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Abstract

This article addresses the question of the planetary through three practices that relate to design and architectural pedagogy and research as well as the broader context of Anthropocene discussions. From Strelka Institute's Terraforming program to the *Terra Forma* book by Aït-Touati, Arènes, and Grégoire and a discussion of Royal College of Art's Architecture program's studio "Something in the Air: Politics of the Atmosphere" the article focuses on framing of "problem spaces" (Celia Lury's term) through studio briefs as well as experimental visualization and mapping. While discussing some methodological underpinnings of planetarity as such a problem space, the article mobilizes the neologism *a natural history of logistics* to analyse practices of scale in the critical design studio briefs and discourses at the centre of the article. The term is pitched as one temporary conceptual anchor for a specific relation to technological framing of a polyscalar Earth as it emerges in design discourses and practice-based approaches.

Keywords

Elemental media; speculative design; Anthropocene; architecture; studio practice

A Natural History of Logistics and Other Studio Briefs: Problem Spaces for Planetary Design

Introduction

The planetary has become a recurring reference point in recent years across different disciplines from philosophy (Spivak 1994, Mbembe and Nilsen 2019; Chakrabarty 2019) to visual, cinema, and design & architectural discourses (Bratton 2021, Gabrys 2018, Likavcan 2019, De Luca 2022) as well as for example sociology (Szerszynski and Clark 2020) interested in “how a planet becomes other than it is” (Ibid.: 4). Much of the work has focused on how the material planet is constantly produced across different scales of material and semiotic operations while the social and political impact of these shifts of scale becomes a crucial aspect of conflicts too. The theme of production of the material planet has been also taken up in geoengineering discourses which address the Anthropocene as a large-scale management issue of for example thermal control (Furuhata 2022) that becomes not only one specific technological solution, but part of a longer history of circulating desires of technocratic control (Beck and Bishop 2020). In this context I am interested in what the planetary means as a specific problematic for cultural politics of spatial thinking. At what scale, with what materials, and by way of which methods the planetary becomes incorporated into an expanded notion of design?

This article addresses planetary design through three practices that relate to design and architectural pedagogy and research as well as the broader context of Anthropocene discussions. I address these themes through the neologism *a natural history of logistics* in order to analyse practices of scale in the critical design studio briefs and discourses that are discussed

in this text. The term is pitched as one anchor for a specific relation to technological framing of a polyscalar Earth as it emerges in design discourses and practice-based approaches. Here however technology is not understood solely as human intervention, invention, or labor but as a broader framework for considering material dynamics, uses, and infrastructures across different registers of practice (see for example Parikka 2015; Peters 2015a; Latour 2005; Puig de la Bellacasa 2017). Thus, it also incorporates material elements such as geophysical deposits and extraction, atmospheres and soil as well as living agents from fungi to plants. Instead of a mere list of materials incorporated into design briefs and discourses, what comes to the fore are different methods of drawing them out in visualizations, cartographies, and in narratives. From my own teaching at Strelka Institute's Terraforming program to the *Terra Forma* book of a French collective (Aït-Touati, Arènes, Grégoire 2020) and a discussion of Royal College of Art's Architecture program's studio "Something in the Air: Politics of the Atmosphere" (ADS7) run by Marco Ferrari, Elise Hunchuck, and Jingru Cheng the design briefs and practices present resonating interventions into the "elemental worlds" (Engelmann and McCormack 2021) of planetary materiality. These interventions can be divided into three points that are at the core of this article too: firstly, a speculative proposal of design as part of so-called natural histories (both as history of colonial knowledge and as material forces), secondly, as addressing non-human materialities in visual and conceptual modelling and alternative cartography, and thirdly, how design and architectural methods can frame atmosphere and water in relation to geopolitics.

Speculative and critical design practices (and education through studio briefs) are on a continuum with practice-led research that deal with the double task of composing materials and problems. Studio briefs like the ones presented in this article help articulate problem spaces (Lury 2021) which address the recursive issue at hand: problem spaces of the planet, and

problem spaces in the sense of dynamic, responsive (and responsible) methods. The word *practice* is here the central engine of the argument: it refers to work with different scales of materials, design methods, and creative collaboration that synthesise multiple angles to the problems at hand. While the Anthropocene can be seen as one reference to the interplay of earth processes—both of spatial scale and of the variety of material transformations across the biochemical and the geophysical registers--the projects help to locate this polyscalarity in historical figures, situations, examples, including imaginary disciplines such as natural history of logistics. In other words, all these projects in this article jointly articulate and compose space and problems. Thus the framework of the problem space proposed by Lury is particularly relevant in how such are “spaces of methodological potential” (2021: 201) instead of containment, management or reproduction of fixed relations. In this vein, also such scalar notions as the planetary become less readymade givens than generative spaces of problematisation without losing sight of their materiality.

Studio briefs are already in their own right interesting entities of knowledge and learning that connect methods, collective learning, and research. Studio or design briefs are used in architecture, design, and creative practice teaching as setting the stage through a specified problem which then structures the unfolding process of activities and links theoretical concepts and discourses with practice-led methods. As such, the brief becomes a mediating element for collective work toward a specified narrative, problem, and theme, but still allows variation within this context that contains both interpretative and affective elements due to the social interaction that emerges around a shared problem (Sosa 2019; Öztürk and Türkkan 2006). Studio briefs function as projects in the fundamental sense of the term: projections across a set of coordinates and resolutions, whether temporal, spatial, or conceptual. While the studio brief and the broader set of practice-led methods are about composition of problems especially in

speculative design, they also feed into the situated question of planetary design. Where exactly one finds such abstractions as the “planetary”, how do issues of scale become part of the situated discussions in a studio, how can large-scale processes be addressed through specifications that might take the form of visuals, video, images, narratives, historical case studies or other? While I draw on selected studio education practices, this article is not meant as a comprehensive address of pedagogy of practice or speculative design, but a discussion of recent practices that can be set into a productive relation with current research approaches concerning elemental media and the Anthropocene.

A Natural History of Logistics

The *planetary* in *planetary design* is defined in the three sections and examples that follow. Nonetheless it is worthwhile to start with Gayatri Spivak’s points concerning planetary alterity as inherently concerning education in the era of globalization:

If we imagine ourselves as planetary accidents rather than global agents, planetary creatures rather than global entities, alterity remains underived from us, it is not our dialectical negation, it contains us as much as it flings us away-and thus to think of it is already to transgress, for, in spite of our forays into what we metaphorize, differently, as outer and inner space, what is above and beyond our own reach is not continuous with us as it is not, indeed, specifically discontinuous. My efforts for the last two decades tell me that, if we ask the kinds of questions you are asking, seriously, we must persistently educate ourselves into this peculiar mind-set. (Spivak 2012: 339)

Hence, the centrality of pedagogy for the underpinning sense of institutional practice is part and parcel of where from and why the planetary becomes redefined in specified patches of materials, landscapes urban and rural, and histories that are narrated also in speculative design. This is also why looking at design briefs and discourses holds a special interest for this article.

Moscow-based Strelka Institute's The Terraforming was a three year programme (2020-2022) of research and teaching with both planetary scale and speculative practice central to its work.¹ Led by Benjamin Bratton, much of the program was defined in relation to a brand of speculative design that is less about an imagined futurity than an epistemology of articulating plans, timelines, models, and projects that both recognizes existing forms of speculating as impactful while articulating alternatives to such existing methods:

As an alternative perspective, speculation is not ephemeral or disengaged. The prevalence of models for risk patterns, ideal options, and plotted-outcomes underscores that speculation itself is not a supplemental or marginal process. It is less "airy-fairy" than it is nuts and bolts: whether for commodities and equities futures, automated A/B testing, enterprise reinsurance or weather forecasting, the global economy functions by speculative models of the near or long-term future. But if so does this disqualify the speculative from the figuring of fundamental alternatives? It does not. Instead of concluding that the future (and futurism *per se*) is lost it we should commandeer modeling infrastructures for better and more vibrant purposes. For this, speculative models are rotated from one purpose to another: less to predict what is most likely to happen (deriving value from advance simulation of given outcomes) than to search the space of actual possibility (even and especially beyond what any of us would conceive otherwise.) (Bratton 2016).

Those spaces of actual possibility are, I argue, enacted in various design methodologies including indeed speculative design as a probing of possible, alternative, even adversarial worlds (cf. Escobar 2018). Some of these points resonate with other voices in recent design and architectural discourse such as Keller Easterling's (2021) focus on medium design that I will return to later. While employing a strongly theoretical discourse, *The Terraforming at Strelka* is less about an institutional relation to philosophy than to urbanism and architecture at a planetary scale. *The Terraforming* extends to discuss infrastructures and logistics of urbanism across a planetary space and thus also the varieties of technological sensing that define such space: "Planetary itself comes into focus through orbiting imagining and terrestrial modelling technologies (satellites, sensors, servers in sync) that have made it possible to measure climate change with any confidence." (Bratton 2019: 9). Thus *Terraforming* is less about modification of other planets for habitability than addressing the conditions, and futures, of habitability of Earth in relation to investigation of what scale of reference is relevant for this task at hand and what forms of practice underpin a methodology interested in simulation, modelling, visualization, and other epistemologically significant practices that can be actionable across different institutional contexts. As such, it is not a continuation of the crude forms of geoengineering – the idea of a simple design fix to planetary issues – but a proposal to think of scales of design, impact, and material repercussions.

In February 2020 I ran a seminar on "Natural History of Logistics". The seminar focused on how to imagine both an "artificial" natural history of contemporary technological culture and a line-up of methods and terms best suited to the task. Building on the work in *A Geology of Media* (Parikka 2015) the aim was to address the material formations and historical strata of contemporary urbanism in terms of an "natural history". The reference to natural history was

not intended as a return to the historical epistemology and material networks of observation and description of nature in the 18th and 19th century. Instead, *Natural History of Logistics* was invented as a temporary placeholder term in order to highlight a connection to the project of the scientific and colonial terraforming that took place across the infrastructure of natural history as it was linked to mapping planetary space. While nation states could thus be characterised as forms of terraforming projects with the Russian Empire as a prime example (Bratton 2019: 108) that continued in the Soviet Union with its megaprojects in the 20th century (Brain 2010), also other colonial projects can be described as fundamental transformations of the bio-geo-chemical contexts from soil to atmosphere.² Beyond Russia, we can refer to the earlier attempts to produce “Neo-Europes” across the world by means of agriculture, cattle, and other techniques of terraforming (Crosby 2019) for particular kinds of habitability that were lethal to many indigenous populations and ecologies.

This proposal for a synthetic natural history might be a new term created for the purpose of staging a particular problem space through the design brief. But it follows the longer lineage of alternative natural histories from Walter Benjamin’s excavations to media artist Ralph Baecker’s 2021 work “Natural History of Networks”, which is an electrochemical performance and installation. Also Jennifer Gabrys’ (2013) natural history of electronics gives tools to evaluate to the material repercussions of media technologies. Similarly as Gabrys had referred to an investigation of the material “fall and decay” of digital technologies our seminar wanted to build a sense of natural history of the artificial and synthetic territories³, which in this case defined through the as logistics and infrastructure that are a key material and informational characteristics of large-scale media operations. Gabrys’ account, inspired by Benjamin’s natural history of capitalism (Buck-Morss 1989) mapped through architecture and material object worlds (including fossils), lead to “a method for exploring the transitory impulses that

unfold through commodities and technologies” (Gabrys 2013: 5) It also led to a position concerning materiality of the involved elements: not only that contemporary technological formations consist of “minerals, chemicals, bodies, soil, water, environments, and temporalities” (Ibid. 7) as Gabrys lists, but their contextualisation in politics and culture.

Our seminar’s aim was to propose that the inverse is true as well: that minerals, chemicals, soil, landscapes, and such are not just *contextualised* as part of human technopolitics, but provide a model for politics and technology as dynamic, conflicting, and material exchanges beyond anthropocentric narratives. In other words, we were after a natural history that does not merely read politics into environmental materialities, but looks at how those material formations produce models and historical contexts where infrastructure, logistics, and planetary scales of habitability take place. This responds closely to what Bratton (2019: 45) defined as 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.”

This form of modelling that reads automation across material processes, landscapes and territories became the defining feature of A Natural History of Logistics: a synthetic imaginary discipline that would become rehearsed through the cohort’s mini-projects and summarised in reflections concerning those practice-based engagements. The rhythm of the intensive seminar consisted of lectures, readings, discussions, and group projects responding to the brief. The task was to look for points of connection where we read landscapes and materials as logistics, that is: as forms of automation, flow, complex causalities, self-organisation, and even optimisation (in order to critically understand its material histories and to problematise its uses). A Natural History of Logistics was meant not to naturalise logistics as it is understood

as a backbone of capitalist-military industrial complex at a particular period of the long 20th century (Cowen 2014; Brennan 2021), but as a term that helps to understand the modelling of ecological processes involved in technological projects that build on and rebuild territorial affordances. While John Durham Peters has offered an argument about media and infrastructure as “traffic between nature and culture” (2015b: 32) the next step is to insist on the primacy of a continuum where logistics, infrastructure, or media cannot be neatly placed on either side. An earlier articulation of this continuum is found in Crosby’s (2019) *Ecological Imperialism* with its case studies of winds, weeds, and animal grazing as elements of imperial expansion of Europe, and Manuel DeLanda (1997) as “a thousand years of non-linear history” that outlined a continuum of matter-energies of non-human infrastructure that underpins birth of cities, language, and technology. Such accounts argue that it is impossible to separate cultural energies from flows of matter (Fuller 2005): epidemics that reformat cities, bacteria that redesign landscapes, ocean currents that warm up whole regions to sustain biomes “artificial” in a particular latitude. Logistics and infrastructure are fundamentally about terraforming as they stretch out beyond contexts of digitally controlled projects to encompass deep time histories of media and colonialism too.

The contextualisation of terraforming as linked to imperial contexts and nation-state accidents helped to build a historical context for the projects that emerged from the seminar. The studio brief start to trigger mini-projects as inaugural proposals for the imaginary discipline at hand. From seeds to silk and soil, the projects⁴ focused on specific historical cases while also expanding to an investigation of the role of materials as traffic on the continuum of naturecultures, medianatures (Braidotti 2016). Ideally, we wanted our cases to be specific in time and location, but some of the work also took the path of being more speculative beyond a historical timeline. A good example was the project Hybrid Anthropochory that focused on the

misfiring Stalin period plan to plant borshevik (Giant Hogweed) in Russia to provide cattle feed. Instead, the plant spread uncontrollably reformatting large landscapes also beyond Russian territory.

In many cases, the projects rewrote key logistical operations back to natural formations: “The Tidal Chronostack” (Fig. 1) was a proposal to rethink temporal organisation in through territorial, and cosmic, patterns. Tidal and other periodic patterns were harnessed into an investigation of large planetary bodies and their relation to planning with the punchline “the territory is the clock”. In other projects too, alternating scales of design from seafloor mining to gravitational forces as the backbone of navigation were complemented with work that pulled theoretical discussions of bioinfrastructure (Bellacasa 2014) into architecture of soil. “The Soil Tesseract” was pitched as “a new incarnation of the cube of Russian Chernozem that was exhibited at the Paris World Fair of 1889” with the aim that "does not only make visible the soil as an object of its own, but unfolds to expose the hidden dimensions in all of its polyscalarity: from the chemical cycle of nitrogen to the precious humus formation, multiplicity of its microbiota and the planetary mapping of soil distribution and flows deeply entangled with human activity.” (Besplemnova, Dalal, Shevlyakov, and Myers 2020)

Cycles, periods, flows of matter, and energy formed the focus of investigations where the research-led practice developed elements for a Natural History of Logistics geared towards the artificial while remodelling what the artificial means through various scales of matter and energy: wind, ocean currents, geophysical deposits, biodynamics, magnetism, erosion, weed patterns, contagions, and epidemics.

Figure 1

The Tidal Chronostack project built a speculative proposal on cartography of periodicity that is drawn from natural phenomena but as a temporal measurement, provides an instrument of planning and design in relation to such large-scale temporal patterns. (c) The Terraforming 2020, Strelka Institute. Image by: Yevheniia Berchul, Chiara Di Leone, Tatiana Lyubimova, Anastasiia Noga, Stuart Turner.

The seminar and the brief took as one of its reference points Matthew Fuller's reading of pataphysics as a historical example of an imaginary discipline and institution. Furthermore, engaging with Fuller's point produced a methodological cue relating to the question how the world already includes its own models of matter, energy, logistics: "All the world's a diagram, a model that gives ornate handles to itself." (Fuller 2011: 27) While this point resonates with "autographic theory of visualisation" (Likavčan and Heinicker 2021; Offenhuber 2019; Schuppli 2020) in recent design and artistic projects that work with techniques that reveal already existing diagrammatic inscriptions for example on material surface (dust traces, oil spill patterns, etc.) it also fed into an imagined body of knowledge and eclectic methods of speculation: a synthetic discipline of investigation of earth forces as mediating, conditioning, logistical, and also as politically significant.

Theoretical discussions and concepts were a central part of how the studio brief was structured—from the Anthropocene to landscape studies and infrastructure (Bélanger 2016) – but the aim, though, was to shift from a theoretical register to the space of design investigations. Such investigations were used as ways to articulate a problem space (Lury 2021) where we operate: design and organisation in a world defined by self-organising through a variety of interacting, complex causalities and feedback loops as patterns of global warming or biodiversity crisis

testifies from slowing down of ocean currents such as the Gulf Stream to cascading feedback loops, epidemic planetary patterns and their prompts for logistical change, and also exposing the historically built exploitation through labor or property, or both. (Bhandar 2018) Indeed, as Brenna Bhandar notes, natural history was one part of the chain of operations that included “measurement and quantification as the primary techniques utilized to taxonomize and classify life forms” furthermore leading up to in “what Mary Louise Pratt has termed a “planetary consciousness.” (Bhandar 2018: 104) In this inverted sense, it was natural history that was discussed as already early unfolding key tenets of logistics of planetarity.

Terra Forma: Non-Representational Modelling

Lury’s development of the notion of “problem space” has already been mentioned in the context of the studio brief although the term emerges in a broader context of discussion about interdisciplinary methods. The term captures how methodological work functions as problematization that accounts for the centrality of epistemic infrastructures including for example contemporary digital data platforms . In addition, it also acknowledges the composite nature of problems and their active work as doings in the gerund form: “active present tense forms that function as nouns” (Lury 2021: 161). One can observe that Lury’s point builds on the longer legacy of “problematization” from Foucault to Deleuze, and in Isabelle Stengers’ words, relates to a way of testing the present as well as become “an affirmative theme dramatizing the creation of problems” (Stengers 2021: 73).

What Lury describes as auto-spatialization (see also Lury and Wakeford 2012) applies well to the spatial practices that the Strelka group engaged in as well as the other examples in this article. Across the practices, the problem space is not to contain but to compose “a problem

across a problem space that is itself changing” (Lury 2021: 9) thus leading into a topological sense of what the gerund form of a practice does and how this activity includes a recursive loop: “all methodology is – unavoidably – methods research, the study *and* practice (study-as-practice and practice-as-study) of methods, a recursively purposeful way of doing, taking methods themselves as objects, as well as means of research, as workings that matter [...]” (Lury 2021: 205). This becomes particularly apt when we realise that this characterisation captures well the polyscalar issues at hand and insights into practice that works across the urban-planetary continuum that the examples in this article represent.

In this perspective, when we proposed a new imaginary, synthetic discipline it was not meant to dismiss existing scholarship in specialised fields of inquiry. Natural History of Logistics included historical reference points but fundamentally it was meant as an invented, temporary theoretical figure to address the interrelationship of information and geography, friction and sovereignty (Bishop 2020), territory and control. It functioned to develop a method of investigation of practices of planetary design.⁵ The planetary here is understood following Spivak’s notes on planetary alterity as opposed to assumption of one smooth surface of globalism. It is also related to the recent work that theorises the visual cosmograms of the figure of the planetary in and across technical infrastructures (Likavčan 2020). It is across this spectrum of politics of heterogeneous patches and the integrating infrastructures and diagrams where the issue of the planetary takes place.

As a contribution to such comparative planetology (Ibid.), the serendipitously named *Terra Forma* book project by Frédérique Aït-Touati, Alexandra Arènes, and Axelle Grégoire offers a “manual of cartographic potentials”. It also builds in relation to historical forms of logistics – maps and diagrams – while aiming to offer elements for design methodologies through

visualization. My aim is not to subsume it under to the term I used in the Strelka seminar but to show their shared problem space of methodological concerns. They also differ: whereas Strelka project was very much an educational studio brief with its temporary attachment to a particular cohort and collective work for the duration of the seminar, *Terra Forma* comes out in the more polished format of a printed book which travels much more fluently across different contexts of use and over a longer period of time. The expertise from history of science to architectural visualisation offers an alternative cartography as well as a cosmography that designs graphical notation for dynamic processes. It concerns the problem of how to visualize space and territory (understanding *terra* as a living, self-inscribing entity) beyond techniques of traditional maps: it aims to build affordances for orientation from the ground-up. The experimental project presented in the format of a book is also a pedagogic manual that links methods of data visualisation and architectural operational mapping with contemporary themes in critical posthumanities and the Anthropocene discourse as far as it concerns polyscalar and polytemporal processes from geophysics of the ground to the biochemistry of air and much in between on the mesoscales of agency. For example, the recent Critical Zones exhibition curated by Bruno Latour and Peter Weibel (2020) could be seen as a dialogue partner, considering the shared interest in such zones that are living, textured, thick and full of non-human life that works against the grain of modern notions of politics, law, and territory. Whereas the Natural History of Logistics brief articulated a problem space of “landscape as infrastructure” (Bélanger 2016), *Terra Forma* provides a surface level of methodology through questions of cartography: a problem space unfolding from the thickness of the surface as a dynamic, living fabric.

Terra Forma unfolds an alternative problem space that starts from observing the hegemony of GPS based positioning (Aït-Touati, Arènes, Grégoire 2020: 8-9) while proposing seven

alternative models of a ground-up perspective (see fig. 2). This is not necessarily a call for more “low-tech” approaches but concerns enriching infrastructures of instruments of sensing with a multitude of posthuman perspectives while visualizing it through graphical notation system and a grammar for a different urbanism (and non-urban landscapes). Here, the implication is that from the vertical height of a satellite-based signal mapping of earth surfaces they descend to the surface of the planet in ways that echoes Bruno Latour’s (2019) recent call for “earth-bound” perspectives, which also implies an epistemology of topological surfaces in varying thickness referred to as the critical zone (Latour and Weibel 2020). From soil to “points of life” to living landscapes, frontiers, and more, the design diagrams offer a version of a natural history of logistics as far as it concerns tracking the vectors, rhythms, and movements of different passages across space that then also redefine and recompose that said space. While my article is not proposing to choose between heights or grounds, data or richness of the soil, I aim to follow the argument of the design-led practice to also see how particular visual figures and ideas build up the sense of problem space.

Figure 2

Source: F.Aït-Touati, A.Arènes, A.Grégoire, *Terra Forma, manuel de cartographies potentielles*, Éditions B42, 2019: 20-21. Used with permission.

Terra Forma’s proposal for speculative maps can be seen as one form of topological thinking that functions ‘as a practice-led methodological cue. As such, the conceptualisation of a Moebius strip of urban and non-urban surfaces includes both insights to subsurface layer visualisation, alternative models to extraction, and also a temporalisation of landscapes across built environments and non-human habitats. Hence, while the models offer patches of different

scales of surfaces from urban space (Paris) to rural areas (e.g. extraction sites), these are arranged according to an assumption of a topological continuity in transformation. This principle is spatio-temporal but it comes also with significant epistemological and methodological implications (see Lury 2020: 9-11)

In *Terra Forma*, the nine models are not representational figures that visualise an environment. Instead, borrowing an idea from Lury, I argue they are ways of composing a non-representational sense of methodology of “model-*ing* interpretation in a graphical environment” (Lury 2020: 161). Lury builds this idea based on Johanna Drucker’s (2018) work on modelling that does not aim to replicate existing input data – e.g. geographical or other in our case – but composes environments of interpretation that have an active sense of aiding the sensory potentials of cartographic spaces. Thus, echoing Lury and Drucker, the focus also with *Terra Forma* is on not merely modelling an environment but an environment of modelling that is able to capture a dynamic sense of the material world. This is also the reason why I want to bring this into our dialogue regarding natural history of logistics and what models of dynamics of space, non-human agency, and complexity are built into visual practices of contemporary design that takes an angle to the Anthropocene.

What’s at stake in the practice-led interventions of *Terra Forma* is, I claim, a non-representational modelling of processes that aims to create a dynamic sense of transformations and distributed agency, multimodal perspectivism, and temporality to inform spatial design and the relevant knowledge diagrams concerned. In the models included in the book this means looking at soil from the perspective of its life – constantly recomposed by both landscape level shifts, biochemical processes, and animals such as worms – which is a slightly different sense of architectural subsurface than mere visualisation of a volumetric interior. While such earth

surfaces are also literally the platform for industrial culture, extraction industries, and infrastructures and logistics of pipelines, they are also defined by the terraformative powers of for example vegetal forces (forests, roots, plants), fungi and micro-organisms echoing much of past years of Anthropocene themes (see, for example, Tsing 2015). Vegetal surfaces are described in terms of the space they inhabit but even more so, by the potentials of transformation of that space and how then to mark these potentials. This alternative grammar is thus one of imaginary media of such instruments and diagrams that are able to describe a tree in relation to a landscape or a site in terms of its potentials of growth, respiration (biochemical transformation of atmosphere), fluxes of sap, photosynthetic energy, cohabitation (from insects to other organisms) and its physical relation to attachments, not least, the earth and the soil. (Aït-Touati, Arènes, Grégoire 2020: 54).

Figure 3:

Source: F.Aït-Touati, A.Arènes, A.Grégoire, *Terra Forma, manuel de cartographies potentielles*, Éditions B42, 2019: 44-45. Used with permission.

The maps, models, and diagrams are planimetric surfaces (see Sloterdijk 2013: 100-101) at the back of knowing and governing different material spaces. Those surfaces are also patches in interaction: they are operational models that facilitate planning and change as well. Polyscalar, incommensurable elements are set into play: animal territories, abstractions of temporal cyclicity, construction industries, etc. Instead of merely stabilising these into a set of prescribed dots, lines, and relations, of figures of the globe and other fictions at the back of the modern period, the non-representational instruments in the *Terra Forma* manual aims to capture the possibility of durational process and change. The transformational view to the planisphere (Aït-

Touati, Arènes, Grégoire 2020: 100) zooms in on growth, movement, and process, but also the alternative modalities of composition of space that can include for example biochemical signalling (such as plants), to paraphrase the book (Ibid., 100-101). This also means a visualisation of architectural elements such as surface, frontier, and threshold as inclusive of depth and texture and oscillation, so as to show in more accurate terms a distribution of spatial potentials instead of inscribing an aerial view of a flat line. As such, it resonates closely with the point made by architecture theorist Keller Easterling in her *Medium Design*: space is teeming with potential – of dispositions – and the work of medium design is to work “with *protocols of interplay*—not things, but parameters for how things interact with each other.” (Easterling 2021: 10)

Terra Forma's version of medium design also plays a part in a broader ethics of landscapes that looks to offer a visual expression to regeneration instead of exhaustion (see fig. 4). In other words, drawing a visual interpretation of the operationalisation of landscapes for resource excavation—the extraction industries—the conceptualisation of artificial, industrial biomes captures the sense of hybrid natures that functions at the back of *Terra Forma's* way of dealing with the legacy of colonialism: an alternative sense of orientation and mapping, and a *terra incognita* that would not reproduce the structure of European scientific exploration (although one might ask: terra incognita to whom?) Contemporary forms of industrial and extraction zones function also as versions of natural history of logistics where the potential of earth resources becomes mobilized into an industrial supply chain of production (Parikka 2015; Önal 2020). Thus the alternative form of marking a territory attempts a counter-operationalisation: a different sense of structuring a rhythm for landscape changes that aims to avoid exhaustion and builds in regeneration as marks that are instructions, that are medium design, and that aim to show capacities of dispositions beyond mere discursive claim about sustainability.

Figure 4:

Source: F.Aït-touati, A.Arènes, A.Grégoire, *Terra Forma*, manuel de cartographies potentielles, Éditions B42, 2019: 146. Used with permission.

As one example in the broad spectrum of speculative design, I read *Terra Forma* in a similar key as some of the work at Strelka: both tease out conceptual themes and material dispositions. The “aesthetic education” addresses polyscalar and polytemporal agency where terraforming is less a technique than a sense of material and epistemological coordinates for practice. More specifically *Terra Forma’s* paper surfaces that capture multidimensional data are besides Drucker’s and Lury’s interest in non-representational modelling also methods of dealing with scale. Well captured in Zachary Horton’s (2021: 6) take on scale, such an aesthetics concerns both scale as an “ethical ground that binds individuals, groups, and territories into interconnected milieus of interdependence and responsibility” and it also offers “set of political tactics for aggregating and disaggregating assemblages.” In this manner, *Terra Forma* draws maps as graphic markers of future capacities (landscape and resource regeneration, multispecies agency, soil dynamics) while at least in passing, arguing that such diagrams need to avoid the reproduction of the colonial trope of *terra nullius*. The logistical operations of rocks, bacteria, rivers and river banks, bird and landscape migration are part of what becomes drawn in (and into) cosmographies of scale, which also Horton’s note on political tactics includes: do we invest “energy into singularities (individual heroes and villains, monuments, memes)” (Horton 2021: 6) or into systematic processes of interplay?

Drawing, modelling, imaging become active interventions into what scales are being visualised. Similarly as other design practices such as *Design Earth* (Rania Ghosn and El Hadi Jazairy), also *Terra Forma* pursues this question of architectural techniques as making of worlds that link “brief organic lifetimes and the immensity of geologic time” (Ghosn and Jazairy 2018: 22. See also Turan 2019). Architectural drawing becomes thus an educational and political form of modelling that itself switches between visual techniques and their storytelling capacities. For example, as *Design Earth* argues is their book *Geostories*, a repertoire of techniques of drawing can function as modelling such polyscalar worlds that build on natural history from Lyell to Darwin but also rewriting, or even more literally redrawing it for other purposes. Axonometry is one of the examples they quote as part of the “anti-perspective mode of representation that privileges a typological planetary imagination” while providing also other examples:

The section drawing, for instance, counteracts the abstract Earth of aerial mappings, diagrammatic flows, and soft perspectives. Its orthographic project plane produces the vertical territory. In natural history, such split-level view (also known as aquarium view) shows domains both above and below the surface of the water or ground. [...] The section goes beyond the isolation of the domains and sciences of the Earth to project a synthetic drawing that provides an opportunity to reimagine the relations of geological and architectural forces at a planetary scale. (Ghosn and Jazairy 2018: 22).

Modelling not only multi-scalar entities but dynamic relations becomes a key trait connecting the different contemporary practices in search for an alternative planetarity (Turan 2019) through architecture and design. It is also the context where I propose natural history of

logistics as an imaginary discipline that captures this task of rewriting, redrawing, and remodelling earlier techniques in current critical practices.

Politics of Atmospheres: The Studio Brief as a Problem Space

So far in this article, I have looked at current speculative practices in design and architecture as responses to the problem space of planetary design and its polyscalar patched realities. The proposal to invent a synthetic discipline of “Natural History of Logistics” was followed by the work of *Terra Forma* as cartography of potentials – modelling and visualisations - very much in the key of “medium design” as phrased by Easterling (2021). Finally, I want to turn to the architectural studio Politics of the Atmosphere at the Royal College of Art which presents a third example of how pedagogy, practice, and design briefs can contribute to a positioning of issues of thinking, doing, and living processes. Here to pair up creative studio practices and speculative design for example becomes one way to focus on the elemental politics, i.e. “how diverse materialities suffuse the volatile geo- and biopolitics of the contemporary juncture, whether or not this is gathered under the name of the Anthropocene” (Engelmann and McCormack 2021: 3-4).

When examining the practices and studio briefs, it is useful to note how they are grounded in an articulation of an institutional situation and collective potential such as work with students. Ideas do not merely hover around. They are practiced, discussed, shared, modified, and dynamically understood (and sometimes misunderstood). The RCA studio like the Strelka seminar are examples of briefs that come alive only in the learning process of project responses. The starting points that are often concepts or broader theoretical themes – the Anthropocene, planetary design, politics of elements, etc. – are rearticulated in the problem space, which is

two-fold: both the object of investigation (“what is the planetary as a problem space?”) and in the studio (“what is the space of co-designing methods and problems for the planetary scale?”) In other words, the studio brief as one expression of problem space happens in this dynamic fashion: an articulation of polyscalar problem where the problem will be redefined and changed in the course of the studio and practice-based rehearsals. The problem space of the studio as a living collective practice speaks well to the composition of visual materials and discursive practices that are able to revolve around issues of political tactics of scale, as Horton (2021) puts it.

The three-voice introduction by Hunchuck, Ferrari, and Cheng to the architectural studio ADS7 at the RCA echoes closely the concerns of the other projects discussed in this article. “Politics of the atmosphere” is opened up as an intervention into questions of planetary-scale design and as “multi-year, transdisciplinary investigation into the relationship between the air and the ground.” (Hunchuck, Ferrari, Cheng 2020). Already in the 2019-2020 version of the research and design studio, atmosphere is addressed from air travel to scientific measurement as elemental chemical parts of an interconnected ecosystem as well as a site of architectural thinking and modelling. Thus, in this way, the studio sees atmosphere

as the domain where the different vectors of climate crisis meet and interplay, and where conflicts around its policing are emerging, the atmosphere also produces multiple localities where these transformations can be observed—and sites of intervention that can be imagined. Far from being understood in all its complexity, the atmosphere continues to elude our ability to model its dynamics or to compute future scenarios. In an attempt to question and drift from the current understanding of planetary-scale ecosystems, this studio will aim to produce alternative cartographies of the atmosphere

and in so doing, produce a different blueprint for architectural mediation. (Hunchuck, Ferrari, Cheng 2019).

Maps and models are also in this design case the media and the instruments that are interfaced with the geopolitics of air and atmosphere. Cartographic imaginaries are paired up with analysis of planning: from cartographic and statistical datasets to historical documentation, input from scientists, environmental agencies, indigenous communities and activists, that studio is pitched as speculating on and testing “new ways of visualising ecological processes” (Ibid.)

Pedagogic interaction, architectural techniques for visualisation and modelling, narrativization, and theoretical discourse constitute core elements of the studio. Furthermore, the studio developed a repertoire of methods that reflected on the material epistemological tools that make sense of the particular sites where interplay of elements that constitute the planetary are observed⁶, prepared, and produced. Indeed, for the studio, such techniques remained a central element of intervention: which images matter, which maps, drawings, and data visualisations are mobilised (Hunchuck, Ferrari, Cheng 2020), which scales of climate crisis are inscribed as cosmograms (Tresch 2007) that pinpoint how planetary scales can be defined as architectural problems: both the built environment and the environments in their elemental dispositions from soil to water to the sky and its geopolitically significant dynamics.

Figure 5: A still from the Sky River video essay (2020)

Used with permission.

While the 2020-2021 iteration of the ADS7 studio focuses on permafrost and the settler-colonial histories of Siberia alongside the processes of resource extraction from gold to energy minerals, the 2019-2020 project developed an approach to questions of material flows and geopolitics resonating closely with the Natural History of Logistics brief as well as with ideas of medium design. “Sky River” video essay (fig. 5) that emerged from the studio was shown in the already mentioned Critical Zones exhibition at the ZKM and it constitutes a visual reference point for articulating the polyscalar narrative that the studio has been developing.⁷ The Chinese Tian He (Sky River) project “is a large-scale weather modification project whose goal is to address the ongoing and increasingly severe water shortage in North China through the extension of water resource extraction into the air.” (Hunchuck, Ferrari, Cheng 2020). The project is a speculative testing ground of hydroscientific models which relate to the vertical layers of elemental geopolitics: deposits of water above the ground and in different parts of the atmosphere become part of experimental extraction industries in ways that has significant geopolitical implications. It also sits as part of a complex network of engineered and digital platforms of water management, including the Digital Yellow River Programme. Hunchuck, Ferrari, and Cheng (2021) write: “The Yellow River is rendered and replicated into a network of gauges and sensors, data processing and storage centers, numerical models, and protocols of intervention—the sky river, which also exists almost uniquely in the form of numerical forecasting models, can be easily integrated into this, extending the headwaters of the Yellow River up, into the atmosphere.”

Looking at the hydrological circle as a central site of resource and intervention for national geopolitics, the video by Hunchuck, Ferrari, and Cheng narrates both the fundamental logistical impact of so-called “white water” – atmospheric water resources modelled as an epistemological object and as unit of management and manipulation. While such medium

design focused on management of water is a central part of constructing mega-infrastructures like the South-North Water transfer project, also weather engineering projects such as “Weather modification operation stations” are ways of designing in relation to atmospheric water resources. As their video work shows, the architectures of a vast network of stoves for Silver Iodide Generation (Warner and Twomey 1956) forms the built environment for designed interventions into the hydrological resources and cycles with their operation controlled and programmed through links to satellite-based observation and forecasting models. (figure 5) Here, as Hunchuck, Ferrari, and Cheng’s video essay argues, such stoves are also operational instruments that architecturally bring to ground the otherwise cloud-high elevated, abstract Sky Rivers. They are part of a network of modelling large-scale atmospheric dynamics while at the same time part of a geopolitically significant way of intervening in such abstract realms that are clouds both in the sky and as data. (Figure 6) The potential effects to Mekong, Salween or Brahmaputra rivers would potentially shift the water problems to south-east Asia and India in ways that demonstrates the significance of atmospheric management for geopolitical ends (Watts 2020). Furthermore, it can be seen as part of the broader “weaponization of water” (Vemuri 2021) in the region that concerns not only the infrastructural politics of the nation states of China and India but also significantly the local indigenous communities (ibid.)

Figure 6:

Weaponization of water diagrammed into the weather modification infrastructure. A still from the Sky River video essay (2020). Used with permission.

As a contribution to the public-facing context of the Critical Zone exhibition and as studio-based work, *Sky River* and *the Politics of Atmosphere* show a detailed link to what I outlined above in terms speculative design, cartographies of dispositions and potentials, and the relation of localities and planetary-scales. As problem spaces, such briefs are polyscalar. The problem space of pedagogic practices with architectural models, techniques, and discourse composes a dynamic of the brief as it is set against cases such as the *Sky River* or in the later studio, *Siberian permafrost* and global temperature changes. They also open up practice-led engagement as methods where Lury's (2021) problem space meets up with Easterling's (2021: 122) medium design: "generating interplay rather than solution, entangling networks, and multiplying problems". In the studio ADS7, the problem space is both articulated in relation to methodological interplay of the studio as a collective of educators and learners, but also as a problem space that is of landscape or regional scale such as the Tibetan plateau, Huang He (Yellow River) watershed, or *Siberian permafrost*. Here, the problem space of terraforming follows already existing dispositions and potentials of elemental worlds. The space of testing and speculating is present both in the studio on the level of methods and also in the mass-scale experiments that work in the register of landscape and atmosphere modifying engineering. As Hunchuck, Ferrari, and Cheng (2021) point out, "the *Sky River* is a paradigmatic act of geographical re-imagination" already in its own right. Such reimaginings are furthermore connected to issues of indigenous rights, weaponization of elementals (territorial management and amplification of growth through water, for example), and other geopolitical means that have been addressed also recently in other artistic work such as Geocinema artistic duo's work "Framing Territories" (2020) on the Chinese Digital Belt and Road (DBAR) science infrastructure (see Parikka 2023).

Conclusions

This article has drawn a relation between existing practice-led approaches, studio briefs, and questions of planetary-scale transformations. The aim has been to produce a productive dialogue across the different featured projects: polyscalar entanglement of issues (and communities) in design and the need to develop increasingly nuanced practices in the broad area of environmental issues and geopolitics. While connecting to many contemporary discussions for example in philosophy (such as critical posthumanities) these issues relate to institutions and contexts of design too so far as questions of early 20th century birth of “world projects” (Krajewski 2014) are moved onto the space of contemporary *planetary* projects. The three projects that feature in this article share a ground in their attempt to open up the planetary as a problem space of “alterity” (Spivak 2012) but more specifically in how they address infrastructures of observing, modelling, and notation systems that help to visualise and plan alternative futures.

The brief focusing on Natural History of Logistics aimed to capture a sense of automation that already exists in material formations. Those formations then condition the contemporary media technological definitions of planetary from GPS systems to remote sensing, extraction industries to models of replicating growth in agriculture and other living systems. The brief also acknowledged the historical contexts and institutions of planetary knowledge – natural history being one – while narratively piggybacking on the legacy of alternative natural histories from Benjamin to Gabrys to propose a speculative institutional discipline as a contribution to the critical posthumanities (Braidotti 2016; 2019).

Terraforming is continued in *Terra Forma*'s book format and the design-practice that offers a manual of a sort. The point is not to read these as practices of identifying and naming of non-

human worlds but as models that help to amplify specified processes and build temporal rhythms into landscapes: this includes for example regeneration but also layers of memory inclusive of a myriad form of agency. To discuss this both as non-representational modelling of interpretation (Drucker 2018; Lury 2021) and medium design (Easterling 2021) helps to place the practice beyond mere repetition of Anthropocene discourse and into the practices of graphical notation systems and epistemological force of cartography. In Bernhard Siegert's words: "the map is the territory" in so far as we are dealing with "maps not as representations of space but as spaces of representation" (Siegert 2011: 13) that build up potential of operations.

As the third example of the RCA studio clearly articulated, the elemental worlds that occupy all of the projects concern large-scale planetary consciousness turned design that can be brought back into studio briefs and practice. Thus, besides the thematic focus on planetary design, the studio context helps to articulate the practice of how to go about composing the problems: what instruments are at the back of epistemological claims, which politics are incorporated into landscape scale projects, what narratives help to tease this out in ways that amplifies collective design pedagogy too. Studio briefs and practices are consequently also polyscalar in their own right: they include design techniques of modelling and narrating which help incorporate abstractions as real-world forces that one designs with. Material landscapes and abstract models compose each other. The focus on medium design is here pertinent, but so is also the vocabulary of politics of elementals that helps to focus on how design captures contemporary geopolitical strategies such as the significance of "white water", a curious hybrid that is both materially real and made tangible in modelled projections of air (cloud) space and instrumentally managed through a network of stoves strategically placed in particular regions

such as the Tibetan Plateau where they are meant to divert precipitation (Hunchuck, Ferrari, Cheng 2019).

The double aspect of such practices that compose space *and* problems has been a central driver of the discussion. Some of these examples work more directly as studio and design briefs as they respond to Lury's call for "spaces of methodological potential" (2021: 201) where the interconnections of scale of reference (planetary as less a given than constantly constructed in different design, sensing, data, elemental politics), concepts, methodologies, and geopolitical contexts are central part of this composition. Questions of scale are part of such living sets of practices that look at natural processes and technological design changing places and producing a hybrid set of proposals through such inversions. Hence the institutional basis of these questions returns: what form of collective work supports the complexity of issues at hand and is adequately able to speak to both politics of elementals and their relation to the planetary scale?

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¹ The Russian invasion of Ukraine sparked also the closing of Strelka’s educational activities after the institute had posted “No To War” message on their social media followed by Terraforming program director Benjamin Bratton’s condemnation of Putin’s authoritarian politics and the war. Important to note is that Strelka like many other large Russian art and culture institutions also received funding from oligarchs close to Putin. Strelka was founded in 2009 “with funding from Russian oligarch Alexander Mamut and guidance from Rem Koolhaas”. Stephen Zacks, “Moscow’s Strelka Institute pauses operations, possibly permanently” *The Architect’s Newspaper*, March 8, 2022 online at <https://www.archpaper.com/2022/03/moscows-strelka-institute-pauses-operations-possibly-permanently/>. At least in the time of writing this (September 2022), Mamut was not on the international sanctions list despite his earlier stated pro-Putin stance.

² On Russian Empire’s “internal colonization”, see Etkind 2011.

³ A focus on synthetic territories in other ways central to such practices as the Urban Morphogenesis Lab at Bartlett School of Architecture, London.

⁴ The below summaries and quotes from the projects are from the internal summary document generated for the Terraforming program. The document is available upon request. For an overview of the cohort and their *final*

projects, see “Design, Modeling & Governance at Planetary Scale: The Terraforming Projects” Strelka Mag website, August 3, 2020, <https://strelkamag.com/en/article/the-terraforming-projects>

⁵ This also relates to definitions of the planetary in the Terraforming program more broadly: “there is no viable political-philosophical planetarity that does not define itself through the disclosures of the astronomic understanding of what a planet is, where it goes, and how it comes to render itself, just as those ideas must inform the premises upon which that rendering species comprehends itself as an interior phenomenon of its planet, not a figure subtracted from it.” (Terraforming 2021).

⁶ The notion of the “Observatory” has become a recurring rhetorical trope in the Anthropocene discourse in arts, architecture, and the Humanities – and of course the sciences – from the Anthropocene observatory (a project at the HKW in Berlin by artist Armin Linke and Territorial Agency architecture unit run by John Palmesino and Ann-Sofi Rönnskog) to the Critical Zone Observatories as sites of scientific work but also humanities discourse (as per the 2020-2021 Latour and Weibel exhibition at the ZKM in Karlsruhe).

⁷ The video was also part of the curatorial selection for the 13th Shanghai Biennale themed Bodies of Water, but was removed from the exhibition (by the authorities) before its opening.