and so on all seem like positives: land, food, ice. Russia is also heating 2.5% faster than the global average and the ecological restoration after 20th century nation-building will mean a terraforming project equally as ambitious⁹⁵ — or perhaps one a few orders of magnitude more ambitious still.

NATION-BUILDING

In the Sakha Republic in Siberia, some people dream of recreating the subarctic steppe of the last glacial period at Sergey Zimov’s Pleistocene Park by using synthetic biology to breed mammoths and reintroduce them to this area. Why do such a thing? Because the beasts eat grass as they roam and stomp on the terra, breaking up the frozen ground, which would let grasses grow again where none grows now, keeping the long captured methane gases and various nasty diseases (both of which may kill us all) buried underground. Rewilding in the extreme, artificial mammoths may not exactly be the Occam’s razor solution here, but somehow turning these areas back into grasslands may be. Thinking it through entails a different relationship between nation-building as terraforming and terraforming as nation-building than the one that has animated Russian’s recent history. Today the country is far too dependent on extraction economies that don’t percolate much interesting innovation through the rest of the economy and which are, of course, vulnerable as planetary energy systems’ shift toward less autophagic options such as wind, nuclear, and solar (that Russia, in principle, could develop quite well). These issues are and are not generally on the radar of a too-insular Russian culture, depending how you look for them. Eschatology plays well in Russia, but mystical fatalism is not our program. Or if the ecological controversies are pressing in local and specific ways, they do not always translate back up to the big picture. In some ways, they may not need to do so as a precondition for urban geotechnologies to come. The insensitive concentration of human settlement in a dozen or so meganodes is not only part of the plan — it’s happening anyway. If anything, in Russia, E.O. Wilson’s Half Earth plan is easier done than said.

AFTER THE NEW NORMAL

The Terraforming is probably a more difficult and more important research program than The New Normal. I think that certainly more is at stake. The New Normal was able to draw a dotted line around a condition that already existed, right there in the open, but which was not obvious because people didn’t know quite how to look for it. Once you saw it in the picture, it became obvious and you couldn’t unsee it. If The New Normal worked with the grain, The Terraforming works against it at a particular, oblique angle. We will work with topics that are familiar but in ways that are not. This will, we hope, align

elements into a new perspective that becomes in itself a useful — if difficult — way for us and for others to work. The available languages to speak through these issues are, to my ear, horribly inadequate and timid: habitual morality tales, cynical denials, and weak metacriticisms. I anticipate that we will lose some people with this program and this book, especially those who have laid “too-late-now” bets on various good guy/bad guy plots which they don’t see reflected in our thesis. It’s okay. The contrarian pragmatism and wild-eyed realism we hope to cultivate is available for them if and when they want it. Our own project work will be developed primarily through cinema and text, together and separately. Each offers a different way to the highest resolution rendering of a concept that is possible. With cinema we will see it until we believe it, and with text we can audit the semantics of ideas at full scale. We hope to bend both cinema and text to develop otherwise uninvited tasks for both. Each is a technology of direct prefigurative articulation and simulation; each has its own biosemiotics and its own geologic origins and debts.

AGAINST DESIGN POPULISM

If *The New Normal* focused on linking the cloud and city layers of *The Stack*, *The Terraforming* focuses on the Earth and the city layers, but considers “cities” not as a collection of well-known valuable settlements, but as the forms folded on Earth’s surface crust composed as its intimately artificial interior network: inhabitable circulation. The *Strelka* program remains positioned deliberately and unapologetically in contrast with design populism, as it is also against reactionary populism on the political stage. The self-satisfied common sense that design and designation must be guided, above all, by simplicity, obviousness, usability, plain talk, and amateur participationism even if – or especially if – at the expense of complexity, nuance, effectiveness, ambiguity, expertise, and planning is, I argue, a local variant of the same crisis of authority that clears ground for mephitic demagoguery anywhere. Both appear when the underlying messy reality is suppressed, not by an egalitarian reason, but on behalf of the performance of a preferred story. Design populism, in this mode, can be defined by the politics of personification subsumed into popular narrative. That narrative of personification authorizes charismatic leaders as well as forums for the contestation of representation. We will continue a more difficult, but I think fruitful, path for the development of urban design practices that are actually required by the reality of circumstances, not the momentum of the plotline. We can hope to find out what those most needed practices look like because we can know only by doing.

“SPECULATIVE” “URBAN” “FUTURES”

The new program remains one of “speculative urban futures”, but only because each of these three terms is undecided and therefore alive. The speculative refers not to the whimsically “creative,” but to what is so functional and necessary — even if equally unlikely — that it makes conventional schemes, however likely they are to be repeated, seem insane by comparison.⁹⁶ This is in fact our predicament. Not only is business as usual psychotic, but the normal genres of concerned response are deeply neurotic, even delusional. As we developed with *The New Normal*, the “urban” belongs to more than just planners and developers. Cities that take shape as historical layers of collapsed real estate schemes may be the norm, but the pressing reality should force a redefinition of what we mean by urban form as such: cities are never separate from ecologies, they are ecologies and must be composed as such. “The Future Has Not Been Cancelled” was a motto of *The New Normal*, and it meant to say simply that self-validating, self-perpetuating collapse scenarios do not a plan make. It also meant to call on the history in waiting of Russian utopian thought, science fiction, and futurism as inheritances to claim. However, in the early 20th century, “the future” was an aspiration to be achieved. Today, “the future” is not just something to be achieved, but something to be prevented. Speculative thought is mobilized to this task of preventing one future so that another might, with luck, come to pass instead: achieved because prevented.

STRELKANAUTS

The Terraforming is planned as a three-year research cycle, with three annual cohorts joining us in central Moscow at the Strelka Institute campus for a five-month intensive curriculum with our faculty, where we will develop original research projects in collaboration. Our faculty is mostly a reboot from The New Normal, both because our research focus is different and because we want to explore a different kind of research outcome and to discover again what shape that can take. The cohorts are formed into model urban design practices, but from more heterogeneous disciplinary positions than most other urban design programs. Half will be architects and urbanists who think and work at the planetary scale, and half will be philosophers, filmmakers, coders, scientists, and various others. Half will be Russian and half will be international; half will be men and half will be women. As ever, the program has no tuition, which allows us to admit those who will benefit the program the most and benefit from it the most. Our work is trained on Russia and the complexities, trials, and opportunities of this deeply complex and amazing land. Here, our contributions to the artificial plan will take shape, and here we will venture into areas that in another context might be unthinkable, too strange, or super problematic. Some semantics, protocols, and formats of planetarity-to-come may come from our most angelic efforts and some may emerge from much darker places — and that is allowed for. The Black Hole image is a terrifying image. It shows the void of gravity that is time. It shows what is seen when primates assemble a planetary optical organ, and it shows a planet sensing its external situation by using parts of a larger sensing system that it also uses to model itself. The reason the image is terrifying, however, is because it promises to reveal something further that we can't know yet. If we define the Copernican turn as the process by which an intuitive and anthropocentric conceptual model creates the technology which in turn undermines that model, then part of what makes the Black Hole image terrifying is knowing that the undermining is yet to come. In the meantime, this question bears repeating as often as needed: if the planet is a camera, where should the cities go?