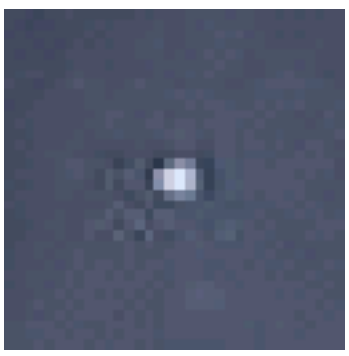
More-than-Planet Atlas



What does it mean to live on a flat, square planet, one shaped not only by natural processes and human land-use histories, but also by media technologies and underlying knowledge cultures? Satellite imagery and digital mapping present the planet as pixelated and objective, yet these representations are pervasively conditioned by modernist legacies and technopolitical infrastructures, often failing to recognise the diversity of other, comparative planetary worldviews. More-than-Planet seeks to critically challenge anthropocentric thinking about planet Earth. It does so by offering a broader overview of planetary imaginaries and how they are constructed through diverse knowledge cultures, environing media technologies, and situated ways of mattering. This perspective contributes to the cultural-environmental literacy needed for imagining a co-inhabited planet—a planet that resists being systematised by any single domain of knowledge or practice.

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waag futurelab

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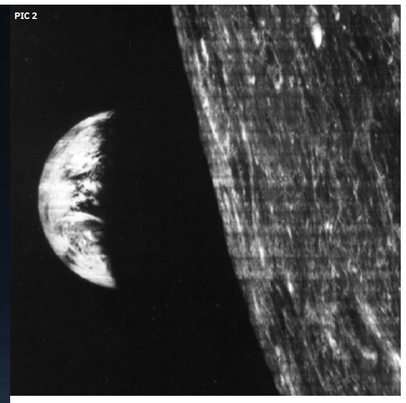
PIC 1



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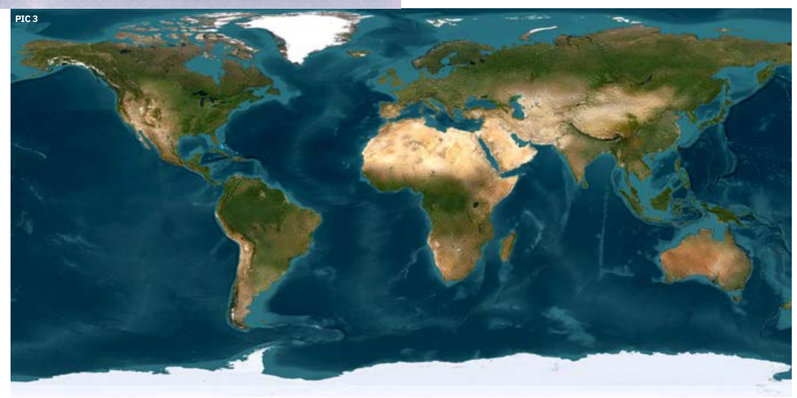

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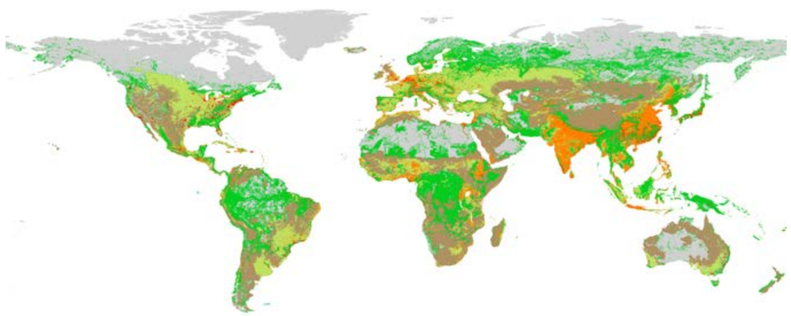
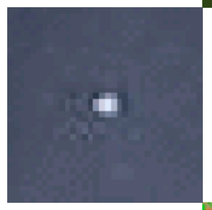
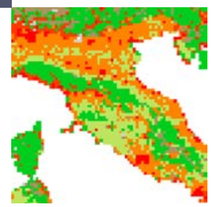


PIC 1: *The Pale Blue Dot Revisited* (14 February 1990, revisited 2020) by NASA/JPL-Caltech. **PIC 2:** *First lunar Earthrise* (23 August 1966) by NASA/Ames Research Center. **PIC 3:** *Cloudless Earth basemap* (2025) by ESRI. **PIC 4:** *Anthropogenic Biomes: 10,000 BCE to 2015 CE* (2020) by Ellis et al.





The Earth as a Flat and Square Planet

For as long as life has existed, organisms such as bacteria, fungi, vegetation, and various animal species—including humans—have constituted and shaped the planetary environment. Although it may not be immediately apparent, human land use has transformed Earth's ecology for thousands of years.[1] While the transition from hunting and foraging to burning land, farming, and industrial agriculture should not be interpreted as a linear historical trajectory,[2] current intensive land use is undoubtedly reshaping global patterns of biodiversity, ecosystems, landscapes, and climate in unprecedented ways. Likewise, oceans, coastal zones, the sea floor, the cryosphere, and the atmosphere have long served as resources, infrastructures, or waste repositories. Yet anthropogenic environmental change is not inherently detrimental: what matters is the dominant cultural notion of land as something to be used, and the intensity of land use.[3]

Through the lens of environmental history, we begin to grasp both the scale of human impact on the environment and how escalating ecological concerns have led to the conceptualization of Earth as a human-made planet. This perspective helps illuminate the underlying cultural drivers of biodiversity loss and other ecological crises. Over the past two centuries, human activity has altered between 75% and 95% of the terrestrial biosphere.[4] According to Ellis and Ramankutty, just as the "classic" biomes (forests, grasslands, and deserts) reflect natural patterns shaped by climate, *anthromes* (anthropogenic biomes) now represent global patterns shaped by human land use over the past 12,000 years.[5] In this reclassification, only a small portion of the Earth remains wild—and even that is under pressure from climate change.

This portrait of Earth as a human-made planet is one of many expressions of the contemporary planetary condition: conceived as an environmental totality, and reinforced by the orbital gaze from outer space. These portrayals build on the legacy of early space exploration: *The Blue Marble*,[6] taken during the final Apollo mission; *Pale Blue Dot*,[7] captured by Voyager 1 after passing Neptune and turning back toward Earth; and, more recently, the *Cloudless Earth*—a composite of satellite imagery widely used as the base map in popular mobile applications.[8]

By shifting attention from what is observed to how it is observed, we uncover a set of underlying conditions that are routinely overlooked yet deeply influence how Earth is made today, as a flat and square planet. These portrayals present Earth as pixelated, expressed as a grid, and compressed through the lenses of remote sensing, satellite imagery, global mapping systems, and digital screens. This is not merely a contemporary visual metaphor, but the result of centuries of viewing the planet through instruments designed to extract, classify, and control.

Technologies do not passively observe the world, they *environ*: they actively shape planetary environments through the mediating capacities of digital tools and infrastructures.[9] Naval maps enabled overseas colonisation and reshaped vast territories of conquered continents. Cadastral surveys defined land use and formalised ownership. Today's satellite imagery contributes to yield maximisation. Such media representations, coupled with orbital distance, give the impression of objectivity, yet these perspectives routinely erase the agency of that which is being observed.

This visual logic descends directly from the imperial cartographic traditions of European expansion, in which Western ways of seeing rendered Earth as a resource-rich territory open to exploitation. Today's global imagery may appear to celebrate the interconnectedness of life, but in practice, it reinforces mechanisms of planetary control.[10] Only through critical insight have we begun to unmask this partiality, asking who gets to image the planet, and how these images shape ecological, cultural, and political realities.

More-than-Planet explores the foundational concepts, knowledge cultures, technologies, narratives, and interfaces that shape this flattened image of Earth. By dissecting these building blocks of planetary imaginaries, More-than-Planet seeks to cultivate public literacy around the cultural, technological, and environmental entanglements that define our world. In doing so, it offers an entry point for more inclusive and diverse planetary futures.

1 Ellis, Erle C., Nicolas Gauthier, Kees Klein Goldewijk, Rebecca Bliege Bird, Nicole Boivin, Sandra Díaz, Dorian Q. Fuller, et al. 'People Have Shaped Most of Terrestrial Nature for at Least 12,000 Years'. *Proceedings of the National Academy of Sciences* 118, no. 17 (27 April 2021): e2023483118. https://doi.org/10.1073/pnas.2023483118.

2 Graeber, David, and David Wengrow. *The Dawn of Everything: A New History of Humanity*. First American edition. New York: Farrar, Straus and Giroux, 2021.

3 Ellis et. al., 'People Have Shaped Most of Terrestrial Nature for at Least 12,000 Years'.

4 Ellis et. al., 'People Have Shaped Most of Terrestrial Nature for at Least 12,000 Years'.

5 Ellis, Erle C, and Navin Ramankutty. 'Putting People in the Map: Anthropogenic Biomes of the World'. *Frontiers in Ecology and the Environment* 6, no. 8 (October 2008): 439–47. https://doi.org/10.1890/070062.

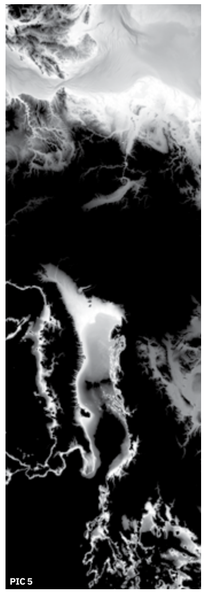
6 NASA. *The Blue Marble*. Photograph. Taken by the crew of Apollo 17, December 7, 1972. NASA Image and Video Library. https://images.nasa.gov/details/as17-148-22727.

7 NASA. *Pale Blue Dot*. Photograph. Taken by Voyager 1, February 14, 1990. NASA Jet Propulsion Laboratory. https://www.nasa.gov/image-feature/pale-blue-dot.

8 Note. Currently, various cloudless Earth products are available—ranging from low-resolution viewing maps and base maps used in GIS applications (e.g., ESRI) to high-resolution datasets used for analysis and processing (e.g., EOxCloudless).

9 Wickberg, Adam. 'Environing Media and Cultural Techniques: From the History of Agriculture to AI-Driven Smart Farming'. *International Journal of Cultural Studies* 26, no. 4 (1 July 2023): 392–409. https://doi.org/10.1177/13678779221144762.

10 Chakravorty, G. Spivak. 'Imperative to Re-Imagine the Planet'. In *An Aesthetic Education in the Era of Globalization*, 335–50. Harvard University Press, 2011. https://doi.org/10.4159/9780674257931-018.



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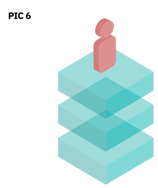

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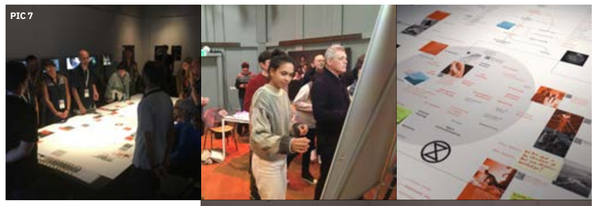

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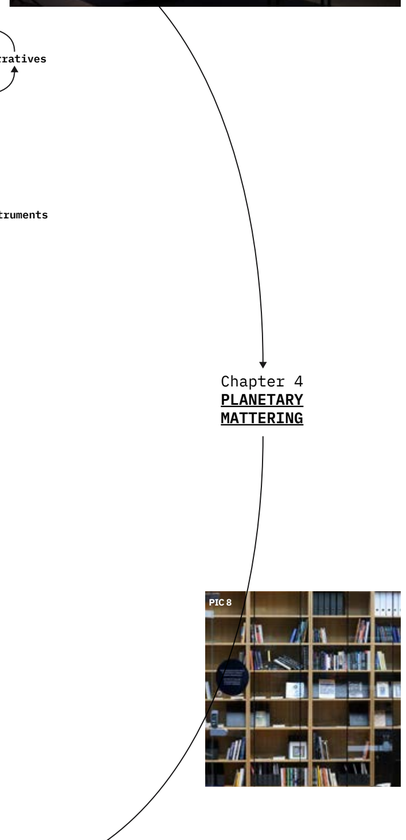

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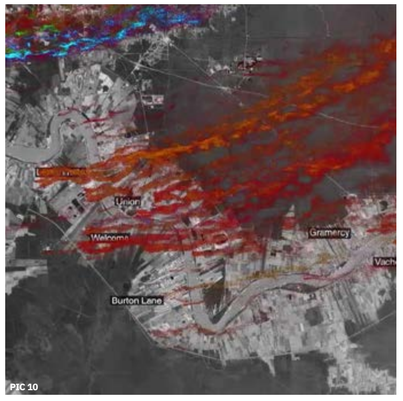


PIC 10

PIC 5: *Sensible Zone* (2021) by Territorial Agency (John Palmesino, Ann-Sofi Rönnskog). **PIC 6:** *Public Stack* (2018) by Waag Futurelab. **PIC 7:** *Planetary Public Stack workshops* (2022-2024) by Waag Futurelab. **PIC 8:** *KSEVT Library* (2024), photo by Katja Goljat. **PIC 9:** *Asunder* (2019) by Tega Brain, Julian Oliver and Bengt Sjölén. **PIC 10:** *If toxic air is a monument to slavery, how do we take it down?* (2021) by Forensic Architecture.

Method: **The Planetary Public Stack**

Imagining a planet is an abstract and mediated endeavour, as planetary vastness escapes direct experience. Planetary concepts are cultural artifacts, shaped by knowledge traditions and shared through various media. Dominant contemporary imaginaries—such as the *globe* or the *Earth system*—are rooted in specific, often exclusive, epistemologies and technologies.

In contrast, More-than-Planet explores inclusive, public-oriented techno-cultural methodologies for composing planetary imaginaries. Here, the notion of the **PUBLIC** draws from the late Bruno Latour's understanding of the public as emergent collectives of concerned people who gather around specific matters of concern.[11, 12] Rather than being a fixed body of citizens, the public forms dynamically in response to issues that demand attention and care, including those involving nonhuman actors. Building on Waag Futurelab's *Public Stack* framework,[13] More-than-Planet offers a structured approach to integrating inherited foundations, design processes, technological infrastructures, and public engagement. This approach is extended to planetary thinking through the **PLANETARY PUBLIC STACK** method, which examines how publics, technologies, and environments co-constitute more plural, situated, and participatory understandings of planets.

People's visions of the **PLANET** are shaped by underlying concepts that, for many, remain unquestioned. Yet, as soon as one starts studying these concepts, an immense variety of them begins to emerge. Latour observed that the divergence in worldviews today is so profound that "we don't seem to live on the same planet,"[14] while Lukáš Likavčan extended such observation into the comparative study of planetary concepts, recognizing their inherent multiplicity.[15] Methodologically, the *Planetary Public Stack* builds on the work of Latour and Likavčan, while further exploring **COMPARATIVE PLANETOLOGY** (Chapter 1) as one of the underlying foundations of how people imagine planets in general, and Earth in particular.

The making of planetary imaginaries also depends inherently on practiced knowledge. Particularly in planetary studies, as a tradition of Western science, knowledge generally appears as universal and objective truth, while methodologically and institutionally failing to recognise the number of other knowledge types addressing the same phenomena. Throughout the study, *Planetary Public Stack* comparatively maps out this variety of **KNOWLEDGE CULTURES** (Chapter 2) and their influence on people's imaginaries, ways of mattering, and consequentially, on the environment itself.

The contemporary practice of looking toward the planet depends on technologies, not only rocketry, but the wider *vast machine*,[16] as described by Paul N. Edwards. It involves much of the physical infrastructure (with satellites gazing at the Earth's surface, orbital & global communications), as well as data and computational infrastructures—everything that fits the description of contemporary media technologies. On a daily basis, all of these provide essential environmental analysis used for planetary as well as more regional or thematic environmental governance and decision-making. Consequentially, these technologies directly influence governing imaginaries which contribute to the *making* of the environments at the scale of the whole planet. As such, *Planetary Public Stack* explores these technologies as **ENVIRONING MEDIA** (Chapter 3), the planet-making media, though from the relevance of the public, civil, creative and critical actors. Following Waag Futurelabs's notion, "if you can't open it, you don't own it," *Planetary Public Stack* maps existing technological settings for more just and caring public interventions.

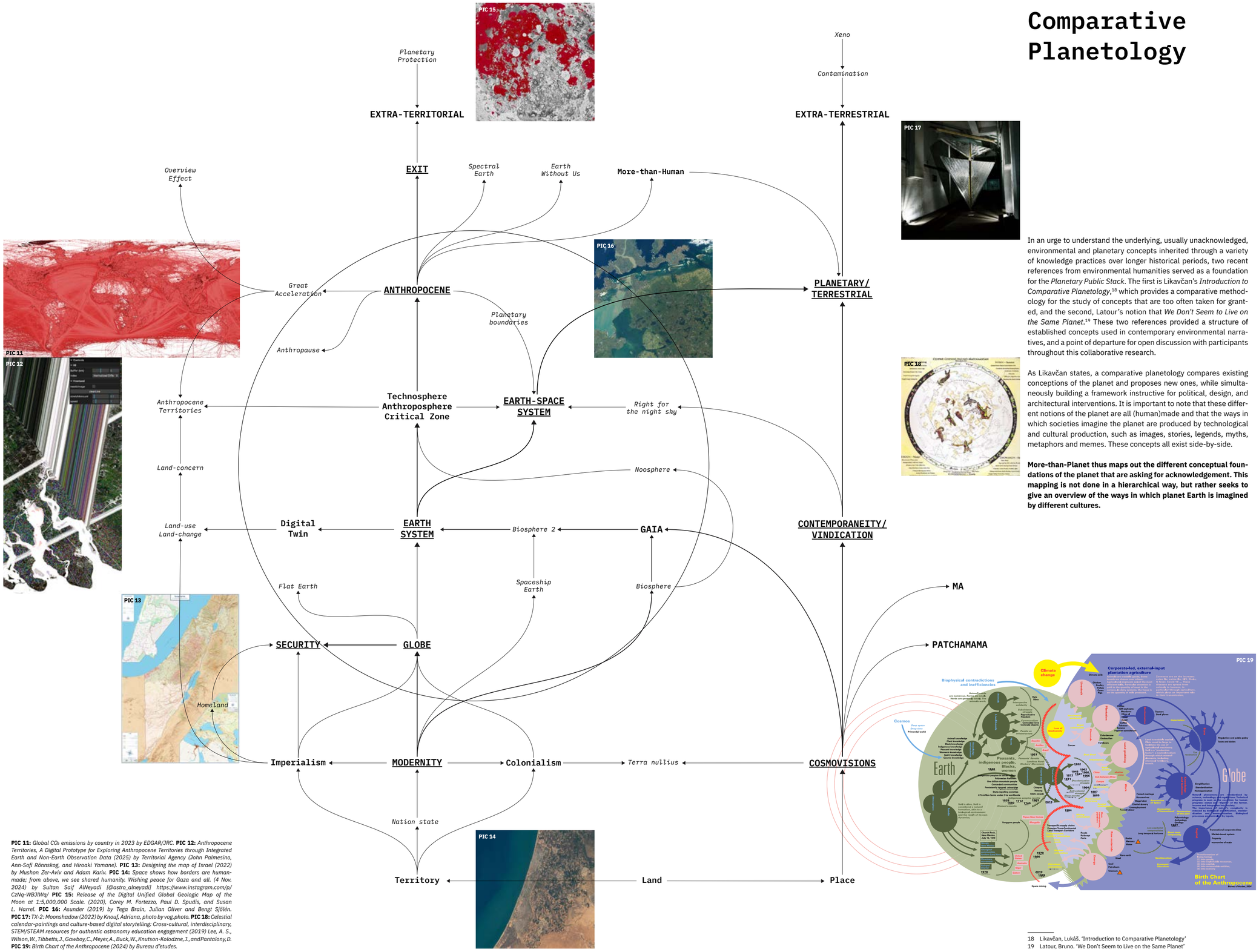
In parallel, *Planetary Public Stack* explores the notion of **PLANETARY MATTERING** (Chapter 4), examining how planetary entanglements between technologies and environments are shaped by diverse value systems and knowledge cultures. This perspective calls for a shift from detached observation to entangled engagement. It underscores that environments are not only produced through facts, data, and technologies, but also through values, concerns, and practices of care. In doing so, it challenges dominant paradigms that regard Earth as a passive backdrop for human activity, advocating instead for a relational, situated, and more-than-human understanding of what matters, and to whom.

All four chapters were explored and co-developed through the More-than-Planet project, with a series of workshops, symposia, conferences, art exhibitions and festivals, and a dedicated working group coordinated by Likavčan. These activities engaged with more than 100 artists and researchers who contributed key insights and case studies to the *Planetary Public Stack*. The text itself went through several iterations —particularly to move beyond Western ways of imagining the planets. Through ongoing discussion and study, the process gradually shifted towards a need to decolonise not only the content, but also the language and narrative used.

The result is presented in this **PUBLICATION** (digital & paper versions), as well as a **DIAGRAM** equipped with visual references presented here and on the project's website, and a **READER**, provided by a newly established More-than-Planet Online Library,[17] of publications on art, culture, humanities and social sciences in the context of outer space and the planetary.

11 Latour, Bruno. *Politics of Nature: How to Bring the Sciences into Democracy.* Cambridge: Harvard University Press, 2009.
12 Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory.* Oxford University Press Oxford, 2005.
13 Waag Futurelab. *Public Stack*. 2019. Link: https://publicstack.net

14 Latour, Bruno. 'We Don't Seem to Live on the Same Planet'. In *Catalog: Beyond the Horizon: Designs for Different Futures*. Philadelphia Museum of Art, 2019.
15 Likavčan, Lukáš. 'Introduction to Comparative Planetology'. *Moscow: Strelka*, Kindle, 2019.
16 Edwards, Paul N. *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*. First paperback edition. Infrastructures Series. Cambridge, Massachusetts London, England: The MIT Press, 2013.
17 Waag Futurelab, *More-than-Planet Library*, More-than-Planet, 2024, https://www.more-than-planet.eu/library.



PIC 11: *Global CO_2 emissions by country in 2023 by EDGAR/JRC.* **PIC 12:** *Anthropocene Territories, A Digital Prototype for Exploring Anthropocene Territories through Integrated Earth and Non-Earth Observation Data (2025) by Territorial Agency (John Palmesino, Ann-Sofi Rönnskog, and Hiroaki Yamane).* **PIC 13:** *Designing the map of Israel (2022) by Mushon Zer-Aviv and Adam Kariv.* **PIC 14:** *Space shows how borders are human-made; from above, we see shared humanity. Wishing peace for Gaza and all. (4 Nov. 2024) by Sultan Saif AlNeyadi [@astro_alneyadi] https://www.instagram.com/p/CzNq-WBJIWq/* **PIC 15:** *Release of the Digital Unified Global Geologic Map of the Moon at 1:5,000,000 Scale. (2020), Corey M. Fortezzo, Paul D. Spudis, and Susan L. Harrel.* **PIC 16:** *Asunder (2019) by Tega Brain, Julian Oliver and Bengt Sjölén.* **PIC 17:** *TX-2: Moonshadow (2022) by Knouf, Adriana, photo by vog.photo.* **PIC 18:** *Celestial calendar-paintings and culture-based digital storytelling: Cross-cultural, interdisciplinary, STEM/STEAM resources for authentic astronomy education engagement (2019) Lee, A. S., Wilson, W., Tibbetts, J., Gawboy, C., Meyer, A., Buck, W., Knutson-Kolodzne, J., and Pantalony, D.* **PIC 19:** *Birth Chart of the Anthropocene (2024) by Bureau d'etudes.*

Comparative Planetology

In an urge to understand the underlying, usually unacknowledged, environmental and planetary concepts inherited through a variety of knowledge practices over longer historical periods, two recent references from environmental humanities served as a foundation for the *Planetary Public Stack*. The first is Likavčan's *Introduction to Comparative Planetology*,[18] which provides a comparative methodology for the study of concepts that are too often taken for granted, and the second, Latour's notion that *We Don't Seem to Live on the Same Planet*.[19] These two references provided a structure of established concepts used in contemporary environmental narratives, and a point of departure for open discussion with participants throughout this collaborative research.

As Likavčan states, a comparative planetology compares existing conceptions of the planet and proposes new ones, while simultaneously building a framework instructive for political, design, and architectural interventions. It is important to note that these different notions of the planet are all (human)made and that the ways in which societies imagine the planet are produced by technological and cultural production, such as images, stories, legends, myths, metaphors and memes. These concepts all exist side-by-side.

More-than-Planet thus maps out the different conceptual foundations of the planet that are asking for acknowledgement. This mapping is not done in a hierarchical way, but rather seeks to give an overview of the ways in which planet Earth is imagined by different cultures.

18 Likavčan, Lukáš. 'Introduction to Comparative Planetology'
19 Latour, Bruno. 'We Don't Seem to Live on the Same Planet'

Established Planetary Concepts

As an object, the **GLOBE** is the perfectly smooth modernist ideal of a unified and interconnected representation of Earth. The figure of the globe associates with the **COLONIAL** and **IMPERIAL**, as Likavčan argues that the globe "imagines itself to be the first and only conceptualization of the planet – as if non-Western cultures did not have any stories about the planet as a whole to tell, and as if they did not develop their own coherent planetary projects."[20]

It was in light of the images taken from space during the space explorations in the sixties that the total view of the Earth as a whole system became the dominant framework. But this view has a longer history within mechanisms of colonialism and control. This global idea of the world, as Elizabeth DeLoughrey writes, is entangled with modern ways of imagining the Earth as a totality, including those spaces claimed for militarism and globalization, derived from colonial histories of spatial enclosure.[21]

The view of the Earth as seen from outer space might suggest a sort of interconnectedness of humanity: we are all together on that blue marble in the distance. But this image also invites us to assume we have an objective perspective on the entire Earth, allowing us to fully govern it.

The answer to the question *what is Earth?* depends on the diverse visual and philosophical cultures through which Earth is imagined. In asserting that "The globe is on our computers. No one lives there." Spivak suggests that the globe is maintained by our exchanges, representations, and computations of it.[22] In response to abstract and technocratic representations of the Earth, Spivak urged us to replace the concept of the globe with the **PLANETARY**—an approach that affirms ways of living with the Earth rather than merely mapping or modelling it.[23] The conception of the planetary challenges conventional notions of unity and global interconnectedness. Instead of perceiving of Earth as a whole entity, as in the commonly referenced astronaut Andres's *Earthrise* (1968) image, the planetary embodies the inherent impossibility of complete resolution or stability. It defies attempts at representation. In *Becoming planetary*, Jennifer Gabrys suggests the planetary as a different figure for undoing the totality of globes and globality. "Rather than bringing the Earth into view as a total object, as is often discussed through the figure of Earthrise, the planetary remains that which cannot be fixed or settled. The planetary resists representation."[24]

What exactly does that mean, to say that according to Spivak and Gabrys, the planetary resists representation? Spivak's exploration of the planetary aims to avoid creating an elusive notion. Instead, it seeks to disrupt an approach to understanding the planetary that relies solely on standardized epistemic representations. The planetary doesn't propose unity, rather an "inexhaustible diversity of epistemes."[25]

Planetary thinking offers a framework for understanding timescales and processes that extend beyond the human. In line with this thought, the **GAIA** hypothesis was introduced by James Lovelock and Lynn Margulis in the 1970s, treating Earth as a living organism that behaves like a living thing,[26] or an emergent property of interaction amongst organisms.[27] The totality of life on Earth is constantly collaborating, creating and maintaining the conditions for life. The conception of Gaia has contributed to the field of **EARTH SYSTEM SCIENCE**, which focuses on analysing the Earth as an interconnected system of physical, chemical, and biological processes.[28]

Extending Gaia's systemic view, Buckminster Fuller introduced the metaphor of *Spaceship Earth*, emphasizing the planet's limited resources and the need for collective ecological stewardship.[29] This vision was echoed by the Theatre of All Possibilities and their Biosphere 2 research facility in Arizona, which attempted to simulate Earth's ecosystems within a closed environment—highlighting both the fragility and interdependence of life systems. In parallel, Octavia Butler's speculative fiction, especially the *Xenogenesis* trilogy,[30] imagines symbiotic futures where survival depends on co-evolution and mutual adaptation, resonating with Gaian ideas of relational life.

20 Likavčan, Lukáš. 'Introduction to Comparative Planetology'
21 DeLoughrey, Elizabeth. 'Satellite Planetarity and the Ends of the Earth'. *Public Culture* 26, no. 2 (73) (1 May 2014): 257–80. https://doi.org/10.1215/08992363-2392057.
22 Chakravorty, G. Spivak. 'Imperative to Re-Imagine the Planet'.
23 Chakravorty, G. Spivak. 'Imperative to Re-Imagine the Planet'
24 Gabrys, Jennifer. 'Becoming planetary'. *Multitudes* 85, no. 4 (24 December 2021): 97–103.
25 Chakravorty, G. Spivak. 'Imperative to Re-Imagine the Planet'
26 Lovelock, James E. *Gaia: A New Look at Life on Earth*. Second edition. Oxford Landmark Science. Oxford, United Kingdom: Oxford University Press, 2016.
27 Margulis, Lynn. *Symbiotic Planet: A New Look at Evolution*. Science Masters. New York: Basic Books, 1998.
28 Steffen, Will, Katherine Richardson, Johan Rockström, Hans Joachim Schellnhuber, Opha Pauline Dube, Sébastien Dutreuil, Timothy M. Lenton, and Jane Lubchenco. 'The Emergence and Evolution of Earth System Science'. *Nature Reviews Earth & Environment* 1, no. 1 (13 January 2020): 54–63. https://doi.org/10.1038/s43017-019-0005-6.
29 Fuller, R. Buckminster. *Operating Manual for Spaceship Earth*. [Carbondale: Southern Illinois University Press, 1969.
30 Butler, Octavia E. *Lilith's Brood*. New York: Aspect/Warner Books, 2000.

Earth *as Gaia* was later reworked by Latour in an attempt to imagine the planet as a constantly changing and evolving plenitude of networks. According to Latour, thinking with and about Gaia requires a new way of seeing, because Earth is not an organism, superorganism, machine, spaceship, political body, plan, mother, harmony, God, control room or rhythm,[31] but a **CRITICAL ZONE**. The critical zone is a thin layer of actor-networks that constitute the Earth, and "a way to bring different disciplines together and in order to refresh the study of the thin skin of the living Earth."[32]

According to Latour, neither the concept of Gaia nor that of the critical zones has gained political traction, largely due to their lack of resonance within existing political frameworks. This is where Latour introduces the **TERRESTRIAL** as a way of being situated and embedded not in national or economic governing systems, but where specific localities entangle with planetary processes, like the impact of rising seas on the coastal cities.[33]

That part of the environment that is totally modified—or even designed—by the human is referred to as **ANTHROPOSPHERE**: the geosphere defined by human activity.[34] Parallel to this idea of human-modified environment is the narrative of Earth as something computational, as paradigms of knowledge systems have changed in light of the digital transition from a physical to a cyber-physical society. Benjamin Bratton has further developed this idea by conceptualizing the planet both as a stacked computational apparatus—a vertical architecture of interlinked technological layers—and as a new geopolitical framework that redefines how sovereignty, governance, and territory are organized in the age of software and planetary-scale infrastructure.[35] The idea of (digital) modelling to make sense of the world is seen in the figure of the **DIGITAL TWIN** Earth projects, in which a digital model of the Earth simulates different processes of Earth, as well as providing future scenarios for Earth, based on human behaviour. Digital twins of Earth constitute a new approach to leveraging the characteristics of the digital transformation in addressing environmental change at the global and European scales.[36]

This overarching notion of the human-made planet as **ANTHROPOCENE** was recognised by geologist Paul J. Crutzen through numerous readings of human impact on the environment in general.[37] Subsequent efforts of the Anthropocene Working Group, lead by Jan Zalasiewicz, also elaborately identified concrete anthropogenic markers of functional changes in the Earth system through the stratigraphic record, as they argue, distinct from the Holocene and earlier epochs.[38] However, formal recognition of the Anthropocene remains contested. A 2024 vote by the International Union of Geological Sciences rejected its classification as a new epoch, revealing tensions between scientific evidence and institutional politics. Some argue that the Anthropocene is better understood as a durational event, unfolding unevenly across time and space, rather than a fixed stratigraphic boundary. "This debate highlights how naming the epoch is not only scientific, but also deeply political."[39] *More-than-Planet* project explored the Anthropocene in collaboration with Territorial Agency as a guest lab at Waag Futurelab:

> **ANTHROPOCENE TERRITORIES: A DIGITAL PROTOTYPE FOR EXPLORING ANTHROPOCENE TERRITORIES THROUGH INTEGRATED EARTH AND NON-EARTH OBSERVATION DATA (2025)** is designed to help users identify and explore Anthropocene Territories—regions where human activity has significantly reshaped Earth system processes. It does so by integrating Earth Observation (EO) remote sensing data with non-Earth Observation (non-EO) datasets in a unified, annotated platform. The prototype combines satellite-derived EO data—such as land-cover change, atmospheric pollutants, and surface temperature—with non-EO sources, including socio-economic data, in situ measurements, policy documents, and historical archives. By mapping these diverse datasets onto a common semantic framework of Earth processes, the platform enables users to explore how human and natural systems interact across time and space. Central to the prototype are interactive annotations that guide users in identifying key Earth processes within the data. These annotations highlight correlations between datasets—for example, linking deforestation visible in EO imagery to commodity price changes or land-use policies found in non-EO records. Machine learning and expert input help generate these annotations, offering context that turns raw data into insight. The prototype's visual interface supports thematic and temporal navigation, allowing users to trace the evolution of Anthropocene territories—such as urban expansion zones, industrial agricultural frontiers, or coastal areas affected by sea-level rise. Users can compare regions, explore causal links, and build complex images that reveal patterns of anthropogenic impact. Collaboration tools allow users to contribute annotations, validate findings, and co-develop knowledge about Earth processes. This participatory approach helps refine the system while fostering interdisciplinary insight. Ultimately, the prototype functions as a powerful tool for recognizing and interpreting the dynamics of the Anthropocene. By connecting EO and non-EO data with annotated context, it supports informed analysis of how humans are reshaping planetary systems, making it a vital resource for research, education, and policy.[40]

A **MORE-THAN-HUMAN** approach in opposition to anthropocentric thinking came into being within the framework of critical Posthumanism, which questioned the conception of *the human*. More-than-human "speaks in one breath of nonhumans and other-than-humans such as things, objects, other animals, living beings, organisms, physical forces, spiritual entities, and humans."[41] A more-than-human Anthropocene acknowledges that human and non-human ways of being are always entangled and intertwined. *Feral Atlas* by Anna L. Tsing and others, for example, acknowledges the value of planetary-scale modelling and big-data analysis, but it argues that this is not enough: that we need a closer look at these anthropogenic ecological patches, from suburbs to plantations to plastic ocean gyres.[42]

Thinking about how the planet would look from a post-Anthropocentric perspective confronts the question of what **EARTH WITHOUT US** would be like. Earth without humans has been theorized by Likavčan as **SPECTRAL EARTH**, a concept that looks at how we should design for extinction, since "only after we fully embrace the extreme probability of our collective non-existence in this world we can truly hope for things being profoundly otherwise, and thus secure a sense of value for humanity's planetary existence while holding true the perspective of Earth-without-us."[43] Narratives of Earth-without-us and Spectral Earth take human life out of a position of centrality in thinking and theorizing Earth.

Other narratives that relate to the post-anthropocentric perspective are about exiting Earth. The Exit from Earth narrative is about a planet in danger of becoming overpopulated, so humanity needs to escape or expand and search for a new planet. Like many contemporaries, Frank White described the planet Earth through *The Overview Effect* as a fragile and interconnected system without political boundaries[44]—yet, he uses it very politically: as justification for leaving Earth for survival due to the climate change and resource depletion, as if these would not be caused by specific politics.

Before proceeding into the broader discussion of outer space concepts, it is helpful to take a step back and clarify the distinctions between *land*, *territory*, and *place*. Among these, **LAND** is the most physical and material concept—comprised of soils, waters, minerals, and the living—yet it remains open to cultural and conceptual interpretation. In European history, land has been increasingly understood as a resource, initially managed as a *commons* before transitioning into systems of private ownership and state governance. This shift laid the foundation for the modern notion of **TERRITORY**: land demarcated by borders, treaties, and conquests—an entity defined by sovereignty and jurisdiction. In contrast, thinkers like Graeber and Wengrow challenge linear, state-centric histories of territoriality by pointing to more fluid, seasonal, and relational land-use practices in early human societies.[45] This view is echoed by James C. Scott, who critiques the narrative of inevitable state formation and emphasizes how environmental control was instrumental in making populations and landscapes more legible to the state.[46] Scott's work is complemented by Elinor Ostrom's work on contemporary commons governance, demonstrating how decentralized communities can sustainably manage shared resources without hierarchical control.[47] Here, land is not primarily defined by use or ownership, but by relationships—an understanding that resonates closely with many Indigenous cosmologies. In these traditions, land is seen not as a possession but as a living relative, embedded in a web of relations with humans, animals, ancestors, and spirits. Such an orientation aligns more closely with the idea of **PLACE**: not simply as location, but as a space imbued with meaning, memory, and identity. Place is shaped by lived experience and situated cultural practices, highlighting the depth of human connection to land beyond its material or political dimensions. *More-than-Planet* project explored some of these aspects through Makery's commission to Bureau d'études:

> **THE LABORATORY PLANET, ISSUE NO. 6** delves into reimagining Earth's future through the lens of peasant and neo-peasant practices. It critiques the transition from a *factory planet* to a *laboratory planet*, highlighting how post-World War II technological advancements, especially those from the Cold War era, have led to extensive environmental monitoring and control systems. This shift has contributed to the current ecological crises and the concept of the Anthropocene. Central to the publication is the advocacy for a *planetary* perspective, moving away from a technocratic *global* viewpoint. This perspective emphasizes the importance of diverse, localized, and democratic biotopes cultivated by peasants worldwide. The issue showcases the Soil Assembly initiative, which brings together various experiences and reflections from emerging networks focused on soil and land stewardship. The publication also explores the historical context of peasant revolts, the impact of industrialization on agriculture, and the resurgence of agro-ecological practices. It underscores the significance of bioregionalism, mutual aid, and multispecies coexistence in creating sustainable and habitable futures. In essence, *The Laboratory Planet No. 6* presents a vision in which embracing peasant knowledge and practices can lead to more resilient and equitable planetary futures, countering the detrimental effects of industrial and technological dominance.[48]

While the nation-state objectifies land as territory, it also draws on a more sentimental attachment—that of the **HOMELAND**, aligning with Latour's concept of planet **SECURITY**. This imagined geopolitical planet is driven by a desire for stability through enclosure, where land is not only a resource to defend but also a vessel of national identity, heritage, and fear of the other. Borders, in this view, are not merely lines on a map—they become militarized frontiers, symbolic and real battlefronts that extend into social norms, cultural narratives, and economic policies.

This logic of enclosure and control has not remained confined to Earth. The space age itself emerged from Cold War rivalries, as two nuclear powers sought dominance beyond the atmosphere. In this context, the environmental and planetary imaginaries taking shape—often beyond the reach of public scrutiny—carry significant weight. The prevailing **EXTRA-TERRITORIAL** paradigm conceives of celestial environments as abiotic, uninhabited, and open to limitless resource extraction, effectively projecting the growth-driven economy of Earth into space. This sharp division between living and non-living worlds is reinforced by planetary protection protocols, which seek to preserve the sterility of outer space. While serving scientific purposes, these protocols also serve to justify and facilitate future exploitation of abiotic extra-territorial resources.

On the other hand, a variety of Indigenous traditions recognise outer space as part of the terrestrial living cycles, with the rights that *should* apply, yet remain unprotected. The **EXTRA-TERRESTRIAL** concept thus explores outer space as a living environment. The SETI programme—based on Drake's equation of the probability of intelligent life in outer space[49]—searches for any kind of indicator of existing life in outer space. Most of the exoplanetary research is searching for Earth-like planets in other solar systems. At the same time, space explorers are already finding life where it was not expected, for example, on the outside of the International Space Station, or assuming survival of tardigrades contaminating the Moon surface after the crash landing of Israel's *Beresheet* spacecraft.

It is important to note that outer space concepts also influence how Earth itself is conceptualised. As Frédérique Aït-Touati argues, they have a mirror effect: the future of life in outer space is shaped by life on Earth, and vice versa. If we want new ways to think about Earth, we need new ways to think about space.[50] One such concept is the **EARTH–SPACE SYSTEM**, which emphasises the interdependency between sustainability challenges on Earth and in orbit, while warning that the unchecked expansion of space resource use may reinforce capitalist structures and deepen social and environmental injustices on Earth.[51] Building on the understanding that *outerness* is itself a cultural construct—rooted in modernity's impulse to separate Earth from the cosmos and to imagine space as a neutral domain—critics now call for a relational understanding of space as fundamentally entangled with Earthly ecologies, histories, and systems of power. As Sloterdijk observes, modernity produced an artificial *Weltinnenraum* (world interior) that seeks insulation from existential risk, projecting space as an external safety valve.[52] Latour, in turn, warns that without reimagining our relationship to the terrestrial, we risk exporting the very same extractive and colonial logics into space that have destabilised Earth. The *More-than-Planet* project addressed the emerging Earth-Space system through an interview with Elena Cirković:

> Current legal systems fall short in managing the environmental impacts resulting from the expansion of human activities into space, such as satellite mega-constellations and space debris. These activities not only affect orbital environments but also have repercussions on Earth's atmosphere and climate systems. For instance, she points out that approximately 10% of particles in the stratosphere now contain spacecraft metals, indicating significant human impact on atmospheric composition. Through the ANTARES project, Cirković's research bridges environmental law, complex systems theory, and critical legal studies. She emphasizes the necessity for legal frameworks that can adapt to the complex and often unpredictable interactions between human activities and the Earth-space environment. Her work calls for a reimagining of law that transcends traditional jurisdictional boundaries, aiming to foster a more integrated and responsive approach to environmental governance in the context of both Earth and outer space.[53]

Interconnectedness and relationality are also part of many Indigenous cosmologies, recognising existential relationships between people, animals, plants and spirits, while extending these relations to the rivers, mountains, sky and celestial bodies. Today's Mapuche people, following Inca and even older traditions, speak of a totality of life, describing water cycles as the essential medium of life flowing through and purifying the sky and stars.[54] If Indigenous cosmologies were marginalized or erased through modernity and the concept of **TERRA NULLIUS**, Latour describes them as a **VINDICATION** planet, "reconnecting with lost knowledge that supported people surviving for thousands of years"[55]—a quality that should be recognised also in the context of today's environmental crisis. *More-than-Planet* project presented aspects of such vindication at an Ars Electronica 2023 thematic exhibition through the work of Felipe Castelblanco and Lydia Zimmermann:

> **CARTOGRAPHIES OF THE UNSEEN (2018-2021)**, based on the research of Castelblanco, queers the use of remote-sensing technologies—typically deployed for scientific, surveillance, or commercial purposes—to expose the vertical cosmopolitical occupation of the Pan-Amazon region, a territory contested by government forces, extractive industries, and Indigenous and ancestral communities. Building on earlier *Filmic Cartographies* that document layers of sub-visible and eco-social relations across the Pan-Amazon landscape, and through co-creation with the Indigenous Media Collective Ñambi Rimai—who use media to support Indigenous self-governance—the project facilitates inter-epistemic dialogue and reveals modes of inter-existence across ancestral territories and beyond. It challenges utilitarian and disenchanted conceptions of the Earth. In the exhibition, the work unfolds in two ways: it invites viewers on a filmic journey through the vertical strata of the territory, while also documenting an ongoing biocultural peace-building process sustained by Indigenous spirituality and governance. Ultimately, it unsettles the conventional separations between ontology, epistemology, and ethics in relation to this region and the Earth system.[56]

Queering of Planetary Concepts

During the *Planetary Public Stack* workshops, some participants articulated the necessity of queering planetary concepts (since concepts growing from modernity may inherit the logics of domination), in order to undo the coloniality embedded in certain planetary concepts. Queering does not operate on domination; rather, it opens concepts, reveals their porosity, and questions their established claims to authority.

The multiplicity of environmental and planetary concepts—each with its own comparative framing—both contributes to the foundations of cultural-environmental literacy and challenges the taken-for-granted status of certain concepts as asserted by specific knowledge domains. Such foundations offer a minimal requirement for open discussion on the answer to the question, what planet is being made? In this context, participants at *Planetary Public Stack* workshops also asked to critically study established environmental concepts, and by doing so, overcome utilitarian understandings of the planet Earth. In this context, queering aims at undoing the binary of normality and abnormality, and thus the authority that comes with "the normal."

In Shannon Winnubst's book *Queering Freedom*, queering can be seen as a method to recuperate concepts such as freedom from the modern logic and practices of domination of naturecultures.[57] Winnubst investigates how the enclosure of private property into the conceptual unit of individual rights in the seventeenth century affects how we live and how we perpetuate a racist world of white domination.[58] This means that the practices informed by concepts shape the land-Earth and the lives and relationships of people living on it. As Winnubst poignantly points out, "The dominant form of modern rationality totalises our sense of the world: instrumental reason subordinates all other kinds of knowing to its final mandates, reducing our worlds and lives to calculations of utility."[59] Following Winnubst, queering planetary concepts means to refuse the logic of utilitarianism inherent to certain conceptualisations of Earth or space, to undo the rigidity and absolutism of certain concepts that are used by science, and to open up to concepts emerging from other cultural-political contexts and naturecultures other than that of the west (though there are also pluralities within the west). Coming from neo-materialism and quantum physics, Karen Barad reckons, "The queerness of phenomena unsettles the presumed separateness of questions of being-knowing-responding. In other words, these various senses of mattering—ontology, epistemology, and ethics—are not separate/separable considerations."[60]

Therefore, mattering the planet also involves unsettling the presumed separation between being, knowing, and responding in relation to Earth. The *More-than-Planet* project, for example, challenged established planetary concepts through Makery's Homo Photosyntheticus lab:

> 50–80% of the Earth's oxygen production comes from the ocean – from oceanic plankton, algae and some bacteria capable of photosynthesis. In marine life, many species (the sea slug *Elysia Chlorotica*, zebrafish, *Costasiella Kuroshimae* or leaf sheep, etc.) have even successfully incorporated microalgae into their tissue over the course of their evolution in order to benefit from photosynthesis. The evolutionary biologist Lynn Margulis often mentions *Symsagittifera roscoffensis*, the Roscoff marine worm from Brittany, a wholly photosymbiotic species that ingests but does not digest its symbiotic micro-algae, keeping it in its tissue and surviving entirely through its photosynthesis. In *Microcosmos*, Margulis and Dorion Sagan speculate on this animal-algae, expanding reflection toward a future Homo Photosyntheticus of the human species, an evolutionary future in which humans become fully phototrophic, a human-plant with no need to feed. So how to draw inspiration from this speculative shift to a Homo Photosyntheticus? The Roscosmoe platform, an art and science initiative that hosts or supports artists conducting researches in the field of marine biology and biodiversity in partnership with the Multicellular Marine Models laboratory of the Roscoff Marine Station (France), has been working with artists on this speculative shift to Homo Photosyntheticus and building knowledge based on that.[61]

More-than-Planet also explored the queering of outer space at the Ars Electronica Festival 2023 thematic exhibition through the work of Adriana Knouf:

> **TX-2: MOONSHADOW (2022)** is an experiment in speculative satellite construction. By its existence, it shows that space missions can be constructed for queer, post-colonial futures, contrary to contemporary commercial, military, and expansionist ends. Consisting of a handmade solar sail, custom 6U cubesat covered in protective sigils for transgender and queer joy, and a sculpted "meteorite" that contains lichen-human hybrid structures, *TX-2: Moonshadow* draws upon the history of transgender desires for extra-terrestrial encounters and suggests possibilities for non-human experiences of outer space.[62]

Planetary concepts are neither neutral or universal, but culturally, historically, and politically situated. From dominant frameworks like the globe and the Anthropocene to emerging notions such as the Planetary, Critical Zones, and the Spectral Earth, each concept shapes how we perceive, represent, and intervene in the world. Through comparative and plural approaches—including Indigenous cosmologies, environmental humanities, and queering methodologies—More-than-Planet invites a rethinking of the assumptions embedded in environmental narratives. By unsettling rigid, utilitarian, or colonial logics, More-than-Planet opens space for multiple, relational, and situated ways of mattering the planet—ways that are essential for more just, inclusive, and liveable planetary futures.

From More-than-Planet Log

> **THE MORE-THAN-PLANET EXHIBITION**, at Old Leiden Observatory and as part of Leiden City of Science 2022, explored the concept of planetary habitability through remote sensing and artistic interpretation. Curated by Miha Turšič, the exhibition presented five screen-based installations that addressed environmental challenges on Earth and questioned our perception of space. Highlights included *Sensible Zone* (2022) by Territorial Agency, which visualised the delicate interface between land and sea; *Asunder* (2019) by Tega Brain, Bengt Sjölén, and Julian Oliver, which used AI to generate speculative climate intervention scenarios; and *If toxic air is a monument to slavery, how do we take it down?* (2021) by Forensic Architecture, which examined the links between environmental injustice and colonial history. Other works, such as Dani Ploeger's *A Space War Monument* (20121) and Minna Långström's *Photons of Mars* (2019), addressed the militarisation of space and our technologically mediated encounters with extraterrestrial environments. Together, the works invited critical reflection on how technology shapes our understanding of planetary systems and our responsibilities within them.
>
> **(UN)EARTHING THE TRUTH.** Ownership and Narratives about the Planet symposium at Ars Electronica Festival 2023 convened artists, scientists, and cultural practitioners to explore the question, "Who owns the planet?" Discussions delved into themes of planetary ownership, environmental justice, and the narratives shaping our understanding of Earth. Participants examined how technological tools, such as remote sensing and artificial intelligence, influence our perceptions of environmental issues and the importance of inclusive, multi-perspective approaches to planetary stewardship. The event emphasized the need to move beyond anthropocentric viewpoints, advocating for a more holistic understanding of Earth's systems that incorporates diverse voices and knowledge systems. By fostering interdisciplinary dialogue, the conference aimed to challenge existing power structures and promote more equitable and sustainable relationships with our planet.
>
> **THE (CO)OWNING MORE-THAN-TRUTH THEME EXHIBITION** at Ars Electronica Festival 2023 called for a fundamental shift in how we view and relate to the planet. From climate change to fake news, the truths we gathered—facts, data, stories—remained fragmented and biased, with unequal impacts. While truth was essential, it was not enough; new, collective actions were needed. The exhibition presented artworks that challenged dominant knowledge systems by exploring truths from landscapes, ecosystems, and data. It created space for plural, interdisciplinary perspectives that fostered deeper, shared understanding and collective responses to global crises.
>
> **THE MORE-THAN-PLANET SYMPOSIUM: OCEAN-SPACE-OCEAN** edition at ISEA 2023 brought together artists, scientists, and researchers to explore the interconnectedness of oceanic and cosmic systems, emphasizing the oceans' crucial role in planetary balance and ecological transition. The symposium featured a diverse lineup of contributors, including art historian Gabriel Gee, artist Maya Minder, historian and philosopher of science Sébastien Dutreuil, artists Alice Pallot and Anthea Oestreicher, biologist and artist Hideo Iwasaki, and legal researcher Elena Cirkovic. Their presentations delved into topics such as marine biodiversity, the impact of human activity on ocean ecosystems, and the legal frameworks governing outer space and oceanic domains. A highlight of the event was the performative dinner *Aquatic Devolutions*, orchestrated by Maya Minder and the TETI Group, which combined culinary arts with speculative narratives to reimagine human-ocean relationships. Through a blend of artistic expression and scientific inquiry, the symposium encouraged a re-evaluation of how we perceive and interact with the Earth's oceans, advocating for a more integrated and sustainable approach to planetary stewardship.

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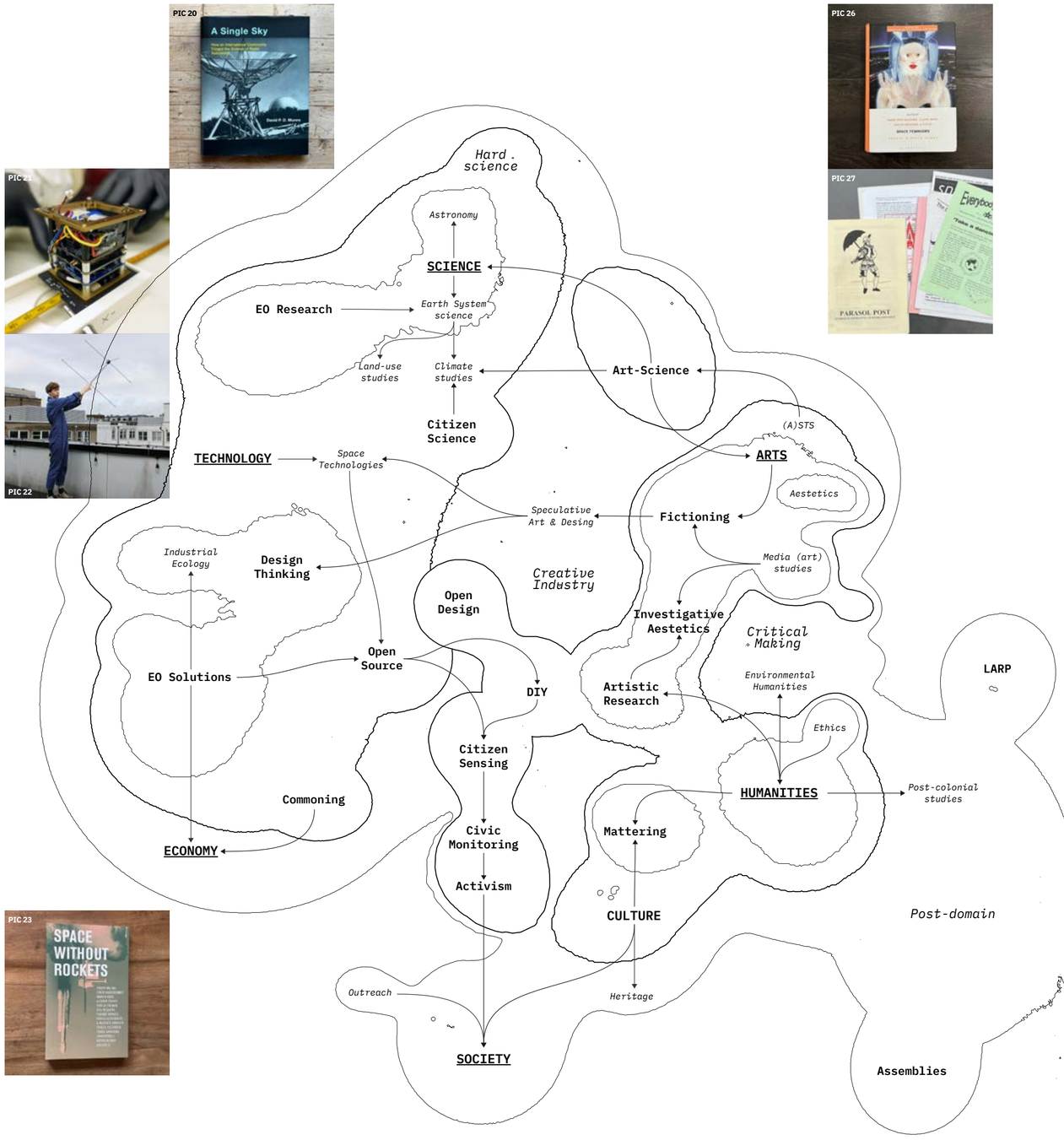

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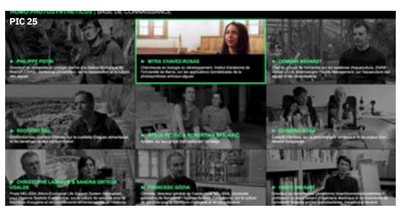

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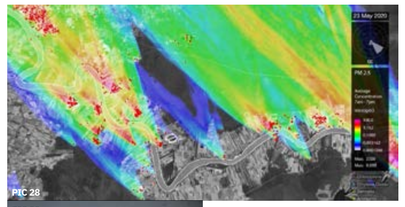

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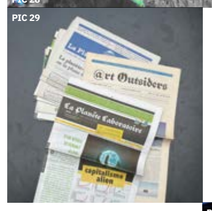

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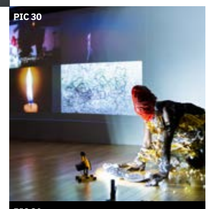

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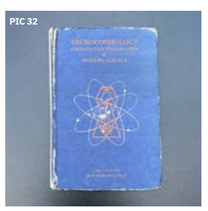

PIC 20: *A Single Sky: How an International Community Forged the Science of Radio Astronomy* (2013) by David P. D. Munns; KSEVT Collection. **PIC 21:** *QUBIK satellites* (2021) by Libre Space Foundation. **PIC 22:** *Open Weather community* (2020-ongoing) by Soph Dyer and Sasha Engelmann, photo by Arieh Frosh. **PIC 23:** *Space without Rockets* (2022) by Rob La Frenais and Ewen Chardronnet; KSEVT Collection. **PIC 24:** *Cultures in Orbit: Satellites and the Televisual* (2005) by Lisa Parks; KSEVT Collection. **PIC 25:** *Homo Photosyntheticus knowledge base (2021-ongoing)* by Ewen Chardronnet and Xavier Bailly. **PIC 26:** *Space Feminisms: People, Planets, Power* (2024) by Boucher, Marie-Pier, Claire Isabel Webb, Annick Bureaud, and Nahum Romero, eds; KSEVT Collection. **PIC 27:** *Association of Authonomous Astronauts collection* (2025) by KSEVT. **PIC 28:** *If toxic air is a monument to slavery, how do we take it down?* (2021) by Forensic Architecture. **PIC 29:** *The Laboratory Planet N.6 - Planetary Peasants | Soil Assembly* (2024) by Ewen Chardronnet and Bureau d'études; ART2M/Makery.info; KSEVT Collection. **PIC 30:** *Imaginary Futures* (2022) by Marcus Neustetter & Fatou Cissé, photo by Quentin Chevrier. **PIC 31:** *The Space Between* (2023) by Michèle Boulogne, Alice Ladenburg, and Zoénie Liwen Deng. **PIC 32:** *Microcosmology, Atom in Jain Philosophy & Modern Science* (1995) by Late J.S. Zaveri and Muni Mahendra Kumar; KSEVT Collection.

Knowledge Cultures

Cosmology is the field of study that encompasses the ways in which people conceptualise environmental phenomena exceeding their personal experiences, like planets, outer space, or the universe, and their relations to all of these. Today's dominant physical cosmology is studied in physics and astrophysics, and was formed through Western scientific thought. However, when something appears as common sense while depending on very exclusive practices, this raises concerns. For the public to better unpack what is generally recognised and discussed as a planet, it is essential to clarify what knowledge practices are used for such understanding.

More-than-Planet understands knowledge as a deeply cultural practice—not in the sense of human exceptionalism nor as a strict division between culture and nature, but as emerging from a diversity of ways in which both human and more-than-human agents make sense of, and relate to, the worlds they co-inhabit. As Latour argues, people's imaginaries are shaped not only by knowledge or ignorance but also by power dynamics—resulting in multiple, often conflicting planetary visions, each constituting a different world. As a means of overcoming these confrontations, More-than-Planet explores the diversity of knowledge cultures that contribute to a variety of planetary imaginaries while focusing on those that have a capacity to empower what could be described as the public. This public is not a predefined or passive body of citizens but, following Latour, emerges dynamically around shared concerns—particularly where planetary, environmental, and technological issues intersect.[63] It includes civil society actors, artists, environmental advocates, and citizen scientists, as identified in quadruple- and quintuple-helix innovation frameworks,[64] but also extends to communities that form around situated knowledge, contested sites, or collective responsibilities.

More-than-Planet maps a wide range of knowledge cultures: those rooted in domains and disciplines shaped by modernity; mission-driven cultures formed through contemporary political agendas; collaborative cultures that seek to overcome disciplinary limitations; liminal cultures situated between established fields such as art and science; and cultures positioned outside Western frameworks, recognised through the concept of the pluriverse.

Domain Based Knowledge Cultures

The More-than-Planet mapping of knowledge cultures begins with the recognition that today's dominant understanding of planet Earth is shaped by Western scientific perspectives, particularly those of physical cosmology. Historically, cosmological thought developed at the intersection of **ASTRONOMY** and **PHILOSOPHY**. While astronomy focused on observing and measuring celestial bodies and their movements, philosophy—especially metaphysics—and religion engaged with questions of creation and the origins of the universe. In the present day, physical cosmology is defined almost exclusively by the **HARD SCIENCES** and **ADVANCED TECHNOLOGIES**, primarily driven by nation-states, international institutions, and increasingly by private commercial actors. Meanwhile, the humanities—once central to cosmological reflection—are largely excluded from participating in how we conceptualise the cosmos today.

SCIENCE generally approaches outer space as a controllable, systemic object where planetary protection serves to keep it uncontaminated by terrestrial life.[65] With that, science reinforces a highly utilitarian understanding of space as a new *terra nullius*. The mapping of lunar and Martian geology, chemistry, and environmental conditions is more often geared toward normalising resource extraction and settler colonisation than, for example, imagining the extension of terrestrial biodiversity into extra-terrestrial environments. What is worrying here is not only the activities in outer space, but also the *Space4Earth* narratives claiming benefits for humanity, while excluding much of this claimed humanity from access to space programmes, or from defining societally driven space policies. For example, EU policies frequently refer to outer space, yet often lack measures or requirements that would include civil society and related organisations, except for access to space data and some space services.[66] The UNOOSA Space for All programme and the democratisation of space narratives, for example, demonstrate the openness in the space domain to countries and universities lacking national space infrastructure for testing or access to space, yet remain limited to scientific and technical research and experimentation in outer space. More controversial examples of societal inclusion are civil space missions, for example *Inspiration4*, where *the civil* is a billionaire paying for himself and three selectees to join a flight. The activities they performed during their few days stay on ISS in 2021 addressed entrepreneurship, philanthropy, and the fascination with the individual experience of outer space—values that are in line with ideologies of neoliberalism, libertarianism, and American exceptionalism.[67]

In parallel, there are many other institutional knowledge cultures that address, research, and contribute to contemporary planetary imaginaries. The majority are described through their domains or disciplines, building on the tradition of **MODERNITY** and its institutions of state, science, and industry—the triple-helix knowledge society. For example, Earth system studies and climate studies are scientific domains increasingly intertwined with socio-economic disciplines, especially as their core subjects—the environment and the planet—are becoming explicitly shaped by human activity. **INDUSTRIAL ECOLOGY**, for example, studies humankind's sphere of life, a complex technical system of energy, material, and information flows, describing it as an anthroposphere,[68] thus, from a systemic and spatial perspective and not a geological one, like the Anthropocene. Over the past few decades, and in a similar way, **LAND USE** and **LAND COVER CHANGE** studies, matured from a variety of disciplines, including economics, ecology, and geography, and gave rise to novel approaches to bridge the different scales of analysis as well as facilitate the establishment of links between science and practice.[69] Both of these disciplines are substantially supported by data and computation infrastructures, with, for example, the International Energy Agency (IEA) providing country and global data on different types of energy, their production, and consumption, and the European Copernicus with *CORINE Land Cover* programme providing regularly updated continental data on how, and for what, European land is used.

Within the **HUMANITIES**, **ENVIRONMENTAL HISTORY** and **ANTHROPOLOGY**, **PHILOSOPHY**, **POLITICAL ECOLOGY**, and **SCIENCE AND TECHNOLOGY STUDIES**, research the environment as a cultural topic, recognising humanity as a part of the larger living system. The **HISTORY** of how the environment mattered throughout linear reading of time has given an essential insight into the

63 Latour, Bruno, Peter Weibel, and Zentrum für Kunst und Medientechnologie Karlsruhe, eds. *Making Things Public: Atmospheres of Democracy ; [Exhibition at ZKM, Center for Art and Media Karlsruhe 20.03. - 03.10.2005]*. Cambridge, Mass.: MIT Press [u.a.], 2005.

64 Carayannis, Elias G., David F. J. Campbell, and Evangelos Grigoroudis. 'Helix Trilogy: The Triple, Quadruple, and Quintuple Innovation Helices from a Theory, Policy, and Practice Set of Perspectives'. *Journal of the Knowledge Economy* 13, no. 3 (September 2022): 2272–2301. https://doi.org/10.1007/s13132-021-00813-x.

65 Rummel, J. D, and L Billings. 'Issues in Planetary Protection: Policy, Protocol and Implementation'. *Space Policy* 20, no. 1 (1 February 2004): 49–54. https://doi.org/10.1016/j.spacepol.2003.11.005.

66 European Economic and Social Committee. and ESPI, European Space Policy Institute. *EU Space Policy and the Involvement of Civil Society:Final Study Report*. LU: Publications Office, 2023. https://data.europa.eu/doi/10.2864/206526.

67 Billings, Linda. 'Neoliberalism: Problematic. Neoliberal Space Policy? Extremely Problematic'. In *Reclaiming Space*, edited by James S.J. Schwartz, Linda Billings, and Erika Nesvold, 1st ed., 25–36. Oxford University Press, 2023. https://doi.org/10.1093/oso/9780197604793.003.0002.

68 Baccini, Peter and Paul H. Brunner. *Metabolism of the Anthroposphere: Analysis, Evaluation, Design*. The MIT Press, 2012. https://doi.org/10.7551/mitpress/8720.001.0001.

69 Verburg, Peter H., Neville Crossman, Erle C. Ellis, Andreas Heinimann, Patrick Hostert, Ole Mertz, Harini Nagendra, et al. 'Land System Science and Sustainable Development of the Earth System: A Global Land Project Perspective'. *Anthropocene* 12 (1 December 2015): 29–41. https://doi.org/10.1016/j.ancene.2015.09.004.

development of today's environmental troubles.[70] **POST-HUMANITIES** provide a knowledge frame for the actualization of the many missing people, whose minor or nomadic knowledge is the breeding ground for possible futures,[71] and **MEDIA STUDIES** shows not only how we understand, but also shape, the world through media technologies.[72]

ART and **CULTURE** are also shaping the way people understand the environment and planet as a whole. Cultural differences in portrayal and in storytelling demonstrate different traditions in relating toward the environment. For example, European Romanticism explored the relationship between the individual and nature, emphasizing the fusion of inner and outer worlds. It projected the inner sublime onto the natural landscape while interpreting inner emotional states as inherently connected to the natural world. Such notions also contributed to traditions of romantic explorers of wilderness as something alien. We can see this in one of the most iconic early films about outer space, Georges Méliès's *Le voyage dans la lune* (1902), depicting the moon as a jungle overgrown by dangerous plants and inhabited by primitive, hostile people, a notion that continues through the popular depiction of aliens and alien landscapes today. While **CREATIVE INDUSTRIES** like film and gaming continue to profit from such concepts as commodities, cultural and art institutions have become more sensitive to these perpetuated colonial imaginaries, and turned to **POSTCOLONIAL** and **DECOLONIAL APPROACHES**, overcoming biases embedded in Westernised cultures.

Liminal Knowledge Cultures

Beside institutionally established and supported knowledge domains, there are many liminal knowledge cultures formed as **INTERDISCIPLINARY STUDIES** established between academic domains, though they vary by intradisciplinary, cross-disciplinary, multidisciplinary, interdisciplinary, and transdisciplinary approaches.[73] The intellectual justification for such studies is that all research can be enriched by theories, concepts, and methods from other fields, while the practical justification is that the world's problems are not organised according to academic disciplines. Similar arguments also underly the **MISSION-DRIVEN RESEARCH AND INNOVATION** approach, acknowledging the directionality of innovation while also harnessing the power of research and innovation to achieve wider social and policy aims, as well as economic goals;[74] within and between sectors and institutions, in order to allow things to happen that otherwise would not have.[75]

Public research, as defined by Waag Futurelab, takes society and its concerns as its starting point. Its goal is to democratise knowledge production and authorship based on the notion that everyone has relevant knowledge, experience or skills to contribute. It has a distinctive position in relation to academic and market-driven research. It seeks to overcome the limitations of institutional domains by situating itself within emerging and marginal knowledge cultures that sometimes relate to established domains yet which might either lack such domain recognition, or where the domain intentionally avoids it.

For example, **ART-SCIENCE** and **ART-SCIENCE-TECHNOLOGY** act as a transdisciplinary practice engaging scientists, artists and technologists on shared topics with completely different methods while sharing tools and data. Some of these collaborations operate in more affirmative and creative use of technologies, others focus on critique or concerns. The best overview of such practices is documented by more than 50 years of *Leonardo Journal*, founded by kinetic artist and co-founder of NASA JPL and UNESCO, Frank Malina, and, until recently, led by his son, astronomer Roger F. Malina, who also co-founded Committee for the Cultural Utilisation of Space (ITACCUS) at International Astronautical Federation. Though many space agencies and organisations (NASA, ESA, JAXA, SETI) in one way or another involve arts in to their activities, artists generally remain guests within scientific institutions. There is no dedicated art or art-science institution that would systemically enable creative or artistic practices in outer space. The majority of space related art-science activities in outer space are realised as unique and exclusive collaborations with space agencies, for example, projects like *A Sign in Space* (2019) by Daniella de Paulis, or *The Inner Telescope* (2017) by Eduardo Kac.

Another science-related knowledge culture inclusive of society scales between **CITIZEN SCIENCE**, where scientists engage citizens to support scientific research, and **CITIZEN SENSING** or **MONITORING**, where citizens use science and its tools for their societal engagements. An example is the project *Hollandse Luchten*, a citizen platform with online tools and air quality sensors for measurement of a living environment in the area surrounding one of the largest European steel factories.[76] Important for this culture is support for citizens with their own agenda, and not only the instrumentalization of their enthusiasm. ESA recently supported several initiatives in this context, mostly in relation to Earth observation, like *CSEOL* (for which Waag Futurelab developed the Sentinel Citizen local air quality forecast model),[77] or small-scale closed ecosystems like *Astroplant*.[78]

As part of the *More-than-Planet* project, Waag Futurelab and Space4Good organised the *Planetary Public Stack* research residencies, supporting four groups of artists. One of these groups—Alice Ladenburg, Michèle Boulogne, and Zoénie Liwen Deng—explored the possibilities for collaboration between Earth observation experts and civil society initiatives:

> **THE SPACE BETWEEN (2023)** research residency explored Earth Observation data can present us with an impressive and useful overview of a site, it is the nuance and unpredictability of a place, with the unique understandings of a local observer, that reflects the infinite ways in which our planet might be imagined. This project invites Earth observations and Ground observations to come together, creating a new area of exploration and discussion: The Space Between. The Space Between brings together space-borne and earth-bound perspectives. In doing this, it asks two complimentary questions: *Can the knowledge and stories of individuals on the ground instigate a paradigmatic shift in technological and scientific environmental research? Can the knowledge of Earth Observation contribute to actions on the ground driven by matters-of-concern and matters-of-care?* Three sites that have been experienced, observed, and discussed are: Hackney Tree Nursery and Garden Forest, London; Kalinago Territory, Waitukubuli, Dominica; Tuinpark Rust & Vreugd, Amsterdam, The Netherlands. Credit: screenshot of the online conversation between artist Michèle Boulogne and remote sensing expert Iain Woodhouse about Kalinago Territory, Waitukubuli, Dominica.[79]

Collaborations closer to industry and technology developers are scaling from more affirmative practices like **DESIGN THINKING**, with a creative problem-solving approach, to more concern-driven approaches like **OPEN DESIGN**, **DO-IT-YOURSELF**, and **OPEN-SOURCE (HARDWARE)**, empowering communities to address their environmental or technological concerns. While design thinking usually builds on an assumed understanding of the problem and seeks solutions, the latter aims more at developing skills, sharing knowledge, and developing open technologies for those whose concerns are not addressed by commercial, state or public providers. The exemplary case in the development of open-source technologies for outer space is the Libre Space Foundation, which in the last decade developed operational open-source ground station ecosystem, communication protocols, and open satellite platforms. A similar and related case is the Open-Weather Community, organising inclusive workshops and developing resources on satellite imagery reception and reading, now including over one hundred DIY satellite ground station operators around the world, from Buenos Aires to Berlin. This capacity of open-source hardware to lower barriers and broaden participation represents a significant step toward the democratisation of space research.[80]

On the more critical side of the spectrum, practices such as **CRITICAL MAKING** and **INVESTIGATIVE AESTHETICS** examine the foundations and institutions of established knowledge domains. The former explores material-making practices as alternatives to market-driven creative industries, emphasizing how making matters in times of ecological crisis and social precarity.[81] The latter demonstrates how practical knowledge from media studies or architectural theory can be applied to concrete cases of environmental interpretation. For example, Susan Schuppli introduces a new operative concept: *material witness*, an exploration of the evidential role of matter as both registering external events and exposing the practices and procedures that enable matter to bear witness.[82] Both, critical making and investigative aesthetics are strongly supported by **ARTISTIC RESEARCH**, methodologically structured around practice- and performance-based research, studying the foundations of cultural, creative, and critical making practices.

Pluriversal Entanglements

While collaborations between traditionally separate or methodologically exclusive domains are often celebrated as progress within Western knowledge-making, scholars such as Latour, Mol, and Stengers have questioned the very origins of these divisions between natural facts and social questions. Rather than merely bridging these gaps, they call for healing the modern compulsion to dissect what is—and has always been—entangled.[83] Such a call follows Latour's observation that even though bridging these domains, we still tend to give one side the power to *know*, and even to explain each to the other. To overcome such a divide, Latour moves from treating facts as fixed truths to seeing them as part of the politics of how we care about the world.[84] This shift suggests that when we think about and interpret our planet, it's never just about hard facts but about diverse ways of relating to the planet, and consequentially about a diversity of coexisting ways of knowing. Knowledges beyond the Western tendency of imposed universalism can be explored through the concept of the **PLURIVERSE**. The pluriverse advocates for a world in which multiple ways of knowing, being, and organising life coexist with equal legitimacy. It is a central idea in decolonial thought, Indigenous cosmologies, and environmental justice movements, and emphasises diversity, relationality, and autonomy. As such, the pluriverse moves beyond critique of universalist knowledge culture toward proposing understanding knowledge cultures as multiple, situated and context specific.

For instance, the concept of ubuntu—rooted primarily in sub-Saharan African cultures, particularly among Bantu groups in contemporary South Africa—shapes ideas, culture, and politics in South Africa and beyond. It can be translated as a form of humanness expressed in the phrase "I am because we are."[85] It has a critical role in building communities that are marked by equity, justice, mutual support and care.[86]

Ontologically, the *we* signifies the human, more-than-human, and the universe, and the indivisibility of all these. It is a decolonial refusing the separability of human and the worlds, or the human exceptionalism that subjugates the Earth and other earthlings into objects for exploitation. Such case of togetherness was presented at Ars Electronica Festival 2023 through the work of David Shongo:

> **CEUX SANS QUI LA TERRE NE SERAIT PAS LA TERRE (2022)** is an art installation with video and photographs looking at the paradoxical beauty of the artificial desert of Kipushi, Democratic Republic of Congo, resulting from the long-term pollution of mining under Belgian colonial rule, alongside the atrocities against the colonised humans and the more-than-human. The artist establishes an analogy between ecological toxicity (resulting from abusive exploitation of the land and subsoil) and social toxicity in his country, characterised by economic inequality and an unjust system, both caused by coloniality. The work moves into the aesthetics-poetics of decoloniality, in which domains of disciplinary knowledge-cultures such as archaeology, geology, and geography about that land are troubled as the bases of their knowledge productions. The traces of what has shaped this land—both materially and relationally—point not only to the violence of colonialism, but also to the enduring coloniality embedded in conventional modes of scientific knowledge production.[87]

There is some resonance between ubuntu and **BUEN VIVIR**. Buen vivir, translated into English as "living in plenitude", can be broadly interpreted as meaning wellbeing is only possible within a community, a community with other humans and more-than-human.[88] It offers a critical reaction to classical Western development theory, and refers to alternatives to development which emerge from Indigenous traditions. For decolonial theorists such as Rolando Vázquez "to open a dialogue with the buen vivir requires an awareness of modernity's outside. The awareness of the exteriority of modernity comes hand-in-hand with the questioning of modernity's universal validity claims and more specifically of the modern/colonial rule over 'the real'."[89]

Beside these established knowledge cultures, new ones are emerging from different ways of relating to the planet and environment. For example, **ASSEMBLIES** or **GATHERINGS** of more-than-human actors seek epistemic justice for things and relations between them that are commonly recognised as an object of knowledge rather than knowledge-making actors. For example, *The Court for Intergenerational Climate Crimes* (CICC, 2021), initiated by Indian academic, writer, lawyer and activist Radha D'Souza and Dutch artist Jonas Staal, is a more-than-human tribunal that prosecutes climate crimes committed by states and corporations, not only in the past and present, but also in the future.[90] The court is organised as an assembly of animals made extinct through colonisation, witness statements and evidentiary materials. *More-than-Planet* project produced and took part at two assemblies:

> **ALGO-RHYTHMIC IDEATION ASSEMBLY (ARIA)** produced by Project Atol, brought together artists Birtalan, Erdmann, and OMSK Social Club in conversation with curators Tjaša Pogačar and Brandon Rosenbluth. In this exchange, the artists outline their individual approaches to role-play, exploring questions of agency, identity, and collectivity, while tracing connections between their practices and traditions of magick and mysticism. They examine the capacity of artistic role-play to bridge affective and political engagement, subvert hierarchical models of education, and rehearse alternative realities—not merely as speculative concepts, but as embodied practices. The conversation also reflects on the potential and limits of role-play in fostering ecological consciousness and imagining post-Anthropocenic politics.[91]
>
> **THE SOIL ASSEMBLY**, presented in collaboration with Makery as part of the 2023 Kochi Biennale, connects experts of a variety of backgrounds to support the freedom of exchange of knowledge, as well as the freedom of movement for plants, animals, humans, algae, fungi and seeds. As such, it subscribes to the essential conviction that life on this planet is symbiotically linked to its food resources and its biodiversity, from the tree tops to the deepest groundwater or ocean surface water sufficiently exposed to sunlight.[92]

Planetary imaginaries are not fixed by scientific fact alone, but are shaped through diverse, often contested knowledge cultures. From dominant cosmologies rooted in Western scientific paradigms to marginalised, liminal, and post-disciplinary practices, what counts as knowledge—and whose knowledge counts—remains deeply entangled with histories of power, exclusion, and resistance. More-than-Planet proposes a shift toward a pluriversal understanding of planetary relations: one that foregrounds situated, relational, and culturally diverse ways of knowing and being. In doing so, it aims to empower publics—artists, civil society, and environmental actors—to reclaim agency in shaping planetary futures that are just, inclusive, and ecologically grounded.

From More-than-Planet Log

SPACE WITHOUT ROCKETS edited by Ewen Chardronnet and Rob La Frenais and published by Villecomtal-sur-Arros: UV Éditions in 20222. This book is a guide to reaching near-Earth orbit and venturing deeper into space—without polluting the atmosphere or worsening the climate emergency on Earth. Written by a diverse group of scientists, engineers, artists, curators, and cultural experts in space exploration, it reimagines how we might navigate Spaceship Earth and journey to the Moon, planets, stars, and beyond in sustainable ways. Intended for space enthusiasts, mission specialists, engineers, astronauts of all kinds (cosmonauts, taikonauts, aeronauts), space agency officials—as well as skeptics, balloonists, Earth system scientists, environmental historians, climate activists, autonomous astronauts, and anyone concerned with our planetary future—it invites all Earthlings to rethink the future of space travel.

GLOBAL PERIPHERY: CONTEMPORARY IMAGINARIES OF SPACE, MULTIPLE VOICES by Leonardo/Olats, Paris 2022. The symposium explored contemporary space imaginaries through artistic works and activities from the space sector, featuring voices from across continents. As more countries and private actors entered the space arena, and new observatories were established in South America, Africa, and beyond, the moment called for a rethinking of how space was imagined—and how those imaginaries shaped our presence both beyond and on Earth. While dominant narratives had been shaped by early spacefaring nations, particularly the U.S. and its Hollywood iconography, Global Periphery highlighted what others had done—and were doing—by questioning, reimagining, and creating alternative visions of space from diverse cultural perspectives.

ŠUM JOURNAL ISSUE #21 presents Algo-Rhythmic Ideation Assembly (ARIA) as a speculative, immersive gathering of "hyperstitional agents"—a collective of artists, researchers, and thinkers engaging in experimental world-building. Held in Ljubljana in August 2023, ARIA employed techniques like "unsorcery" and "Real Game Play" to challenge entrenched perceptions and foster new modes of being. Participants explored concepts of "unworlding" and "unlearning," aiming to dissolve the boundaries of the autonomous self and envision "second bodies" and alternative realities. The initiative emphasized the creation of a "cosmo-grammar" to invoke new intra-world visions, blending fiction and reality to reimagine identity and agency in times of planetary upheaval. ARIA's approach underscores the potential of collective imagination and mythopoesis in confronting contemporary crises and envisioning transformative futures.

ŠUM JOURNAL ISSUE #23 reflects on the Algo-Rhythmic Ideation Assembly (ARIA) summer school held in Ljubljana in 2023 and 2024. ARIA blends art, theory, and immersive role-play to explore new forms of collective imagination amid ecological and political crises. Participants engaged in speculative practices—drawing from philosophy, somatic techniques, and digital technologies—to challenge the Western notion of a stable, autonomous self. The issue presents contributions that envision alternative models of embodiment, such as the planetary, networked, or more-than-human body, dissolving ego-centric boundaries. These perspectives aim to move beyond colonial modernity's human-centric worldview, proposing relational and metabolic understandings of existence. By intertwining fiction and reality, ARIA fosters transformative practices that reimagine identity and agency in times of planetary upheaval.

PUBLIC OUTER SPACE at the Public Spaces Conference 2024, organised by Waag Futurelab, explored the tensions between space as a domain of scientific achievement for humanity and its current dominance by industrial, commercial, and security interests. Despite its profound societal implications, outer space is largely shaped without the involvement of civil society. The session asked: how can we ensure space technologies and their spin-offs remain relevant and accessible to society—and how do we keep outer space truly public? Speakers Elefftherios Kosmas (Libre.Space), Xiao-Shan Yap (Space Commons), and Lars Petzold (European Space Policy Institute) shared concrete examples of civil engagement in space, from open-source space technologies to participatory governance models, and discussed the emerging concept of the space commons.

EXPEDITION TO PUBLIC OUTER SPACE, organised by Waag Futurelab at Center Noordung in Vitanje (2024), addressed the urgent question of how to reclaim a public role in outer space. The initiative launched both physical and online libraries to make marginalised knowledge—spanning art, culture, humanities, and social sciences—publicly accessible. While space is often celebrated for scientific breakthroughs, today's activities are largely driven by national and commercial agendas that sideline civil society and public engagement. This expedition challenged that imbalance by advocating for inclusive knowledge infrastructures. It featured two workshops: one on developing the KSEVT Collection, focused on physical publications in space-related cultural and social thought, and another on expanding the More-than-Planet Online Library, aimed at surfacing underrepresented perspectives in space discourse. Both workshops were supported by discussions involving Slovenian and international space and cultural organisations, highlighting overlooked contributions and encouraging a more democratic approach to space exploration.

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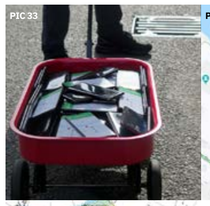
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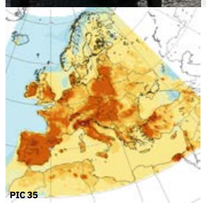
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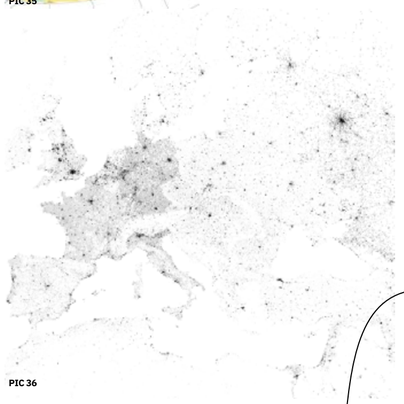
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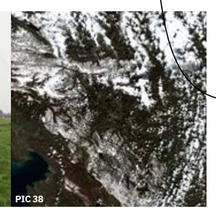
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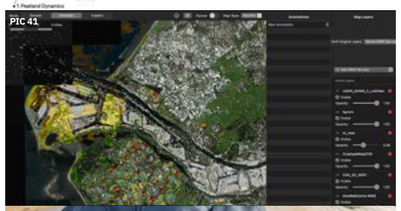
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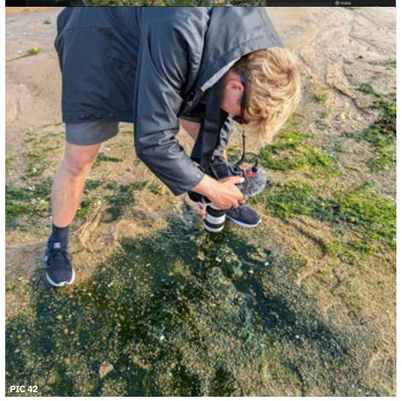
PIC 42

Environing Media

Portraying the planet Earth as a conceptual whole that exceeds an individual's experience of their perceivable surroundings (as studied by Western science), requires a complex and comprehensive socio-technological infrastructure. Phenomena like climate change, the anthropogenic footprint on the environment, or even the traditional cadastres, come into existence only through some of the knowledge cultures discussed above, and the constantly evolving *vast machine*[93] of *planetary-scale computational infrastructure*.[94] This chapter maps out the invisible structure of *environing media*[95]—the planet-shaping media—through both the struggle of representationally depicting not only the *orbital gaze*[96] but also through capture from within the *terrestrial*.[97] Next, the chapter builds an understanding of how these media actively contribute to the making of the planetary environments. As existing infrastructure remains strongly entangled with colonial tradition,[98] the technological layer of *Planetary Public Stack* provides insights into the cultural dimension of planet-making technologies, as well as creative and critical making tools for public engagements between the More-than-Planet actors.

Planetary infrastructure is primarily built and maintained by international and national institutions, and large corporations. Their main output is environmental data, generated through a pipeline beginning with orbital infrastructure—specifically, instruments mounted on satellites, aeroplanes, or drones. This is followed by the standardised processing of atmospheric, geophysical, and space-time-calibrated raw data into geolocated and gridded datasets. These datasets are made available via a range of Earth observation and environmental data platforms, each catering to different types of data analytics and interpretation, commonly described under the term planetary computation. The results are typically used to inform environmental policy, industrial applications, or protective measures—territorial practices that often exclude the involvement of terrestrial and planetary actors who actually inhabit the land. To develop more public planetary imaginaries, artistic and creative practices engage with these systems by constructing narratives and interfaces that invite more direct public involvement. These public imaginaries do not focus solely on the environment, but also critically address the *environing media* itself, intervening in its structures and assumptions.

***Planetary Public Stack* identifies four steps of data production and its use: the first, producing data with a variety of remote and situated sensing instruments deployed on the Earth's orbit, air, and land; the second processing data levels from raw measurements towards their use; the third, analysing data through planetary computation; and lastly, developing the variety of planetary imaginaries.**

Infrastructure

The material body of planetary-making imaginaries consists of an expansive network of infrastructures—spanning Earth observation systems, telecommunications, data processing architectures, and institutional frameworks. These infrastructures are neither neutral nor passive. They are active agents in shaping how the planet is sensed, known, and governed. They enable the collection of satellite imagery, climate modelling, environmental monitoring, and real-time data flows that make the planet legible and manageable—primarily through computational means.

In Europe, such infrastructures are managed and coordinated by institutional actors such as the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), and the European Commission's Copernicus programme. These bodies operate satellite constellations (like Sentinel & MetOp), manage vast climate and environmental datasets, and develop tools and services for policy-makers, industry, researchers, and civil society.

However, planetary infrastructures are not merely technical systems. They are also geo-political, epistemological, and economic constructs reflecting specific priorities, access regimes, and territorial logics. While offering powerful capabilities for environmental monitoring and disaster response, they also risk centralising control over planetary data, and overlooking plural knowledges and alternative ways of sensing and interpreting Earth. Thus, any planetary public stack must critically reflect on whose infrastructures are being built, who gets access them, and which imaginaries are encoded into these systems of planetary mediation.

Instruments

Key components of the observing system are those **REMOTE SENSING INSTRUMENTS** deployed on Earth's orbit through Earth observation (EO) space missions. Two established EO missions are NASA/USGS's Landsat missions, begun in the early 1970s, and Copernicus/ESA's Sentinel missions, initiated by the European GMES initiative in the late 1990s. These missions are organisational units that facilitate activities in outer space, from studies and analyses, to design, development, and operations. The leading objective of EO missions is the monitoring of dynamic chemical imbalances as an essential characteristic of life on Earth,[99] through the electromagnetic spectrum reflected from the Earth's surface. For example, Sentinel 2's *MultiSpectral Instrument* monitors variability in land surface conditions, while Sentinel 5p's *TROPOMI* instrument monitors gases in the atmospheric column. Spectroscopy aside, remote sensing also includes polarisation and radar techniques. The raw data resulting from such monitoring is broadcast from satellites to dedicated ground stations. The second step, the EO data processing, is provided by ESA and partner organisations like Sinergise, translating raw data into useful data products. While the initial Sentinel hub solution was built on Amazon Web Services, the current transition of their solution to Copernicus dataspace is now hosted by European CREODIAS consortium, returning data sovereignty to Europe. In parallel, weather and climate monitoring are provided by EUMETSAT and data processing by ECMWF, both acting as independent European agencies.

However, such techno-scientific views on the infrastructure can be also explored more critically. For example, *Calculating Empires: A Genealogy of Power and Technology*, 1500–2025 (2023) by Kate Crawford and Vladan Joler, traces the intertwined histories of computation, classification, and control through the last 500 years, framing computational technologies as the latest expression of centuries-old imperial and extractive logics. The work reveals how technological systems have long served to organise, exploit, and govern life on a planetary scale. The technology that claims benefits for society and the environment is actually devastating both. In *A Geology of Media*, Jussi Parikka reminds us of the geophysical and deep time implications of such infrastructures as the materials they are made of, like metals, minerals, and chemicals, will eventually become dust, technofossils, and plastiglomerates.[100]

In parallel to the technospheric sensorial infrastructure described above, there is the idea of the **PLANET AS A SENSORIUM**: an entity capable of sensing, responding, and self-regulating through its interwoven ecosystems. Earth's diverse living systems interact dynamically with the atmosphere, water, and geological structures to respond to both human and nonhuman activity. For example, deforestation in the Amazon not only alters local microclimates, but also affects global climate patterns and biodiversity. As Stephan Harding explains, this capacity for systemic response arises from the integration of life, atmosphere, rocks, and water, all working together to maintain the planet's surface conditions within habitable limits. Life is not passive, but an active regulator. It plays a central

PIC 33 & 34: *Google Maps Hacks* (2020) by Simon Weckert. **PIC 35:** *Europe air quality daily aggregated forecast – NH₃ surface concentration* (2025) CAMS. **PIC 36:** *Where we live—a summary of the achievements and planned evolution of the Global Urban Footprint* (2017) by Esch et al. **PIC 37:** *Dense Dark Vegetation* (2023) by Lili Carr and Matthew Harvey. **PIC 38:** *Atlas Slovenia / Sentinel 2* (10 April 2022) by Miha Turšič. **PIC 39:** *Toward a Boreal Intelligence* (2024) by Cesar&Lois. **PIC 40 & 41:** *Anthropocene Territories, Use Case Scenario: Integrating Earth Observation and Sedimentary Records for Anthropocene GSSP Analysis* (2025) by Territorial Agency (John Palmesino, Ann-Sofi Rönnskog, and Hiroaki Yamane. **PIC 42:** *Roscoffensis I/O* (2024) by Miha Godec and Roscosmoe Lab.

93 Edwards, Paul N. *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming.*
94 Bratton, Benjamin H. *The Stack: On Software and Sovereignty.*
95 Sörlin, Sverker, & Nina Wormbs. 'Environing Technologies: A Theory of Making Environment'. *History and Technology* 34, no. 2 (3 April 2018): 101–25. https://doi.org/10.1080/07341512.2018.1548066.
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97 Bruno Latour, "The Verifiable Image of the World," *Bruno Latour.fr,* 2006, accessed June 17, 2025, http://www.bruno latour.fr/node/883.
98 Chakravorty, G. Spivak. 'Imperative to Re-Imagine the Planet'.
99 Lovelock, J. (1986). Geophysiology: A new look at Earth science. *Bulletin of the American Meteorological Society*, 67, no. 4(1986), 392–397. https://www.jstor.org/stable/26225119
100 Parikka, Jussi. *A Geology of Media*. 1st edition. Minneapolis, Minn. London: University of Minnesota Press, 2015.

role in controlling atmospheric composition, ocean acidity, global temperature, and nutrient cycles. When viewed as a whole, this self-regulating system of interactions resembles the behaviour of a living organism.[101] This is the foundation of the Gaia theory: not that Earth is alive in a metaphorical or mystical sense, but that it functions as a dynamic, co-evolving entity capable of sustaining life through continuous feedback between its biotic and abiotic components.

Data

In order to make orbital **DATA** useful, EO data processing levels standardise steps towards universally useful datasets. Though every mission applies slightly different nomenclature, there are four main levels that translate raw data into modelled gridded data. Level 0 products are raw data captured by the instrument's sensor and received by ground stations, and not shared with the users. Level 1–2 products are multichannel datasets with applied geophysical calibration, atmospheric corrections, and some also with cloud detection. Level 2–3 products provide time-space composited data from several over-passes of the same sensor. The result is wider regional or global gridded datasets. Level 3–4 products provide analysed data from several channels or sensors and are, as such, used as modelled gridded data. EO data thus provides an insight into the chemical imbalance, described above, as identified through temporal changes in the electromagnetic spectrum at a specific location on Earth's surface or in the atmosphere.

As part of the *More-than-Planet* project, Waag Futurelab and Space4Good organised *Planetary Public Stack* research residencies, supporting four groups of artists. One of these groups—Lili Carr and Matthew Harvey—investigated the process of EO data production:

> **DENSE DARK VEGETATION (2023)** research residency asked which EO pixel in the Netherlands is the most surveyed. As the artists put it, remote sensing is a tool that records and displays every place on the planet the same way, including the colours chosen by analysts to indicate their categorising impulse (red = bad; green = good, etc). This project invited ways of unflattening this difference by bringing to the fore, and celebrating, the fuzziness, contingencies and complexity of the pixel, as defined by its edge. What began as an investigation into the process of producing data at the level of satellite multispectral sensors, through to their post-processing into a geographic-visual language expressed in pixels, led the artists to an exploration of on-the-ground validation and calibration practices that inform (and are informed by) those models of Earth. They found the Cabauw atmospheric research facility, located west of the town of Lopik in the province of Utrecht (NL), as a site where the groundwork of atmospheric science intersects with in-situ measurements that inform how remotely sensed data is processed. They proposed that this site makes up some of the most surveyed pixels in the Netherlands, the density of observations of it, and the volume of data produced from it, informing expectations of how and what we interpret from afar.[102]

Despite more than half a century of continuous orbital gaze, public access to satellite data is a relatively recent achievement. With its origins in the Cold War, today's EO domain is open to the commercial and civic sectors, especially in support of various industries and related research, while the public sector (with media, education, & culture) remains on the margins. Sentinel Hub and Copernicus data platforms are the most established European platforms. Aside from a variety of technical features like API access to the database and plug-ins for popular platforms, they also provide thematically processed data (forest fires, droughts, agricultural classifications, etc.), time lapse animations, and very basic online scripting tools for composing different channels that do not require programming skills.

At Planetary Public Stack workshops, participants used a pipeline of Google Earth for basic exploration, Sentinel Hub for access to EO data with different special, temporal, and spectral dimensions, Google Earth Engine for processing EO and environmental data, and QGIS for basic analysis, data compositing and presentation. All these applications are open and free to use; some are also open source, with a strong community developing them (for example, QGIS).

In addition to these platforms providing access to data and basic programming, there is a layer of specialised applications. Some focus on particular knowledge domains like hydrology, biodiversity, land use, and cover change, and others on more applied solutions in agriculture, forestry, energy, transport, or insurance. Based on their user base, we separate those used for research and education from those used by industry.

However, as described in the context of digital twins, environments are not systems. EO and environmental data, like any data, are partial and framed—collected by someone, for some purpose, using protocols that reflect particular interests and assumptions.[103] Even though access to EO data has become more public, and is used increasingly in counter-surveillance practices (such as open-source intelligence (OSINT) and investigative journalism), the assumed objectivity of data remains questionable, particularly given its political and cultural applications. A notable example is the case of mass graves during the Kosovo conflict in 1999, where satellite imagery provided by NATO and narrated by CNN was used to justify military intervention. Among other concerns, Lisa Parks questions what kinds of violence become visible, and for whom—and how such imagery can reify certain narratives while silencing others. Her study demonstrates that EO data is not politically passive, but performative within the geopolitical theatre of war, justice, and humanitarianism.

While the EO sector often promotes satellite data through visually appealing images of natural phenomena—algal blooms, vibrantly coloured geographies, or meandering rivers, for example—the industry itself rarely uses the data in a visual way. Instead, EO data is operational, read primarily by machines capable of analysing its vast spatial, temporal, and spectral dimensions. This operational nature of EO data is precisely captured by Harun Farocki's concept of **OPERATIONAL IMAGES**, with "images not intended for human eyes, but as integral parts of technical and machine-vision systems—including satellite surveillance or missile targeting—created neither for representation nor aesthetic contemplation, but rather, to serve specific functions within automated processes."[104]

Yet the issues with EO data begin as early as the definition of objectives for environmental mapping. These are generally established within the domains of environmental policy-making, governance, planning, and industries such as agriculture and logistics. As a result, these objectives—and the data they generate—often remain unrelated to citizens and civil society. A range of studies on EU space policies, land-use change, and climate research has acknowledged the drawbacks of social exclusion, inequality, and ecological simplification.[105] While citizen science initiatives attempt to address these limitations via citizen sensing and monitoring, public engagement with more infrastructural sciences—such as Earth observation, planetary computation, and data modelling—remains limited. Consequently, scientific findings and related policies are frequently met with scepticism and resistance.

What is all this infrastructure with data and applications used for? In scientific terminology, it is used for environmental data analytics, building on Earth system theory and related disciplines. In technological terms, it is to monitor, model, and manage the Earth's natural systems. However, due to its impact on geopolitics, the economy, society, and the environment, such analytics cannot be understood as uncritically neutral. *Planetary Public Stack* therefore explores not only the representational capacity of such analytics, but also questions their underlying values, and the ways they shape the world.

Planetary Computation

The general aim of **PLANETARY COMPUTATION** and **ENVIRONMENTAL ANALYTICS** is the production of facts about chemical, biological, and physical phenomena. They are published in the form of research papers describing models with related, used, and produced datasets. Good examples are ECMWF's planetary anthropogenic CO2 emission monitoring (CHE), JRC's *Emission Database for Global Atmospheric Research* (EDGAR). Another is Copernicus's *CORINE Land Cover* datasets, which integrate observations, emission inventories, land surface characteristics, modelling, and inversion systems into comprehensive modelled data products used as reference in both research and policymaking.

On the applied side, such models are taken up by different industries, from agriculture (managing their resources) to insurance companies (predicting risks & evaluating damage). Industrial applications are the most established domain of planetary computation, yet the least publicly accessible, as their services and products are locked behind commercial paywalls. Their objectives are mainly extractive, viewing nature as a resource, seeking higher productivity and efficiency, yet recently acknowledging a need for more sustainable practices.

From a techno-philosophical perspective, Benjamin Bratton describes planetary computation as a form of *planetary intelligence*: neither astronomical, geological, nor ecological, but rather, political and philosophical.[106] Such planetary condition emerges through the co-evolution of computation and the world, each shaping the other. At the core of this dynamic is design as a mode of planetary governance, where systems architecture and infrastructure serve as instruments of political organization. Bratton deliberately flattens the role of human, non-human, machine, and ecological actors, treating all as integral components of the political field.[107] However, his approach has been critiqued for its technocratic and systemic orientation, which tends to treat ethics, social inclusion, and lived experience as secondary, or even peripheral, concerns.

This critique becomes even more apparent when considering how emerging technologies like *digital twins* promise total environmental oversight, while simultaneously overlooking the inherent unpredictability and relational complexity of life. Such approaches often reproduce the assumptions of systems theory, foundational to both computational governance and modern ecology, reducing ecological entanglements to functional or operational terms. Even the term *ecosystem* stands as a reminder that the history of ecology is enmeshed with systems theory, and presupposes that species entanglements are inherently operational or functional.[108] *More-than-Planet* exhibition in Leiden in 2022, presented the work of Tega Brain, Julian Oliver, and Bengt Sjölén, showcasing limitations of the environment as a system:

> **ASUNDER (2019)** creates a fictional environmental manager that proposes and simulates future alterations to the planet to keep it safely within planetary boundaries. It does so by using climate and environmental simulation technology, a 144 CPU supercomputer and machine learning image-making techniques. The absurdity of the work not only lies in the unacceptable results of this *management process*, but also in the impossibility of having such a God-like figure that takes care of the planet. This speculative art project reminds us not to wait for a *manager* or a powerful geopolitical entity to take action on a planetary scale. Instead, we need to take matters into our own hands and care for the planet in situated manners, such as acting as citizens, rather than as consumers, in advocating for sustainability.[109]

Following on from the question of who makes the environment, there are key differences between those made by living organisms inhabiting the actual environment, and those that shape the environment remotely, through remote sensing and computation. For example, Waag Futurelab developed a Sentinel Citizen model for local air pollution forecast that combines CAMS and local citizen sensing data, providing information on pollution peaks a few days in advance.[110] Such citizen-driven approaches give local communities agency in advocating for a reduction of emissions on peak pollution days, yet such a solution still lacks recognition by policy and governing actors.

Planetary Imaginaries

The multiplicity of ways in which people relate to, perceive, construct, and empathise with the planet—as a concept larger than their immediate surroundings—is articulated by More-than-Planet through the notion of the *imaginary*. This is not opposed to the real, but rather is the very faculty through which the world becomes real to us.[111] The imaginary shapes not only individual realities but also social and environmental ones. Through the lens of planetary imaginaries, More-than-Planet acknowledges the wider entanglement of actors, challenging the exceptionalism of Western anthropocentrism by recognising the many ways in which the *human* is inseparably intertwined with other *living being*s and *things*, as active makers of planet Earth. The More-than-Planet approach to planetary imaginaries thus contributes to the making of a diversity of comparative planetary concepts by including previously unacknowledged actors. It also proposes the environing media of the Planetary Public Stack as a digital public space where entanglements between technological and environmental actors are acknowledged.

Planetary Public Stack explores two technical pillars of planetary imaginaries, the **NARRATIVES** and **INTERFACES**, both building on the outcomes of planetary computation, while demonstrating the presence or lack-of the public. The main characteristic of both is their visuality or embeddedness into the visual media society. When seeking for manifestations of planetary imaginaries, they can be found mainly on screens, mostly produced digitally as the supporting technologies are all data driven, but not exclusively.

In such context, the most distant portrait of Earth, *Pale Blue Dot*, is not only an iconic image of space exploration, but also an exemplary narrative describing the Earth's size as less-than-a-pixel against the vastness of space, as if pixels would make any sense in describing a planet outside of the medium itself. Such examples show both the struggle and the power of planetary narratives depending on media technologies. A similar narrative struggle is seen in flat Earth beliefs, which are not merely denialism, but a culturally and technologically shaped distrust of scientific authority.[112] Emerging from 19th-century pseudo-science, and spanning algorithm-fuelled conspiracies, these beliefs reflect anxieties over control, perception, and reality in the era of planetary-scale computation.

STORYTELLING is one of the oldest continuous cultural practices. Emerging not only through language, alphabets, and writing, but also from a sense of community, it enables the transmission of knowledge, shared values, and collective memory. While it is often assumed to begin with oral traditions which evolved into written and visual forms, archaeological evidence challenges this linear narrative. Prehistoric artworks such as the Blombos Cave engravings (c. 73,000 years ago), the Lascaux cave paintings (c. 17,000 years ago), and the rock art along the Jinsha River (c. 13,000 years ago) clearly demonstrate that visual storytelling has long coexisted with oral traditions. Today, storytelling increasingly takes digital and visual forms, including interactive media, data visualisation, and algorithmically generated content. Within the context of planetary imaginaries, these visual formats serve to weave together scientific data, cosmological visions, and societal narratives. The convergence of storytelling and visual media forms the basis of narrative media—the mode of participation of human agents (authors, actors, readers) in the narrative event.[113]

Two examples of more mainstream visual narrative media, especially in the context of climate change studies, best demonstrate the visual nature of planetary imaginaries. *Warming Stripes* (2018), by climate scientist and one of the lead scientists on the IPCC 6th Assessment Report, Ed Hawkins, has become, in recent years, one of the most iconic representations of global temperature change. Though constructed of modelled scientific data of average global annual temperatures from 1850 until today, when shown in such a basic way as stripes coloured from light blue for cooler temperatures towards dark red for warmer temperatures, the message is clear, even to an uneducated gaze. Another viral case is a hockey stick graph used also by Al Gore in his book[114] and the subsequent film, Guggenheim's *An Inconvenient Truth* (2006). With its origin in paleoclimate research, reconstructing hemispherical mean temperatures for the past millennia,[115] it sparked a decade of disputes between scientists and industrial lobbies on the precision of underlying models. In the context of narrative media, both cases demonstrate not only the power of visual data representations but also the way they are used by different actors, and their effect or impact on the culture.

Such disputes and controversies can also be observed between affirmative and critical media narratives. Industry and states usually produce **PROPAGANDA NARRATIVES**, with the goal of convincing the public of the validity of specific master plans, while civil initiatives and critical filmmakers dissect such narratives or produce **ALTERNATIVE NARRATIVES**. Jonas Staal, in his film *Propaganda Theatre* (2023), explores the structure of propaganda with its infrastructures, narratives, and imaginaries. An important part of such propaganda is the turning of passive spectators into spect-actors who step out from the screen into a staged and performed reality without awareness, and even claim such realities as their own. Though Staal focuses primarily on war propaganda, similar narrative formats can be observed in the contexts of outer space and environmental futures. For example, stacks of digital twins, smart cities, and platform economies increasingly strip citizens of their agency, recasting them as passive users or consumers dependent on these technologically constructed realities. Turning existing cities into "smart" ones is not a neutral act. Projects like *The Line* in Saudi Arabia exemplify this narrative form, its desert setting echoing the aesthetics of analogue Moon or Mars settlements—remote and extreme environments used to rehearse life in supposedly uninhabitable worlds—thereby blurring the lines between speculative fiction, technological spectacle, and political propaganda.

In opposition to such master narratives, researchers and artists explore also more **CRITICAL**, **CONCERNED** or **CARING NARRATIVES** addressing more sensitive cultural entanglements with the environment, planet or outer space. An example of such contemporary planetary storytelling is *Kitcikisik* (Great Sky),[116] a work by the Cree researcher and educator, Wilfred Buck. His work contributes to the revival of the lost constellations of Canadian First Nation communities as connected to their cosmological traditions and social struggles, simultaneously inspiring future generations of scientists. His main medium is a mobile planetarium with a projection of traditional star constellations. Annette S. Lee describes such planetariums not only as immersive experiences for visitors to understand different cultures through stars, but also as a means of raising awareness that these stories are not alone myths, as they are often portrayed, and dismissed. These stories are a rich source of information about how ancient cultures lived and what was relevant and important to them. The stories are a rich source of scientific data that have been preserved in the stars and passed down from generation to generation orally.[117]

A more critical example is the work of Kongo Astronauts artists Eléonore Hellio and Michel Ekeba, who perform as astronauts alienated on their own planet. Their work addresses the societal and environmental devastation wrought by colonialism and extractive economies. In a similarly concerned vein, Territorial Agency—through *Oceans in Transformation* (2021) and *Sensible Zone* (2022)—visualizes large-scale environmental issues such as ocean overuse and rising sea levels. Their practice serves as a form of visual policymaking, using data-driven imagery and spatial analysis to influence environmental awareness and governance discourse. Offering a more caring and grounded narrative, Felipe Castelblanco's *Cartographies of the Unseen* (2018–2021) traces a vertical landscape shaped by territorial conflict, while enacting gestures of resistance and care for the biocultural region spanning the Andes and the Amazon.

As More-than-Planet also builds on the recognition of **NON-HUMAN ACTORS AS NARRATORS**, one can acknowledge sentinel landscapes as places of memory and agency, shaping human behaviour and cultural meaning, or multispecies ethnographies where human and nonhuman lifeworlds are treated as entangled and co-constitutive.[118] Such intertwined temporalities and subjectivities suggest that more-than-human narratives challenge linear, human-cantered chronologies and instead offer a more layered, relational approach to storytelling. In so doing, they offer opportunities to rethink existing narrative frameworks and propose new ones.

However, as we have seen, narratives are never independent of their medium. The NASA Apollo mission didn't land only on the Moon—it also landed on millions of television screens and magazine covers, dominating the media landscape of its time. Earlier still, in an effort to popularise space exploration, Wernher von Braun collaborated with Disney on the educational film *Mars and Beyond* (1957), imagining extraterrestrial life, and co-authored a series of articles in Collier's magazine (1952–54) portraying space stations and rocket travel as both plausible and imminent. Meanwhile, the countercultural magazine Whole Earth Catalog placed early satellite images of Earth on its covers, framing the planet within techno-ecological networks of interconnection and care.

However, as we have seen, narratives are not independent of the medium. The NASA Apollo mission didn't land only on the Moon, but also on most **TV SCREENS** and **MAGAZINE COVERS**, as dominant media at the time. Before that, in a push for popularisation of space exploration, Wernher von Braun collaborated with Disney on a series of **EDUCATIONAL FILMS** *Mars and Beyond* (1957) discussing possible life in outer space, and with the *Collier's* **MAGAZINE ARTICLES** in the period of 1952–54, portraying rocket travel and space stations as something imaginable and not so out-off this world. On the other hand, the countercultural magazine *Whole World Catalogue* portrayed some of the first satellite images of the Earth on their covers in the context of exploring interconnectedness within the techno-ecological systems.

Such mediated concepts of the planet evolved further through **MEDIA ART**. A notable example is *Terravision* (1993) by ART+COM—a pioneering virtual interface of the Earth. The installation featured an interactive system where users could navigate a digital globe using a large physical sphere as a controller, a 3D mouse for spatial movement, and a touchscreen for interacting with geographic data layered over the virtual Earth. While groundbreaking as an artistic exploration of planetary representation, *Terravision* also later became more widely known through a Netflix dramatization, due to its central role in a legal dispute over alleged patent infringement by what would become Google Earth.

FILM has long served as a central planetary interface, shaping collective imaginaries of Earth and space through powerful narrative and visual means. As Tiago de Luca, cinema does not merely depict the world—it participates in producing the planet as an object of imagination, awe, and control.[119] He challenges the common notion that planetary consciousness began with the Apollo missions and the *Blue Marble* image, instead tracing a deeper lineage of planetary visualization through panoramic media and early cinema. From speculative visions like Fritz Lang's *Frau im Mond* (1929) and Pavel Klushantsev's *Road to the Stars* (1957), to iconic works such as Kubrick's *2001: A Space Odyssey* (1968) and Tarkovsky's *Solaris* (1972) outer space films have helped construct what de Luca calls the planetary sublime—a technologically mediated sense of scale, immersion, and domination. More recent productions like *Avatar* (2009) and *Gravity* (2013) extend these visual traditions, blending spectacle with ecological and existential themes. Yet not all cinematic contributions to planetary thought come through blockbuster aesthetics. Experimental works such as *Powers of Ten* (1977) by Charles and Ray Eames offer a meditative scaling of the universe, while *Hidden Figures* (2016) foregrounds the historically overlooked contributions of African-American women whose computational labor helped launch space exploration itself. In these varied forms, film functions both as a site of dominant planetary visions and as a medium for reclaiming or reimagining the terms through which Earth, space, and society are understood. As such, cinema remains a key arena in which the politics of visibility, scale, and power are negotiated in the making of planetary imaginaries, bridging artistic storytelling with the operational logics of planetary interfaces like *Terravision*, Google Earth, or real-time environmental sensing tools.

Yet the most common planetary interfaces today are actually **MOBILE MAP APPLICATIONS**, like Google and Apple Maps, which provide a sense of the world *in your palm*. They are only a recent iteration of an otherwise long history of maps. What matters for *Planetary Public Stack* is, who gets to make these maps. Big Tech—a term commonly used to refer to dominant technology corporations like Google, Amazon, SpaceX and Planet Labs—controls many of the digital infrastructures and platforms through which planetary data is produced, accessed, processed, and visualized. These corporations provide only information of interest, like business and venue locations, or traffic information. What open-source map providers like OpenStreetMaps provide, in addition, is openness to the technological concerns underlying such platforms, allowing communities of users to have access both to the code and design of such interfaces. However, what both lack is a representation of environmental concerns: they show traffic density as a matter of interest, but lack information on local pollution from this same traffic. For example, the *Sodaq Air* platform for air quality sensing, attached to bicycles, not only measures traffic pollution, but also suggests cleaner routes for daily commutes.

Discussion with artists at the More-than-Planet and Planetary Public Stack workshops mapped out not only media and interactive interfaces but also performances as planetary and outer-space cultural interfaces. There is a list of early performances in microgravity, like the choreographic experiments by Kitsu Dubois, the cosmokinetic theatre production *Biomechanics Noordung* (1999) by Dragan Živadinov and Dunja Zupančič, or the collective art experiments by Kosmica. A list of experiments on the International Space Station, like *The Inner Telescope* (2017) by Eduardo Kac, *The Contour of Presence* (2018) by Nahum, *TX-1* (2020) by Adriana Knouf, and *Moon Gallery* (2022) by Moon Gallery Foundation, fit into the category of performances exploring comparative planetaries in the absence of terrestrial conditions.

However, performance as a practice also allows for the direct engagement of people, who gain an opportunity to ground themselves and explore the environment through actual or even enhanced presence. An example of such performance is the *Aerocene* community project (2012–ongoing) led by Tomás Saraceno, which advocates for zero-emission air and space travel. Though the challenge appears technological, it is mainly political, as it confronts extractive industrial practices. As such, it is mostly built by activists and artists advocating for communities that are victims of lithium mining.

This chapter has explored how the planet is not only observed, but actively shaped, through complex socio-technical infrastructures and the media imaginaries they support. From satellite-based environmental data pipelines to narrative and visual media, planetary-scale technologies shape what becomes visible, knowable, and actionable. Yet, these infrastructures are neither neutral nor universally accessible—they carry histories of extraction, exclusion, and control. More-than-Planet proposes a shift toward more situated, critical, and inclusive practices of planet-making, in which society is not a passive data subject but an active participant in sensing, imagining, and shaping planetary futures. Through art, open technologies, and collective storytelling, it becomes possible both to challenge dominant narratives and envision more just and liveable worlds.

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102 Waag Futurelab and Space4Good. 'Planetary Public Stack Research Residencies'. More-than-Planet (blog). 15 January2025. https://www.more-than-planet.eu/logs/planetary-public-stack-research-residencies.

103 Mattern, Shannon. 'A City Is Not a Computer'. *Places Journal*, no. 2017 (7 February 2017). https://doi.org/10.22269/170207.

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106 Bratton, Benjamin. 'Planetary Sapience', *NOĒMA*, 17 June 2021. https://www.noemamag.com/planetary-sapience.

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108 Brain, Tega. 'The Environment Is Not A System'. *A Peer-Reviewed Journal About* 7, no. 1 (6 July 2018): 152–65. https://doi.org/10.7146/aprja.v7i1.116062.

109 Tega Brain, Julian Oliver, and Bengt Sjölén, *Asunder*, 2019, installation, exhibited at More-than-Planet exhibition, Old Observatory, Leiden, 2022.

110 Waag Futurelab, "Hollandse Luchten"

111 Lennon, Kathleen. *Imagination and the Imaginary*. Routledge, 2015. https://doi.org/10.4324/9781315730387.

112 Midal, Alexandra, Emma Pflieger, and Antoine Foeglé. *Keep It Flat: A Little History on Flat Earth*. Edited by Jolanthe Kugler and Scott Longfellow. Les presses du réel, MUDAC (Museum of Contemporary Design and Applied Arts Lausanne), 2023.

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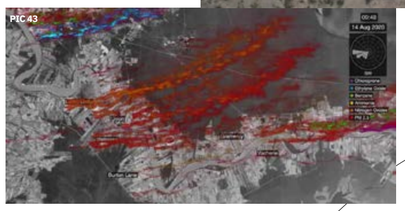
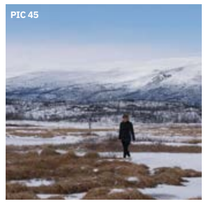
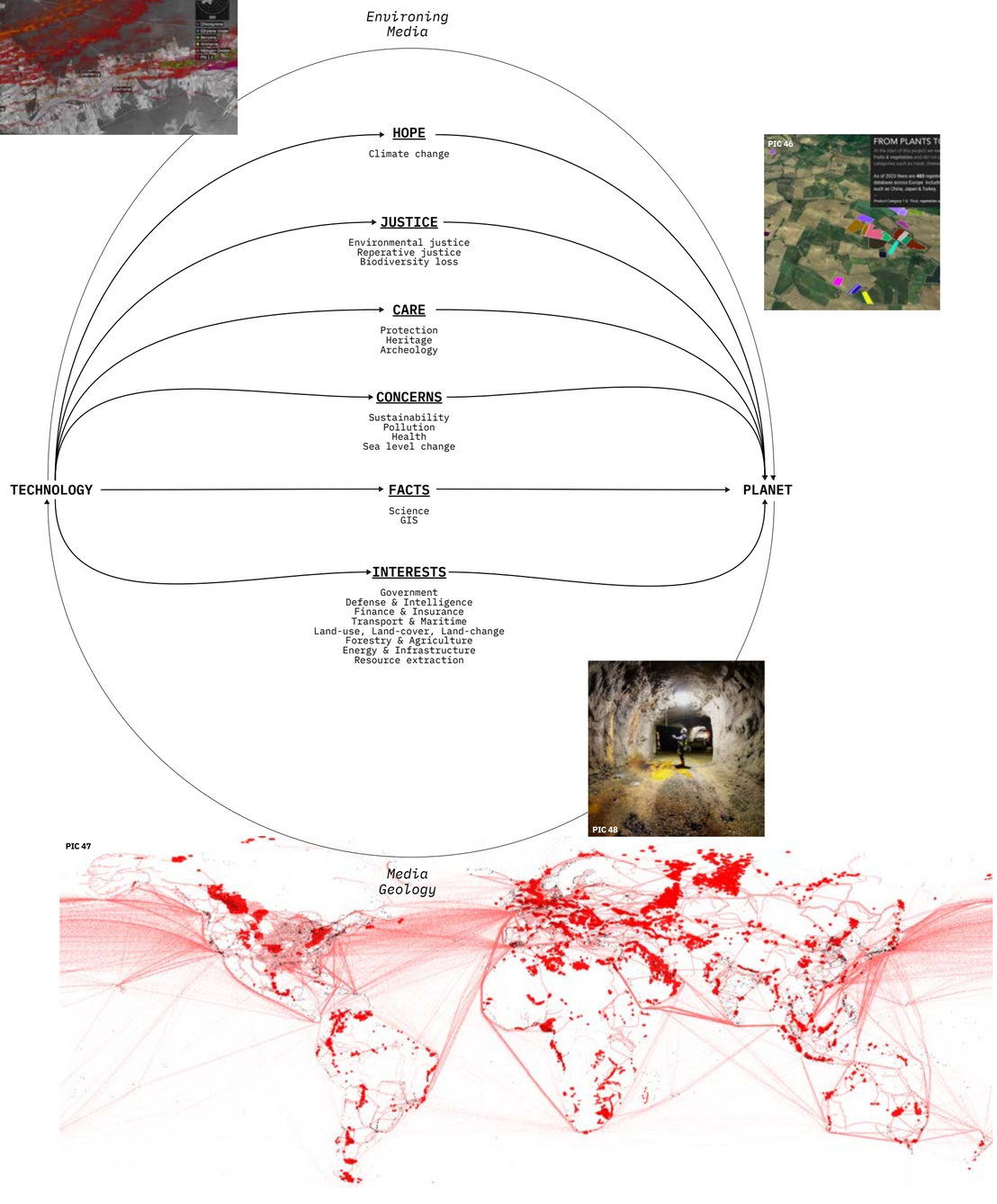
117 Lee, Annette S., Nancy Maryboy, David Begay, Wilfred Buck, Yasmin Catricheo, Duane Hamacher, Jarita Holbrook, et al. 'Indigenous Astronomy: Best Practices and Protocols for Including Indigenous Astronomy in the Planetarium Setting', *International Planetarium Society Conference Proceedings* 2020. https://doi.org/10.48550/ARXIV.2008.05266.

118 Michaela Fenske and Martha Norkunas. 'Experiencing the More-than-Human World'. *Narrative Culture* 4, no. 2 (2017): 105. https://doi.org/10.13110/narrcult.4.2.0105.

119 Luca, Tiago. *Planetary Cinema: Film, Media and the Earth.* Amsterdam University Press, 2021. https://doi.org/10.5117/9789463729628.







PIC 43: *If toxic air is a monument to slavery, how do we take it down?* (2021) by Forensic Architecture. **PIC 44 & 45:** *Spectral Lands* (2024) by Felicia Honkasalo. **PIC 46:** *Terroir that Travels* (2023) by Centre for Genomic Gastronomy (Cathrine Kramer, Zack Denfeld, and Emma Conley). **PIC 47:** *Becomig.eco(logical)* (2020) by Miha Turšič and Špela Petrič. **PIC 48:** *Void residency at the 1,444-metre deep Pyhäsalmi Mine* (2023) by Anti Tenetz. **PIC 49:** *MushMap* (2023) by Soldati, Margherita, Florian Geerken, Wanda Von Bremen, Bálint Csanád Katona, and Chris Julien. **PIC 50:** *Atlas Slovenia* (2024) by Miha Turšič. **PIC 51:** *Digitised archive of old cadasters, SI AS 176, SI AS 177, SI AS 178, SI AS 179, SI AS 180, SI AS 181, SI AS 182* (1823-1869) by Ministry of Culture, Archives of the Republic of Slovenia.

Planetary Mattering

Matter is both noun and verb—it is about *material* and *materiality*, and about how it matters. Mattering in vital materialisms cuts across human and nonhuman bodies, emphasising how human agency is dependent on non-human forces.[120] According to John Law, when it comes to the question of what matters, one needs to acknowledge that there is no single reality. "They are different realities that exist in different worlds with different facts. But values are also different and non-convergent."[121] Additionally, mattering is not just about *what* matters, but more about *how* it matters, and to whom it matters. Mattering is the process of meaning-making and situating concerns and care. It is the material process of what comes to matter, in the dynamic relations of different facts, values, ethics, feelings and emotions, and social-cultural-political-economical-technological arraignments. Since mattering is a material practice, it also actively shapes environmental and planetary materiality.

More-than-Planet thus explores how planetary entanglements between technologies and environments matter through different value systems practised by the variety of knowledge cultures, and through that, not only imagine the planet, but actively shape it.

Environmental and Planetary Mattering

In his well-known essay *Why has critique run out of steam? From matters of fact to matters of concern*, Latour proposed a shifting of critique from inquiring about matters of fact to addressing matters of concern. Instead of debunking what is considered fact, when human actors critique, the aim is to protect and care about what concerns them.[122] Environmental science is supposed to produce facts, but science is also culture, and scientists should therefore also think about how environmental facts come to matter through concern and care. In the capitalist system, environments are considered as matters-of-interest, both in the economic and the litigative sense. An official argument for biodiversity is often that it is in the human's interest to preserve species.[123] But this anthropocentric stance is deeply problematic, as by doing so, humans put themselves on the top of the hierarchy of beings, prioritising the interests of the species, rather than in the mesh of interdependencies with more-than-human.

Environmental mattering is three-fold. It means connecting facts of techno-environmental issues to what people care about, thus shifting from matters-of-fact to matters-of-care. It requires stepping out of the anthropocentric point of view and listening to, and becoming response-able to, the more-than-human and their needs.[124] That is to say, as Haraway describes, cultivating the capacity to respond *with* rather than *for* others, in ways that are situated, reciprocal, and shaped by entangled histories. Response-ability is not about control, but about staying with the trouble, as Haraway describes it —learning to live and act ethically within multispecies worlds.

For planetary mattering, this three-fold movement weaves into the planetary life-sustaining system and the interlocalities that connect the specific environment of each place with the planetary flows of water, air, materials, lives including humans, and toxins.

Ecofeminist thinker María Puig de la Bellacasa argues that speaking of care is not only about the labours of mundane maintenance and repair that require agency, but about the degree of liveability in a more-than-human world dependent on the care it is able to enact.[125] That means, for planetary mattering, More-than-Planet acknowledges the need to work with concepts, stories and technologies that facilitate and actualise care, moving from matters-of-fact and matters-of-interest toward matters-of-concern and matters-of-care. As Vanessa Machado de Oliveira points out, the single story of *forward - the progress* of modernity - is faltering.[126] We can see how *development* causes planetary disasters, propelled by extractivism and the centuries-old exploitation of the Earth and humans (colonialisms, slavery, enclosures of communally-stewarded lands, mining, deforestation, overconsumption, to name but a few). The roots of the violence of modernity/coloniality lie in the ontological and metaphysical realms, the realm of *being*, the story of how the human is separate from everything else: the imposed sense of separation between ourselves and the dynamic living land-metabolism that is the planet and beyond, as well as the theological separation between creature and creator.[127] The concept of human exceptionalism has been used to legitimise domination, ownership, management, and control of the natural environment.[128] Therefore, new concepts and stories are needed to imagine, to dance with, in order to work towards futures that can be *otherwise* than modernity/coloniality has prescribed.

In terms of technologies, these cannot be separated from cultures, and the stories that lead to their creations. On the other hand, as described in the chapter on environing media, technologies make environments. Therefore, it is not that humans need to make new technologies to *solve the problems*, but rather, More-than-Planet proposes, humans need to scrutinise the ideas behind mapping, orbital and space technologies, and how they make environments, and for whom. Do they enable the civil or more-than-human to use data and advocate care for the planet? At the same time, one should not neglect the technologies used by Indigenous peoples to maintain the reciprocal relationship between human and the life sustaining system, for instance inter-cropping,[129] malting/germina-

120 Bennett, Jane. *Vibrant Matter: A Political Ecology of Things.* Durham: Duke University Press, 2010.

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122 Latour, Bruno. 'Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern'. *Critical Inquiry* 30, no. 2 (January 2004): 225–48. https://doi.org/10.1086/421123.

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124 Lippert, Ingmar. 'How Do Environments Come to Matter?' *Science as Culture* 27, no. 2 (3 April 2018): 265–75. https://doi.org/10.1080/09505431.2017.1398225.

125 Puig de La Bellacasa, María. *Matters of Care: Speculative Ethics in More than Human Worlds*.

126 Machado de Oliveira, Vanessa. *Hospicing Modernity: Facing Humanity's Wrongs and the Implications for Social Activism*. Berkeley, CA: North Atlantic Books, 2021.

127 Machado de Oliveira, Vanessa. *Hospicing Modernity: Facing Humanity's Wrongs and the Implications for Social Activism*.

128 Machado de Oliveira, Vanessa. *Hospicing Modernity: Facing Humanity's Wrongs and the Implications for Social Activism*.

129 Belshaw, Deryke. 'Taking Indigenous Technology Seriously: The Case of Intercropping Techniques in East Africa'. *The IDS Bulletin* 10, no. 2 (January 1979): 24–27. https://doi.org/10.1111/j.1759-5436.1979.mp10002004.x.

tion,[130] prescribed burning,[131] and other agroecological technologies that do not involve high-tech. They are tools and techniques that are used to yield food and crops for a dignified life while nourishing the ecosystems.

For Latour, a **MATTER OF CONCERN** is what happens to a matter of fact when you add to it its whole scenography, much like you would do by shifting your attention from the stage to the whole machinery of a theatre.[132] As part of the *More-than-Planet* project, Waag Futurelab and Space4Good organised *Planetary Public Stack* research residencies, supporting four groups of artists. One of these groups—Centre for Genomic Gastronomy with Cathrine Kramer, Zack Denfeld and Emma Conley—investigated a case of agricultural concern:

> **TERROIR THAT TRAVELS** research residency asked how humans could make room for the plants and people that will migrate to and within Europe due to climate change. This project demonstrated how artists used Earth observation data for matters-of-concern: migrating plants and people caused by climate change. The collective looked into the EU crop map and *The Land Use/Cover Area Frame Survey* (LUCAS), and within the framework of Planetary Public Stack, they tried to map the changing terroirs of crops, and zoom in on the case of the pink garlic in Lautrec, France, looking into how drought has influenced it. They explored the dynamics between the moving terroir of the crop and the economical-cultural-political border of the crop that refuses to move. The project used legal documents, environmental data and satellite imagery to identify potential sites for pre-enacting disrupted tastes of place. It asks: "What does local food taste like when climate changes everything?", "Who and what belongs where?" and, "What will thrive and what will be left behind?" The collective has begun a process of visiting and meeting with impacted food communities to develop an ongoing conversation between remote sensing data and on-the-ground lived experience.[133]

María de la Bellacasa stresses that to work on **MATTERS OF CARE** means standing for sustainable and flourishing relations with the more-than-human, not merely survivalist or instrumental ones.[134] Another Planetary Public Stack research residency group—Margherita Soldati, Florian Geerken, Wanda Von Bremen, Bálint Csanád Katona, and Chris Julien—investigated urban case of environmental care:

> **MUSHMAP** research residency questioned what conventional map elements—such as surfaces, lines, and borders—fail to capture, and speculated on alternative ways to represent biodiversity and its boundaries. As a planetary matter of care, they wondered how we might collaborate with other species to hold liveable spaces for the more-than-human. They questioned the limitations of maps, the rigidity of the defining lines of maps, and why ecotones (transitions of two biological communities), as in where the in-between space of a park and urban space, are unrepresented in maps. What would maps look like from the point of view of living organisms such as fungi and underground root systems? Biodiversity raises questions: How are species engaging with their environments? Who is making the map—and whose agency is represented? Does a political border in the middle of a desert make sense?[135]

One of the endeavours in the pursuit of **MATTERS OF JUSTICE** is the acknowledgement of colonialism-capitalism as a driving force behind socio-environmental injustices, to centre state accountability in environmental governance and decision-making, and to recognise the value of restoring Indigenous knowledges and practices.[136] *More-than-Planet* exhibition in Leiden in 2022, presented the work of Forensic Architecture, presenting a case of environmental injustice and racism:

> **IF TOXIC AIR IS A MONUMENT TO SLAVERY, HOW DO WE TAKE IT DOWN? (2021)** In the US state of Louisiana, along the Mississippi River between Baton Rouge and New Orleans, a heavily industrialised *Petrochemical Corridor* overlays a territory formerly known as *Plantation Country*. Residents of the majority-Black *fenceline* communities bordering those facilities breathe some of the most toxic air in the country and suffer some of the highest rates of cancer, along with a wide variety of other serious health ailments. They call their homeland, *Death Alley*. Here, environmental degradation and cancer risk manifest as the by-products of colonialism and slavery. Together with fenceline community activist group RISE St. James, Forensic Architecture has developed a method to help locate unmarked cemeteries of enslaved people in support of long-standing local efforts to protect ancestral sites and contribute to demands for a moratorium on the further expansion of the Petrochemical Corridor. All of Forensic Architecture's research is open-source and made available to the public. Forensic Architecture built a platform that *mosaics* and *anchors* aerial imagery and maps from multiple sources, spanning three centuries of the region's transformation, including the reconstruction of the land according to racist, profit-oriented principles.[137]

In another initiative, the People's Planet Project, the initiators are building a planetary movement with the aim of assisting Indigenous communities in their battle against deforestation through the use of video technology and geospatial data.[138] For the team and the Indigenous communities, to fight for their territories as a commons and for the balance of Mother Earth is a matter of planetary justice. In a similar initiative, *Sensing for Justice*, citizen sensing is both a source of evidence in environmental justice litigation and as a tool for environmental mediation.[139] For the initiator Anna Berti Suman and the concerned citizens whose lives have been impacted by environmental problems such as pollution, the environment is a matter of justice.

MATTERS OF HOPE can be seen as critical in the time of disasters, because critical hope is an action-oriented response to contemporary despair.[140] It is also "an act of ethical and political responsibility that has the potential to recover a lost sense of connectedness, relationality, and solidarity with others."[141] Environmental activist groups such as Extinction Rebellion embody and practise radical hope, a hope for what is still possible, while supporting each other in preparation for a more turbulent future.[142] Through a regenerative culture they may salvage and repair what is left. On the other hand, from a perspective of queer feminism, Kim Q. Hall argues that those with radical hopes for queer crip feminist eco-futures must both desire and commit to alternative ways of life and relationships in a context of uncertainty (including the relationship to the planet and the organic and inorganic beings with which we share it). A viable future will therefore be both queer and disabled, since privileged, fossil-fuel-supported, consumption-centred human life will not be operable because of climate change and environmental disasters. The radical hope of queer crip feminism commits to experiment with living otherwise, and imagining the future as more-than-human.[143]

Planetary mattering calls for a shift from detached observation to entangled engagement. It foregrounds how environments are not only shaped through facts, data, and technologies, but also through values, concerns, and care. In doing so, it challenges dominant paradigms that treat Earth as a passive backdrop for human activity, and instead insists on a relational, situated, and more-than-human understanding of what matters—and for whom.

Through the lens of mattering, More-than-Planet invites us to attend to the processes by which planetary realities are made, recognized, and contested. This includes not only the infrastructures of sensing and mapping, but also the ontologies, cosmologies, and stories that determine whose worlds count and whose do not. Technologies, in this framework, are not neutral instruments, but rather, active participants in shaping planetary conditions, imbued with the narratives and power structures from which they emerge.

Planetary mattering, then, is not merely about caring for the planet in the abstract, but about cultivating practices of response-ability—ethical, political, and ecological—towards realising a liveable future. This requires not only the rethinking of technological development, but also making space for diverse knowledge cultures, cosmopolitical imaginaries, and intergenerational, more-than-human forms of care. In doing so, we begin to shift from matters-of-fact and matters-of-interest to a plural landscape of matters-of-concern and matters-of-care, in which the planet is not a problem to be solved, but a web of relations to be attended to.

130 Baranwal, Deepika. 'Malting: An Indigenous Technology Used for Improving the Nutritional Quality of Grains- A Review'. *Asian Journal of Dairy and Food Research* 36, no. 03 (3 August 2017). https://doi.org/10.18805/ajdfr.v36i03.8960.

131 Lewis, Henry T. 'Ecological and Technological Knowledge of Fire: Aborigines Versus Park Rangers in Northern Australia'. *American Anthropologist* 91, no. 4 (December 1989): 940–61. https://doi.org/10.1525/aa.1989.91.4.02a00080.

132 Latour, Bruno. 'What Is the Style of Matters of Concern?' In *The Lure of Whitehead*, edited by Nicholas Gaskill and A. J. Nocek, 92–126. University of Minnesota Press, 2014. https://doi.org/10.5749/minnesota/97808167995 9.003.0004.

133 Waag Futurelab. 'Planetary Public Stack Research Residencies'. *More-than-Planet* (blog). 15 January2025. https://www.more-than-planet.eu/logs/planetary-public-stack-research-residencies.

134 Puig de La Bellacasa, María. Matters of Care: Speculative Ethics in More than Human Worlds.

135 Waag Futurelab. 'Planetary Public Stack Research Residencies'. *More-than-Planet* (blog). 15 January2025. https://www.more-than-planet.eu/logs/planetary-public-stack-research-residencies.

136 Johnson, Adrienne, and Alexii Sigona. 'Planetary Justice and "Healing" in the Anthropocene'. *Earth System Governance* 11 (January 2022): 100128. https://doi.org/10.1016/j.esg.2021.100128.

137 Forensic Architecture, *Environmental Racism in Death Alley*, Louisiana, 2021-ongoing, investigation.

138 People's Planet Project, *People's Planet Project*, 2019-ongoing.

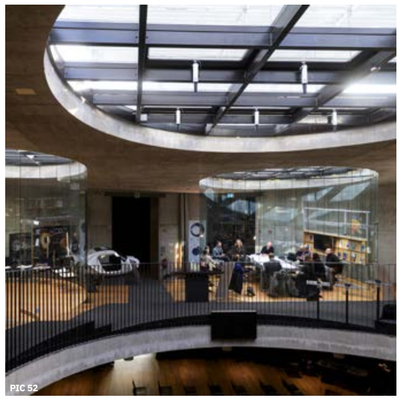
139 Berti Suman, Anna, *Sensing for Justice*, 2023.

140 Bozalek, Vivienne, Brenda Leibowitz, Ronelle Carolissen, and Megan Boler, eds. *Discerning Critical Hope in Educational Practices*. London ; New York, NY, 2013.

141 Zembylas, Michalinos. 'Affective, Political and Ethical Sensibilities in Pedagogies of Critical Hope: Exploring the Notion of 'critical Emotional Praxis'. In *Discerning Critical Hope in Educational Practices*, edited by Vivienne Bozalek, Brenda Leibowitz, Ronelle Carolissen, and Megan Boler, Routledge, (2013): 11–25.

142 Stuart, Diana. 'Radical Hope: Truth, Virtue, and Hope for What Is Left in Extinction Rebellion'. *Journal of Agricultural and Environmental Ethics* 33, no. 3–6 (December 2020): 487–504. https://doi.org/10.1007/s10806-020-09835-y

143 Hall, Kim Q. and Philosophy Documentation Center. 'No Failure: Climate Change, Radical Hope, and Queer Crip Feminist Eco-Future'. *Radical Philosophy Review* 17, no. 1 (2014): 203–25.



PIC 52

The Cultural Gravity of Space: **Policy, Practice, and Imagination**

The European Cultural Outer Space Activities (ECOSA) Lab explored the foundations of cultural and artistic engagement with outer space. The study revealed that artists working with outer space and planetary themes regard art as a legitimate form of knowledge production, exploring cultural and philosophical dimensions, and offering alternative imaginaries. There is a shared frustration with the superficial inclusion of art in space contexts, where art is often instrumentalised for outreach and impact. Instead, artists call for structural integration into space institutions, research and innovation frameworks, long-term support for independent and critical practices, and the democratisation of space beyond purely scientific and national interests. Many artists and cultural organisations operate through fragile, project-based networks, relying on DIY infrastructures, alternative communities, and cross-disciplinary collaborations to pursue research-led, often speculative, and culturally grounded work. This precarious mode of operation reflects a deeper asymmetry in how knowledge is legitimised in space discourse—where artistic and cultural approaches remain marginalised despite their contributions to planetary imaginaries and epistemic pluralism.

While the More-than-Planet project broadly demonstrates the diverse ways in which artists engage with outer space and planetary issues, often in parallel with governmental, scientific, and industrial efforts, the ECOSA study focused more specifically on the structural changes required. It addressed necessary shifts in cultural and space policy, institutional culture, and the development of new models of collaboration.

Institutional and Structural Recommendations

There is a need for structural inclusion of societal and cultural activities within the space sector and its programmes. This includes embedding culture at strategic levels, developing lasting frameworks, and ensuring autonomy for artists.

- **MAKE CIVIL SOCIETY A REAL ACTOR IN SPACE POLICY.** Eliminate structural barriers that limit civil society's contribution to the space sector, and create inclusive engagement mechanisms for cultural organisations, local communities, and NGOs. These often gather otherwise marginalised actors, such as Indigenous and LGBTQ+ communities.
- **CULTURAL MANDATES WITHIN SPACE INSTITUTIONS.** Establish formal roles for cultural producers within space agencies and institutions, not just one-off artist residencies or exhibitions organised by individual champions. These should be strategic and systemic.
- **INDEPENDENT ARTIST INFRASTRUCTURE.** Create funding mechanisms and support structures that respect artists' autonomy, rather than demanding alignment with predefined institutional goals or trends.
- **LONG-TERM SUPPORT FOR CRITICAL CULTURAL RESEARCH.** Space agencies should not treat art alone as a communications or outreach tool, but support it as a valid form of knowledge-making and critical thinking.
- **POLICY-LEVEL INTEGRATION.** Include art and culture as essential contributors in official space policy agendas, diversity programmes, sustainability efforts, and democratisation frameworks. Monitor the inclusion of culture, democracy, and civil society in political and institutional narratives. Reassert exploration and imagination as core to space engagement.
- **SHIFT FROM OWNERSHIP TO RESPONSIBILITY, STEWARDSHIP, AND COMMONS.** Reframe the discourse, moving away from owning nature or space towards caring for, and managing, shared planetary systems collectively, through the commons.

PIC 52: *ECOSA workshop during the Expedition to Public Outer Space at KSEVT* (2024) by Waag Futurelab, photo by Katja Goljat.

Cultural, Epistemological & Methodological Shifts

The role of art in the space sector is not to reaffirm existing norms but to challenge them and seek new ones. To truly reimagine space, the space sector must embrace alternative ways of knowing, such as those provided by the arts, Indigenous epistemologies, or speculative thinking.

- **RECOGNISE ART AS EPISTEMOLOGY.** Art should be seen neither as decoration nor a narrative boost, but as a tool to generate knowledge, challenge assumptions, and explore new ontologies of outer space.
- **CHALLENGE SYMBOLIC/PERFORMATIVE DECOLONISATION.** Avoid shallow gestures of inclusion or decolonisation that still operate within established institutions. Ensure that terms like "community" or "decolonial" are situated in actual practice.
- **SUPPORT FRAGILE, POETIC, NON-INSTRUMENTAL PRACTICES.** Many cultural approaches—such as sonic ceremonies, speculative rituals, or performative cartographies—do not yield easily measurable outcomes, yet carry deep emotional and cultural significance. Their value is often overlooked in the space sector, where societal impact is typically assessed through superficial metrics. For example, artistic interventions that honour ancestral sky knowledge or commemorate erased colonial histories of celestial navigation offer ways of relating to space that are affective, restorative, and culturally rooted—yet rarely find recognition by space institutions.
- **RECOGNISE COMPARATIVE PLANETARY IMAGINARIES.** The interdependence of space activities, society, and environments should be acknowledged as part of cultural and epistemological diversity. While the space sector is traditionally founded on techno-optimism, art produces novel, complex, and subtle imaginaries of outer space and the planetary condition.

Collaboration & Cross-Sector Dynamics

Meaningful collaboration between artists, scientists, and institutions requires mutual respect, structural support, and a rejection of extractive models. Artists need time, resources, and allies, not token invitations.

- **ENCOURAGE MUTUAL RESPECT IN COLLABORATIONS.** Artists must gain enough technical grounding to respect the labour of engineers and scientists. Avoid extractive models in which artists simply "borrow" expertise without context.
- **FACILITATE BETTER MATCHMAKING.** Support systems should help connect experimental artists with like-minded developers or technologists willing to work under artistic conditions (e.g., low pay, DIY environments).
- **VALUE COMMUNITY-DRIVEN WORK, BUT AVOID EXPLOITATION.** Outreach and educational efforts should not be unpaid labour for artists. Institutions should properly value and resource these activities.
- **BRIDGE GLOBAL SOUTH AND GLOBAL NORTH ASYMMETRIES.** More focus is needed on supporting artists and researchers from non-spacefaring nations. Democratisation must go beyond access for countries—it must include the diverse cultural specificities of the Global South.

Although it is not necessarily expected that the space sector will adopt these cultural recommendations, they serve as valuable guidelines for cultural organisations and practitioners in developing new programmes. More-than-Planet will use these guidelines as a reference for future activities.

Conclusion: **Toward Just Earth-Space Society**

The contemporary planetary condition is not alone a matter of environmental urgency. It is a conceptual, infrastructural, and epistemic battleground. As Earth is increasingly sensed, modelled, and governed at planetary scale, it becomes ever more urgent to ask: *which planet is being made, with what knowledge, by which infrastructures, and for whom?*

More-than-Planet studies the entanglements between planetary imaginaries, knowledge cultures, and technological systems. It asserts that the planet is not a passive object to be observed, governed, or rescued. Instead, it is continuously made—conceptually, materially, and politically—through the ways it matters to different cosmologies, communities, and life-forms. In response to the dominant, often universalising narratives of the globe, Earth system, and Anthropocene, this project offers a layered, situated alternative: a planetary public stack where multiple ontologies, epistemologies, and agencies can co-exist and co-shape shared futures.

Taken together, these shifts outline a framework for planetary governance, one that is co-created, critical, and committed to justice. As planetary crises deepen and geopolitical tensions extend into space, it is not enough to intervene in policy or technology alone. We must also intervene in the stories, systems, and structures that make the planet matter.

Reclaiming Planetary Concept-Making

PIC 53

Planetary concepts are not neutral abstractions. They are powerful frameworks that influence how Earth is imagined and shaped. Reclaiming planetary concept-making involves critically examining how dominant cosmologies are produced and legitimised, while cultivating the conditions for more diverse and alternative imaginaries to form. More-than-Planet advances this work by assembling conceptual, technological, and ethical tools that unsettle universal planetary narratives in support of plural, situated, and more-than-human ways of world-making.

Established planetary figures such as the globe, Gaia, Earth system, and the Anthropocene are not merely descriptive. They are steeped in colonial histories and universalising logics that often marginalise other epistemologies. Developing a critical understanding of these frameworks enables creative, civic, and research actors **TO INTERVENE** in the dominant technologies, infrastructures, and institutions that shape planetary governance, creating a shift toward more equitable, accountable, and responsive configurations.

At the same time, empowering marginalised and Indigenous cosmologies offers opportunities **TO LEARN** from less well-known but co-existing traditions. These knowledge systems contribute distinct ontologies, practices, and values, enriching planetary thinking through both their comparability and their deeply rooted contextual specificity.

Recognising that all planetary concepts are cultural artefacts allows us **TO DEVELOP** new, reflexive concepts that continuously evolve from emerging knowledge cultures, technologies, and embodied modes of environmental entanglement. These are not fixed definitions, but living tools for rebuilding planetary conditions.

Reclaiming planetary concept-making is vital in addressing contemporary environmental and technological challenges, challenges that often fail to critically examine their underlying assumptions and overlook the potential of a vast diversity of alternative perspectives.

Recognising the Multiplicity of Knowledge Cultures

More-than-Planet begins from the understanding that knowledge is not singular, universal, or apolitical, but diverse, situated, and shaped by histories of power and exclusion. Today's dominant knowledge cultures, especially those rooted in Western science, technology, and economy, evolved through the intertwined trajectories of colonialism, modernisation, and globalisation. These systems have been instrumental in shaping Earth as a measurable and manageable entity. However, this dominance has come at the cost of epistemic diversity: marginalising other ways of knowing, flattening ontological difference, and rendering alternative relations to Earth illegible or irrelevant.

In response, *More-than-Planet* seeks **TO DECENTRE DOMINANT EPISTEMOLOGIES** by actively questioning the authority of Western science and technology as default frameworks. It fosters spaces for dialogue between diverse knowledge systems—Indigenous, local, feminist, non-Western, and community-based—without assimilating them into dominant logics. This includes supporting epistemic diversity by funding and platforming knowledge-holders from traditions that are often underrepresented, and embracing multilingual, multisensory, and non-textual modes of knowledge transmission and archiving.

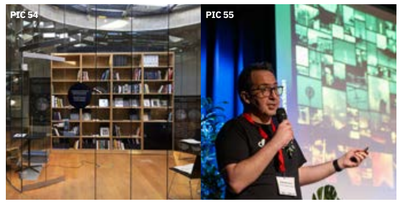
This effort also demands **A COMMITMENT TO ONTOLOGICAL PLURALISM**, recognising that not all worldviews conceptualise Earth as a system. For some, Earth is kin, territory, spirit, or community. As such, *More-than-Planet* supports the design of tools and methods that accommodate relational, cyclical, and non-binary worldviews, going beyond conventional scientific models.

The project also works **TO DEMOCRATISE ACCESS TO KNOWLEDGE INFRASTRUCTURES**, making scientific tools such as satellite data, modelling platforms, and Earth observation systems available to civil society, artists, and local communities. By building co-created platforms, it enables these communities to produce, validate, and share knowledge on their own terms.

In its broader aim to confront Earth–Space systemic injustices, *More-than-Planet* **RECOGNISES THE WORLD-MAKING POTENTIAL** of Indigenous and marginalised knowledge cultures—not only as traces of erased heritage, but as dynamic forms of resilience and resistance to ongoing systemic inequalities. Artistic research, investigative aesthetics, and critical making likewise reveal embedded injustices in technological systems, dominant narratives, and extractive infrastructures. Recognising marginalised knowledge cultures amplifies their voices and affirms their legitimacy in addressing shared planetary, environmental, and technological challenges.

As these knowledge cultures remain dispersed and under-recognised, *More-than-Planet* works **TO MAKE THEM VISIBLE AND ACCESSIBLE TO A WIDER PUBLIC**. With spacecrafts like the Voyagers leaving the solar system behind, and no dedicated library for planetary and outer space arts, culture, humanities, and social sciences, the project has established new infrastructures for collective memory. The physical KSEVT collection and the online More-than-Planet catalogue serve to collect, support, and disseminate these unique bodies of knowledge—preserving and sharing plural planetary imaginaries for generations to come.

Opening Planetary Infrastructures


PIC 54

PIC 55

If you can't open it, you don't own it. This principle extends beyond hardware, software or data transparency. It strikes at the heart of planetary sovereignty and justice. Infrastructures—satellites, instruments, data platforms, and computational models—are the invisible physical architectures through which the planet is sensed, imagined, governed and shaped. Today, these systems remain largely controlled by state, military, and corporate actors. Yet what they observe and model affects everyone, humans and non-humans.

Opening planetary infrastructures is a democratic imperative. It means challenging the prevailing opacity of Earth observation systems and reclaiming environmental data as a public good. It calls for public computation—where technologies are designed not just for efficiency or profit, but for care, participation, and accountability. Initiatives like Libre Space Foundation and Open Weather exemplify how open-source and citizen-led efforts can produce alternative infrastructures rooted in local relevance, autonomy, and distributed stewardship.

The need for pluriversal knowledge also requires an appropriate knowledge infrastructure, built for epistemic plurality, relational ethics and decolonial practices. Reorienting them toward inclusivity requires not just technical interventions, but also cultural shifts toward shared ownership, interdependence, and respect for situated knowledges. This includes the agencies of artists, activists, Indigenous communities, and even non-human actors whose environments are governed by invisible technological stacks.

To open planetary infrastructures is to redistribute power across the stack, from orbital architectures to interface layers. It means inviting plural imaginaries into the circuits of sensing, data modelling, and acting. In doing so, More-than-Planet provides for a truly public planetary condition, one that is not simply observed from above but composed, through collaboration, dissent, and collective care, from below.

Reclaiming Planetary Matterings

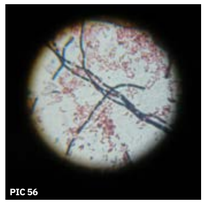
The shift from territorial globalisation to planetary governance demands more than institutional reconfiguration. It requires a fundamental rethinking of how the planet is made to matter. In the contemporary planetary condition, mattering is not a neutral process. It is a cultural, political, and technological practice that defines *who* and *what* counts in the making of shared worlds. More-than-Planet has revealed that planetary imaginaries are not merely cognitive models or scientific abstractions, but are deeply shaped by knowledge cultures, media infrastructures, and ways of mattering.

Reclaiming planetary mattering means refusing inherited epistemic hierarchies and embracing the multiplicity of ways in which the Earth becomes meaningful, from Indigenous cosmologies and situated knowledges to critical making practices and speculative imaginaries. Doing so insists we move beyond the logic of facts and interests toward a politics of concern, justice and care. This reclamation is both conceptual and infrastructural. It opens up the technological stacks that shape environmental governance, and it makes space for plural, sometimes conflicting, ways of knowing and relating to Earth.

In times of environmental injustice, climate collapse, and orbital enclosures, planetary governance must begin with **RECLAIMING HOW THE PLANET MATTERS—AND TO WHOM**. This requires not only the inclusion of new actors, but the transformation of the very terms of participation. It is not enough to speak of sustainability or resilience without addressing histories of extraction and exclusion. Mattering must become a practice of care, oriented toward justice, plurality, and regeneration.

By recognising mattering as the foundational act of planetary governance, we can begin to imagine and enact an Earth–Space society that is not only technologically advanced but also socially inclusive, environmentally just, and culturally diverse. The work of planetary mattering is ongoing, contested, and urgent. It is through this work that planetary futures are both reclaimed and (re)made.

PIC 53: *Atlas Slovenia* (2024) by Miha Turšič. **PIC 54:** *KSEVT Library* (2024) by Waag Futurelab, photo by Katja Goljat. **PIC 55:** *Libre Space Foundation presenting at Public Outer Space panel discussion* (2024) by Waag Futurelab, photo by Lotte Dale.



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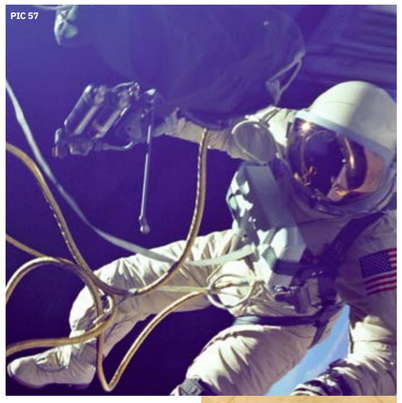

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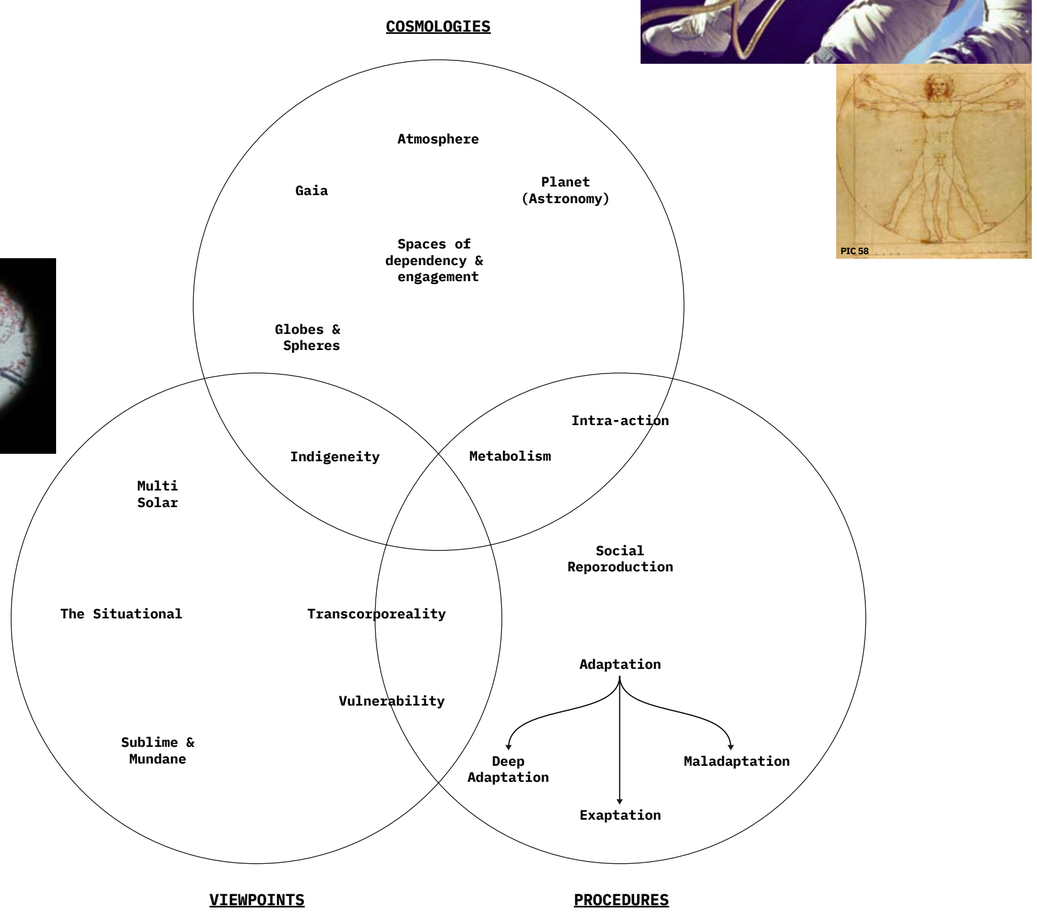

PIC 59

PIC 60

PIC 56: *Bacillus cereus and Escherichia coli*. **PIC 57:** Leonardo Da Vinci, *Vitruvian Man*. For NASA engineers, "Our great twentieth-century space adventure has become far more than a long journey to the planets. It has become a journey into man." This is a journey deeper into the human as figured in the image of the Vitruvian, the human singularity to be resourced, defended, and articulated into symbolic and technical perfection for survival's sake. **PIC 58:** Edward H. White II, the first astronaut to 'let go' and drift in zero gravity, 1965, was still nevertheless locked into a relation of interdependence through the cumulative umbilical cables tethering him to shuttle, station and, ultimately, planet. These serve as the connective tissue of life in a cosmos of risks. A cosmopolitical approach allows for a figure of the human that has less to do with the body as the sovereign scene of its own invention and actions, and more to do with the body as the scene of disabused mastery. **PIC 59 & 60:** *Holding Rivers, Becoming Mountains* (2024) by Solveig Qu Suess.

More-than-Planet Working Group: Research Collection

Planet - A Cultural Affair

Lukáš Likavčan

This collection of essays and research reports is the result of a year of discussions between the members of More-than-Planet Working Group (WG), which consisted of Solveig Suess, Adonis Leboho, Klára Pelousková, Lukáš Likavčan, and Chris Julien. The members of the WG would like to extend their thanks to the supportive community of Waag Futurelab, especially Miha Turšić, Zeynep Birsel, Natalia Vargas, Zoénie Liwen Deng and Bonnie van Vugt. Special credit is also given to the attendees of the workshop organised by the WG at the 2023 edition of transmediale, titled "Towards a Planetary Cultural Landscape": Sam Danello, Nicola Triscott, Jol Thoms, Amy Harris, Martin Born and Pragya Jain.

At the beginning of the discussions of WG were two pivotal, deeply intertwined questions, which emerged from the project mission of re-imagining the cultural-scientific understanding of the planetary environment as a conceptual whole:

1. How to think about the planet as a cultural object?
2. Why is there an urgency for integration of cultural practices into planetary and outer space research?

Although the contributions in this collection do not provide exhaustive or definitive answers to these questions, they introduce the problem space and the conceptual landscape that can inform potential ways of addressing both of them. This strategy follows the WG's research methodology, which begins with the unique training and intellectual perspective of each member of the group. After pooling concepts informed by the respective backgrounds of WG's members, they were organised into three clusters (based on their semantic familiarity) – **COSMOLOGIES**, **VIEWPOINTS** and **PROCEDURES** – and further discussed at the Transmediale 2023 workshop with its participants. The internal notes produced at the workshop then served as the basis for revision of the diagram of the conceptual landscape, which allowed each member of the WG to navigate individual choices regarding how to approach their final contributions.

In 1976, eight countries - Brazil, Colombia, Congo, Ecuador, Indonesia, Kenya, Uganda and Zaire - unilaterally declared that their territory extended infinitely up into outer space; this effectively claimed their sovereignty over what is known as "geostationary orbit" - an orbit enveloping the Earth's equator, which is important for navigation satellites. This decision, referred to as the Bogotá Declaration, was never approved by any other country, yet the declaration presents a powerful case that brings to the surface the question of who outer space belongs to, and how politics and culture happen not just here on Earth, but also up above the clouds. In particular, it responds to a paradox between the reality of outer space geopolitics and lofty promises of the 1967 United Nation's Outer Space Treaty, which stated that "exploration and use of outer space [...] shall be the province of all mankind."[1] Whereas Article II of the treaty says that "[o]uter space [...] is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means,"[2] the practical reality of power relations in space in the early 1970s was that the realm was essentially occupied by the USA and USSR; this left other countries without much say in cosmic affairs, including satellite orbits. For this reason, the eight equatorial countries defined in the declaration the geostationary orbit as a limited natural resource that belongs to them. Based on this definition, the countries further claimed that the geostationary orbit is unfairly managed (or in fact occupied) by external actors. As the Bogotá Declaration reads, "under the name of a so-called non-national appropriation, what was actually developed was technological partition of the orbit, which is simply a national appropriation, and this must be denounced by the equatorial countries."[3]

What is interesting, however, is not just the radical act of reclaiming outer space as an extension of the natural wealth of a country - which foregrounds the question of justice and public good with respect to cosmic research and its technological applications - but also the cultural impact of this gesture. The Bogotá Declaration inspires investigation about how outer space becomes endowed with meaning, and as a result, how cosmic realities enter into a feedback loop with human cultures. For example, the "Declaration of the first meeting of equatorial countries" (as the title of Bogotá Declaration goes) became a leeway for artists Joanna Griffin and Alejo Duque "to draw out what the geostationary orbit can mean to us and to define our own protests, rituals and love songs in relation to it."[4] In this vein, the declaration is interpreted not just as a claim of sovereignty, but also of the right of Earth-bound humans to decide upon a cultural meaning of a portion of outer space. This is what anthropologist Lisa Messeri calls *gestures of cosmic relation*. As she puts it, "astronomy does not stand apart from terrestrial pursuits but rather deeply informs understandings about Earth and our modes of being in the world."[5] She continues her explanation with comments on the most famous chapter from the history of outer space culture - the Apollo astronauts' photographs of the Earth:

> "The most significant legacy of the Apollo missions was not a deeper scientific understanding of the moon but rather a view of Earth from space that became totemic for the environmental movement. Even though human space flight was meant to push us further into the solar system, the Apollo astronaut's gesture of cosmic relation directs our attention back down toward Earth, refocusing on the one planet known to be capable of sustaining life."[6]

1 UN General Assembly (1967). 2222 (XXI). *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*. United Nations, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html.
2 Ibid.
3 *Bogotá Declaration* (1976), https://www.jaxa.jp/library/space_law/chapter_2/2-2-1-2_e.html.
4 Triscott, Nicola (2016). "Transmissions from the Noosphere: Contemporary Art and Outer Space." In Dickens, Peter and Ormrod, James S. (eds). *The Palgrave Handbook of Society, Culture and Outer Space.* London: Palgrave Macmillan, 415-444.
5 Messeri, Lisa (2017). "Gestures of Cosmic Relation and the Search for Another Earth." *Environmental Humanities* 9(2), 327.
6 Messeri, "Gestures of Cosmic Relation," 327.

One of the central motivations of the More-than-Planet project is that these recursive gestures - when the knowledge of celestial affairs is beamed back to Earth - constitute the real essence of outer space exploration, and that these gestures inevitably concern cultural and political domains of human existence. The Bogotá Declaration is a great example of such a gesture, and one can find countless other instances of these gestures in the history of artistic and design practice, as shown by other contributions in this whitepaper.

Another way to enter the argument about the socio-cultural role of outer space would be by means of analogy. Take any city in the world - there is surely a way to rigorously define a city as a human settlement with a certain population threshold, density, administrative status or public functions and services. Yet this definition is by no means exhaustive of what constitutes a city in reality. Every city is also a cultural object: it exists in the shared dimension of human imagination and it means different things to different people. For example, a city can be seen by some as a home; for others, it might be viewed a place they would never even consider visiting. Notice the use of the word "place" here – the use of this word already signals the realm of meaning-making. "Place" denotes something familiar and intimate, as opposed to the abstractness and emptiness of "space". Seen from the vantage point of outer space, Lisa Messeri claims that human dealings with cosmic realities – both scientific and popular – are marked by such operations of endowing meaning.[7] She calls these operations *extraterrestrial place-making*:

> "Place is more than a given category; it is a way of knowing and of making sense. In connecting the mundane and the extraordinary, extraterrestrial placemaking grounds knowledge of other planets in familiar contexts. Scientific practices of place-making turn the infinite geography of the cosmos into a theatre dotted with potentially meaningful places that are stages for imaginations and aspirations."[8]

Think about exoplanet scientists. In their daily routine, they encounter objects of their interest only indirectly. For example, the first planet orbiting another star ever discovered, called 51 Pegasi b (or Bellerophon), was detected by means of the radial velocity method, which is based on observing minuscule periodical shifts in a star's electromagnetic spectrum caused by the orbiting exoplanet.[9] Hence, the planet has never been directly imaged, as is also the case with the vast majority of almost 6000 exoplanet candidates astronomers know of today.[10] Similarly, the most successful method to date – the *transit method* (employed by the well-known Kepler space telescope) - relies on indirect observation. It takes advantage of repetitive oscillations in the luminosity of a star caused by an orbiting planet passing in front of it from the perspective of an observer on Earth. The diagram of the changing amount of light beamed by the star in direction of the observing telescope is called the "light curve", and it usually looks like this:

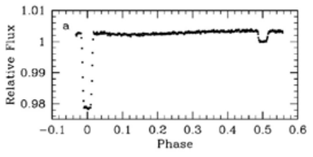

Figure 1. Light curve of the star HD189733A and its planet HD189733Ab. The dip on the left side is the primary eclipse; the second dip represents the secondary eclipse. Taken from Seager, Sarah and Deming, Drake (2010). "Exoplanet Atmospheres." Annual Review of Astronomy and Astrophysics 48, 640.

According to Messeri, to make sense of their abstract discoveries - which exist mostly as raw data from telescopes translated into diagrams and plot charts - exoplanet astronomers mobilise a great deal of creativity and imagination, not unlike artists. They talk about distant planets as worlds, in order to emphasise that they are real places "that can be not only perceived but also experienced."[11] Messeri continues:

> "'World,' unlike 'planet,' connotes an inextricable linking between Earth and humanity. It is this relationship that exoplanet astronomers leverage. 'World' elevates the exoplanet above a simple scientific thing, marking it as something, someplace, that is relatable to our own experience and existence."[12]

This leads to one of the central questions of this contribution: What actually is a planet? The meaning of this term in English goes back to its ancient Greek origins - *planetai* has its roots in the verb "to wander", hence ἀστέρες πλανῆται (*asteres planetai*) were "wandering stars". The Greek name reflects the visible movement of these celestial bodies across the night sky. While stars appear to be static with respect to each other, planets travel on the cosmic foreground, appearing and disappearing while changing their mutual constellations in a rather complex fashion. Beyond the Western tradition, planets were similarly identified and systematically observed in many cultures ranging from those in South America to East Asia. In all of these cultures, planets have held a firm place in the organisation of human activities, endowed with cultural meanings associated with yearly cycles or mythological narratives. Since it became possible to study them closer - first thanks to modern telescopes and later space probes - they also firmly entered the realm of visual cultures, on top of making their lasting cultural impact as attractors of ceaseless public curiosity and imagination.

From a more scientific point of view, we can begin with the Resolution 5A (also referred to as Resolution B5), accepted at the International Astronomical Union's (IAU) congress held in Prague in 2006. According to this definition, a planet is a celestial body that

1. is in orbit around the Sun,
2. has a nearly round shape, and
3. has cleared the neighbourhood around its orbit. [13]

The first point in the definition has been evident ever since Copernicus' heliocentric model; the second point has even longer history, dating back to ancient cultures of Greece and India. What remains unclear is the rather technical point three. Put in simple terms, this point demands that a planet achieve "gravitational dominance" - its gravity must be strong enough to either pull away any small objects from its orbital trajectory, or to adopt them as permanent satellites (such as Earth's Moon, or the dozens of smaller or larger satellites orbiting Jupiter). Such a definition has some serious consequences: when it was accepted at the 2006 congress of IAU in Prague, the immediate result was the relegation of Pluto to the status of "dwarf planet", since it did not fulfil the third criterion of gravitational dominance. Thus, the Solar System lost one planet, its youngest and smallest family member. Of course, this move has been met with many critical reactions, notably by Alan Stern, the principal investigator of the New Horizons mission (the first probe that closely studied Pluto and other KBOs, launched in the same year as IAU's Prague congress). Stern argued that the criterion of gravitational dominance has absurd consequences, and that the decision-making leading to Resolution 51 was far from scientific, led instead by personal preferences and politics within the scientific community.[14] Later, when the New Horizons probe made its flyby around Pluto, it turned out to be much more similar to the official eight planets of the Solar System than previously thought. Instead of a dead, cold body, Pluto shows evidence of water in the polar ice caps, geological activity resulting in a diverse, mountainous surface, volcanoes and nitrogen glaciers (including the famous heart-shaped Sputnik Planitia), as well as atmospheric phenomena such as ground fogs and clouds.[15]

Although it is very unlikely the IAU definition will be reverted in the foreseeable future, the case of Pluto is an important gateway towards relativizing astronomical definition for the sake of other contexts in which planets occur. Planets are not pure scientific objects; as suggested by Messeri, they represent a case of *boundary objects* between otherwise divergent communities of practice.[16] Susan Leigh Star and Geoffrey C. Bowker developed this term in order to focus on how real objects simultaneously exist in multiple worldviews, and how they facilitate acts of classification or transfers of insights between various ways of knowledge-making:

> "Boundary objects are thus both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use and become strongly structured in individual-site use."[17]

What this means is that there is an actual possibility that IAU's scientific definition can peacefully coexist alongside other conceptualisations of what a planet is (folk, cultural, political, artistic), which may or may not count Pluto among the planets. If planets are not just scientific objects, but also carriers of cultural meaning, it is not just up to astronomers' discretion what will and what will not be a planet. In other words, the status of a planet is not just an astronomic "matter of fact", but also a social and cultural "matter of concern", to use Bruno Latour's terminology.[18] Or as Lisa Messeri frames it in her early contribution to the Pluto debate, one cannot rely here just on *scientific cosmology*, but also on *cultural cosmology*:

> "Cultural cosmologies broadly encompass lay understandings that there are nine planets in the Solar System, with each planet having an associated mythology that gives it a personality, and with Earth as unique among the planets. Pluto takes its place within this cosmology as the endearing underdog and oddball. Astronomers who were concerned that the lay audience would be alienated or upset if the definition of planet was too technical or if Pluto was no longer a planet sought to preserve the cultural cosmology within the new definition."[19]

After all, even some astronomers agree with such a viewpoint. Besides Alan Stern, one can mention Michael E. Brown from California Institute of Technology. In his conversation with Gibor Basri, he admits that "it has become apparent in the past few years that the extent of education and media makes it unlikely that the idea of Pluto as a true planet will ever be abandoned."[20] He thus concedes that culture has an overwhelming say in the matter of what a planet is, while elegantly stating: "Planets are far too important to culture to expect that any newly legislated definitions will have much sway."[21]

Once its becomes clear that the status of a planet is not just an expert issue, one can follow up with another question: Shouldn't planets, their status and their role, be a kind of public concern? One can say that is clearly the case with at least one planet - the Earth. The ecological emergency of the climate crisis makes urgently visible the status of the Earth as a public space and as a focal point of cultural activity. So what prevents us from extending this concern to other planets? After all, the discovery of climate change is part of the history of technoscientific reflexivity - the ability of the knowledge apparatus of science to look back at itself and view technoscientific activities as a part of the larger context of human pursuits (e.g,. of the economic production and consumption, related to the use of non-renewable energy resources resulting in carbon emissions). This discovery was made possible by almost two hundred years of foundational shifts in Western chemistry and physics caused in large part by the development of new astronomical knowledge and methods.[22] A pattern emerges here: the long march of exchange between natural sciences, culture and the ramification of public affairs, melting these three ostensibly separate domains into one continuum. In this continuum, scientific entities simultaneously exist as cultural objects or protagonists of political affairs, testifying to their status as boundary objects.

As a reader, you may now be asking: do we want to refuse the astronomical definition of a planet? Is the aim to deny science the authority to say what a planet is? Surely we do not want to deny the authority of science in defining a planet, since we admit the way of knowing and the picture of the world Western science produces is relevant to many aspects of human life, both individually and collectively. What we would deny, however, is a kind of privileged position, which would make science's position the default applied to the world, without providing extra justification on a case-by-case basis (ideally a kind of justification that is broadly accessible to the public). Hence, in our perspective, Western science belongs to a larger pool of knowledge-making practices, alongside art, politics, religion or folk beliefs. Or put differently: science lives in the environment of culture(s), which is the most general term for sets of regular practices (including production of knowledge) shared by people in a community. It follows that science is cultural through and through; culture - such as visual cultures of the astronomical study of planets and other cosmic objects - is not a by-product of science, or some apex of the pipeline meant mainly for PR and interaction with a "general audience": it is an integral part of what science is and how it makes sense of the world. Making knowledge means making culture, and vice versa. And it is exactly the reverse order of this slogan - i.e. "making culture is making knowledge" - that the other contributions in this whitepaper focus their attention on.

7 Messeri, Lisa (2016). *Placing outer space: an Earthly ethnography of other worlds.* Durham, NC: Duke University Press, 2.
8 Ibid., 3.
9 Méndez, Abel and González-Espada, Wilson (2016). *Searching for Habitable Worlds. An Introduction.* San Rafael: Morgan & Claypool.
10 Estimate according to, NASA Exoplanet Archive "Exoplanet and Candidate Statistics," NASA Exoplanet Science Institute, https://exoplanetarchive.ipac.caltech.edu/docs/counts_detail.html. (accessed June 7, 2023). A handful of directly imaged exoplanets are mostly extremely massive gas giants - hot Jupiters - orbiting around stars relatively close to our Sun (up to ~500 light years).
11 Messeri, Lisa (2016). Placing outer space: an Earthly ethnography of other worlds. Durham, NC: Duke University Press, 113.
12 Ibid., 114.
13 IAU General Assembly (2006). *Resolution B5. Definition of a Planet in the Solar System.* International Astronomic Union, https://www.iau.org/static/resolutions/Resolution_GA26-5-6.pdf.
14 As also recounted in Dick, Steven J. (2020). "Pluto, Discovery, and Classification in Astronomy." In *Space, Time, and Aliens. Collected Works on Cosmos and Culture.* Cham: Springer Nature, 506.
15 Stern, Alan and Grinspoon, David (2018). *Chasing New Horizons: Inside the Epic First Mission to Pluto.* London: Picador.
16 Messeri, Lisa (2010). "The Problem with Pluto: Conflicting Cosmologies and the Classification of Planets." *Social Studies of Science* 40(2), 190. See also Bowker, Geoffrey C. and Star, Susan Leigh (1999). *Sorting Things Out. Classification and Its Consequences.* Cambridge (MA): MIT Press, 293-298.
17 Bowker and Star, Sorting Things Out, 297.
18 See Latour, Bruno (2005). *Reassembling the Social.* Oxford: Oxford University Press.
19 Messeri, Lisa (2010). "The Problem with Pluto: Conflicting Cosmologies and the Classification of Planets." *Social Studies of Science* 40(2), 187–214.
20 Basri, Gibor and Brown, Michael E. (2006). "Planetesimals to Brown Dwarfs: What is a Planet?" *Annual Review of Earth and Planetary Sciences* 34(1), 20.
21 Ibid., 20.
22 Pierrehumbert, Raymond T. (2011). *Principles of Planetary Climate.* Cambridge: Cambridge University Press, 60.

Designing for Elusive Objects[1]

Klára Pelousková

Space exploration is a deeply cultural endeavour. The way we represent and communicate cosmic phenomena, but also the way we envision and plan for human presence in outer space, is rooted in earthbound cultures and power dynamics. In space, terrestrial social, political and institutional norms are reproduced – and reinforced – bouncing back to Earth in a recursive manner. Therefore, in order to get a grasp of such patterns, the way images of or designs for space are shaped matter and need to be continuously negotiated and reflected on.

It is the culture of imagined lunar or martial settlements, for instance, that is characteristic of such symbolic and pragmatic recursions. In recent years, Skidmore, Owen & Merrill (SOM), one of the largest global architectural firms, has been developing concepts of modular human habitats on the Moon that may evolve into permanent structures. Together with the Lockheed Martin Space company, SOM took on a "human-centred approach" to the design of lunar dwellings. In the interior of the protective capsules, the designers claim to promote health, wellness and comfort:

> "Green walls and natural looking, yet flame-resistant materials from Earth will cover many of the interior surfaces, and the crew quarters at the edges will be customizable to make the spaces feel like home. Projections in each private room can mimic settings from Earth, and circadian lighting will help replicate our 24-hour sleep-wake cycle. The centre of each floor will be reconfigurable to accommodate a range of uses, including work, exercise, and dining."[2]

In another design, co-developed with the European Space Agency and Massachusetts Institute of Technology, SMO explores the possibilities of self-sufficient living and innovation in resource utilisation that may inspire new energy or waste management on Earth. The envisioned *Moon Village*, composed of flexible inflatable modules, may eventually *"grow into a thriving community: a hub for science, exploration, even tourism" and "kickstart an outer-space economy."*[3]

As is apparent from the firm's statements, SMO's space architecture is a blend of established design cultures that are mirrored in the future cosmic settlements, expanded on by technological innovation required for lunar habitability, and further reproduced in the promises of increased infrastructural efficiency applicable in terrestrial systems. "Human-centeredness", for instance, is one of the hegemonic design principles ingrained in a distinctly Western understanding of the human as a figure surrounded by a controllable environment. Cosiness and seamless docility of all furnishings and devices are sought after – and often materialised in simple and economical forms inspired by North European design traditions. Not only do these qualities correspond to the constrained spatial and operational conditions of cosmic habitats, but are, in reality, bound to the ruling economic paradigm shaping material flows and organisational structures on Earth. Efficiency, adaptiveness and flexibility are just a few of the principles that help streamline the processes of extraction and consumption. So, rather than an aesthetic choice, minimalism has been rendered a necessity. It is a complex alloy of specific cultural, market and production imperatives that designers now implant in emerging outer space realities, as if these norms were politically neutral and universal.

More broadly, human-centeredness fixes the standpoint from which non-human entities and systems are viewed and, as a result of that, obscures their agency as well as a multitude of more-than-human interdependencies that are constituent of what a human really is. However anthropocentric the designer's intentions, though, man-made artefacts and apparatuses resist human dominance and control by creating new, unexpected connections, interactions and meanings themselves. If the Blue Marble image once provided an illusion of totality, the subsequent proliferation of imaging technologies and expansion of data networks resulted in a diversification of possible points of view and a multiplication of concerns that together make up various versions of the world.[4] Inadvertently, humans achieved their own decentring, arriving at a more realistic self-understanding as components of autonomous systems that don't always depend on their input.[5] As pointed out by David A. Mindell, MIT Professor of Aeronautics and Astronautics, space exploration has been one of the contexts that made this – however broadly unacknowledged – cultural shift apparent: "human-centeredness" of particular control features of the Apollo spaceship, for instance, was above all a gesture of consolation for the astronauts, affording them a (false) sense of agency in automated processes.[6]

Just like reflection of design cultures, cultural production itself can shed light on the nature of research and knowledge. Curator and art theorist Nicholas Bourriaud talks about the capability of artists to create new "planes of visibility" that enable us to situate humans within larger and deeper cosmic or geological contexts: "[…] *for* [contemporary artists], *it is the reality as a whole (including atoms, rocks, micro-organisms and machines) that now plays the role of symbolic interlocutor, and forms the plane on which their work unfolds."*[7] For Bourriaud, the work of Katie Paterson or Julian Charrière is particularly representative of this approach. In his view, they both focus on the "great outdoors" of timeframes and biochemical formations that are incommensurate with human experience. By prioritising non-human temporalities, they *"arrive at a realistic representation of the world, that is, one that is definitively rid of the illusion that humanity is at its center."*[8] In her work Totality (2016), Paterson has collected the majority of solar eclipses documented by humans and placed them onto a mirror ball itself mimicking the progression of an eclipse in the gallery space. While Paterson's medium to translate cosmic processes is light, Charrière works with soil representing different periods of geological time (*On the Sidewalk, I Have Forgotten the Dinosauria,* 2016).[9]

Bourriaud argues that simply by focusing on unfamiliar timescales, Paterson and Charrière remove the human from the centre of concern. However, what they achieve is rather setting the human aside from non-human processes and thus maintaining the distinction between humanity and the untouchable "great outdoors". Here, the "outside" remains the domain of the sublime[10] – romantically wild, threatening, but magnificent - that defies its binary other: reason. The Western concept of the human stays intact, firmly united with the artist or the viewer. "Decentring" in itself doesn't complicate the understanding of what the human is from the biochemical and historical perspective: an ever-evolving composition of in/organic matter intertwined with and disrupted by complex political and cultural forces. As the environmentalist Stacy Alaimo puts it when defining the concept of "transcorporeality", *"all creatures, as embodied beings, are intermeshed with the dynamic, material world, which crosses through them, transforms them, and is transformed by them."*[11] Seen through the lens of posthumanism, the idea of a "great outdoors", clear boundaries, or a definable "environment" falls apart, exposing the human as a tangled, incidental organism contingent on webs of precarious interdependencies.

Contributing to a cluster of kindred thought, artist Jenna Sutela looks at the subtle connections between the human microbiome and outer space. The main protagonist of her work *Holobiont* (2018), the bacterium *Bacillus subtilis*, inhabits the human gut just as it is able – as an extremophilic organism – to survive in the conditions of outer space. The artist studies the Planetary Protection rituals that take place at the European Space Agency, and the rituals are aimed at the prevention of other celestial bodies from being contaminated with terrestrial microorganisms. While considering techniques enabling the preservation of cosmic ecosystems and their specific conditions, Sutela simultaneously entertains the peculiar idea of panspermia - that microbial life has always stretched over the vastness of outer space- and that, perhaps, life on Earth might not have been of purely terrestrial origin. However unlikely a scenario, "*the alien is in us*", says the artist, and the human body is *"an entity made of many species, all inseparably linked in their ecology and evolution."*[12]

Similarly to *Holobiont*, the work *Drosophila titanus* by Andy Gracie invites us to ponder the idea of interplanetary evolution – and its potential occurrence in the past, the present and the future.[13] Taking the ubiquitous fruit fly *Drosophila melanogaster* as a metaphor of terrestrial life and Titan, one of Saturn's largest moons, as a representation of Earth's pre-human past, Gracie tries to mimic the process of an organism's adaptation to specific environmental conditions. While engineering an insect hypothetically able to survive on Titan, the artist reflects on the processes of scientific investigation of evolutionary developments and examines the culture of intentional modification or enhancement of organisms. These efforts may be tied to projects that perhaps don't exceed the domain of the speculative or the virtual today, but are already imbued with distinct political aims. If we follow the logic of artificial interplanetary evolution, can we fashion a human species that would be able to conquer other planets?

Metaphorical and hyperbolical in nature, these artworks prompt us to engage with the concept of life in ways that not only decentre, but also situate the human in complex multispecies networks and temporal scales. By so doing, they prevent the human viewer from taking on an "outside" perspective. And it is not a question of multifaceted entanglements related to living matter alone – technical apparatuses that arose from the Earth itself are just as constitutive of what human life and society have become. In his work Solaris (2017), artist Oscar Santillán shows compellingly that what we see and perceive is contingent on the media derived from the matter that the planet is composed of.[14] Santillán sourced sand from the Atacama Desert in Chile – a site more than convenient for astronomical observations – and melted it into a glass lens he used to photograph the landscape through. The desert looked back at itself, activated by the human. Similarly, in the context of outer space research, the black hole image taken by the Event Horizon Telescope in 2019 is a result of infrastructural cooperation between multiple radio telescopes scattered around the globe. No single human or even humanity as a whole is capable of capturing something so distant and so elusive; it is only possible through intimate engagement with technology made of the planet.[15] From this perspective, humans are one of the Earth's resources as well – the planet uses humanity to make sense of itself.

The awareness of the fact that humans are a fundamentally fragile, ever-evolving species firmly tied to the planet's geophysical and biochemical processes has far-reaching implications for both politics and design. In his essay *Planetary Alterity: Solar Cosmopolitics and the Parliament of Planets*, Bronislaw Szerszynski recalls Bruno Latour's and Isabelle Stengers's concept of cosmopolitics that urges us to consider two main questions: "*How many are we?*" and "*How shall we live together?*".[16] In Latour's Parliament of Things, these questions set the agendas of its two houses: one concerned with the problem of truth and the second negotiating hierarchies and institutional procedures that structure the agency of the Earth's inhabitants.[17] Szerszynski takes the idea of both actual and virtual multiplicity of life even further than Latour by making a case for more-than-human *geophilosophy*. Planets, like humans, are also "many" in the sense of a continuous process of individuation and becoming. They too never cease to *decide*, *reckon*, *count* and *accommodate*, and are capable of answering the question of how they shall live together for themselves. Szerszynski argues that the *Parliament of Things* does not need human representatives to speak on behalf of non-human actors – and claims that a new Copernican turn may be emerging from the realisation of planetary alterity and the potential of planets to self-assemble and self-actualise.[18]

Szerszynski suggests that people have seized authority over counting: by establishing a set of determinate conditions, they have enclosed the space of possibility of what a planet can be (and by consequence, they have decided that some, like Pluto, do not qualify for such a designation). Szerszynski reminds us, however, that counting is always intrinsically bound to physical processes that – to some extent – resist abstraction and generalisation. He concludes that, as historical entities, planets are *"qualitatively unique, path-dependent entities, whose powers and possibilities are dependent on the particular course of development through which they have passed."*[19] Such a view implies that by unconstraining the possibility of cosmic self-identification, we may open up space for potentially transformational *political* alterity back on Earth. In

1 Some of the references used in this text were mentioned by the participants of the More-than-Planet workshop titled Towards a planetary cultural landscape co-lead by Lukáš Likavčan, Klára Pelousková and Solveig Qu Suess at Transmediale in February 2023. Among the participants were: Martin Born, Sam Danello, Zoénie Deng, Amy Harris, Pragya Jain, Jol Thomas, Nicola Triscott and Bonnie van Vugt.
2 "New Frontiers," SOM, accessed July 5, 2023, https://www.som.com/research/new-frontiers/.
3 "Moon Village," SOM, accessed July 5, 2023, https://www.som.com/research/moon-village/.
4 Beatriz Colomina and Mark Wigley, *Are We Human? Notes on an Archaeology of Design* (Baden: Lars Müller Publishers, 2016), 16-17.
5 Benjamin H. Bratton, *The Stack. On Software and Sovereignty* (Cambridge (MA): The MIT Press, 2015), 251-289.
6 David A. Mindell, *Digital Apollo. Human and Machine in Spaceflight* (Cambridge (MA): The MIT Press, 2011).
7 Nicolas Bourriaud, "Julian Charrière and Katie Paterson: Meteors and Metabolisms," Katie Paterson, accessed July 5, 2023, https://katiepaterson.org/read-essays/julian-charriere-and-katie-paterson-meteors-and-metabolisms-by-nicolas-bourriaud-for-gallerie-tschudi-2021/.
8 Ibid.
9 Ibid.
10 Nicolas Bourriaud, *Planet B - Climate Change and the New Sublime* (Dijon: Les presses du réel, 2021).
11 Stacey Alaimo, "Trans-corporeality," in *Posthuman Glossary*, ed. Rosi Braidotti and Maria Hlavajova (London: Bloomsbury Academic, 2018), 435.
12 Jenna Sutela, "Holobiont," interview by Luciana Parisi, VDrome, 2018, https://www.vdrome.org/jenna-sutela/.
13 "Drosophilia Titanus," Andy Gracie - Hostprods, accessed July 6, 2023, https://www.hostprods.net/drostit.
14 "Solaris," Studio Antimundo: Oscar Santillán, accessed July 6, 2023, https://antimundo.org/works.
15 Benjamin Bratton, *The Terraforming* (Moscow: Strelka Press, 2019), Kindle.
16 Bronislaw Szerszynski, "Planetary Alterity, Solar Cosmopolitics and the Parliament of Planets," in *Environmental Alterities*, ed. Cristóbal Bonelli and Antonia Walford (Manchester: Mattering Press, 2021), https://www.matteringpress.org/books/environmental-alterities/read/planetary-alterity-solar-cosmopolitics-and-the-parliament-of-planets-o-bronislaw-szerszynski.
17 Ibid.
18 Ibid.
19 Ibid.

other words, if a substantial shift in the dominant political or economic paradigms requires an adoption of a post-anthropocentric perspective, the decentring of the human itself may require a consideration of indeterminacy that reaches far beyond the contours of one single planet.

Being a process of political negotiation in its own right, design connects the realities on and beyond the Earth through man-made artefacts and systems – both literally and metaphorically. Architect and writer Nicholas de Monchaux has made a convincing argument about design – in the sense of the conception and planning of the artificial – by looking at the evolution of the ultimate "soft" Apollo spacesuit, supporting the life of a concrete human in the harsh conditions of outer space.[20] Similary to how Szerszynski opposes the idea of absolute assertions in relation to non-human cosmic entities, de Monchaux refutes the paradigm of total control established by systems theory and cybernetics in the post-war era of military and outer space research.[21] The author poses the question of why some of the previous, hard, impermeable spacesuit prototypes failed – and why this failure echoed in the fate of the US government's experiments to extend the protocols of systems engineering to urban design.[22] Inspired by findings from evolutionary biology, de Monchaux argues that these designs were inadequate because of a lack of distributed robustness and evolvability. By following a set of foundational principles that seemingly ensured controllability through technology, the designers created hardwired systems unable to resist perturbations and adapt to environmental changes. In the case of the spacesuit, the final design was eventually a soft, layered, individually tailored structure made of materials intended for close contact with the body that met the needs of human exposure to the extreme, including unpredictable conditions.[23] Taking this case as exemplary, de Monchaux concludes that design in general should be approached as an intimate process of mediation between natural and man-made systems that, more often than not, follows a path of unexpected adaptation.

Just as the enumeration of celestial bodies will never be "final", no design will ever be "perfect", "optimal", or even truly "human-centred". As the multiple artistic or theoretical accounts mentioned above show, the human – just like the planet – is a moving target, and while any attempt to design for the human inevitably entails its provisional steadying, the course of transforming into new set of relationships and interactions is always continuous and uncertain. Not to mention, for the unpredictable, increasingly unfamiliar nature of the worlds we design for, aiming for adaptiveness (of artificial systems) is necessary. However, the process of adaptation eludes control, despite what neoclassical economy teaches us – and so it may be more beneficial to approach adaptation as open-ended and transformative rather than preservative. When imagining life in outer space, then, perhaps it is possible to view design as a means of enhancing exploration of the unfamiliar and not simply reproducing dominant terrestrial paradigms of how we live together. An ongoing reckoning through cultural production can help us uncover the underlying meaning of emerging concepts and potentially shape the loops of recursion between the worlds we (wish to) inhabit.

20 Richard Buchanan, "Wicked Problems in Design Thinking," *Design Issues 8*, no. 2 (Spring, 1992): 14, https://web.mit.edu/jrankin/www/engin_as_lib_art/Design_thinking.pdf.
21 Nicholas De Monchaux, *Spacesuit: Fashioning Apollo* (Cambridge (MA): The MIT Press, 2011).
22 Ibid, 298-310.
23 Ibid, 317-325.

Finitude, Planetarity, Cosmopolitics

Adonis Leboho

> I have of late—but wherefore I know not—lost all my mirth, forgone all custom of exercises, and indeed it goes so heavily with my disposition that this goodly frame, the Earth, seems to me a sterile promontory; this most excellent canopy, the air—look you, this brave o'erhanging firmament, this majestical roof fretted with golden fire—why, it appears no other thing to me than a foul and pestilent congregation of vapors. What a piece of work is a man! How noble in reason, how infinite in faculty! In form and moving how express and admirable! In action how like an angel, in apprehension how like a god! The beauty of the world. The paragon of animals. And yet, to me, what is this quintessence of dust? Man delights not me.
>
> William Shakespeare, Hamlet, Act 2, Scene 2

Finitude of human life

Finitude, the subjection to limits and limitations, plays a decisive role in the governance of life. According to the philosophy of finitude, which has been the mainstay of Western philosophy for three centuries at least,[1] "finitude/mortality [is] the unsurpassable horizon of our existence."[2] Various threshold conditions categorised under the sign of finitude serve as compositional frameworks for existence and constitute the abstract and material determinants of life. In short, finitude stages reality insofar as it delimits what we can know, think, do, and experience. There is scarcely a discipline, field, or discourse that hasn't long since been touched, transformed or, indeed, frustrated by the idea of finitude. Following this line of thought, this chapter engages finitude as a consequential object of planetary study.

Planetarity is not exempt from the determinations of finitude. The concept is presently undergoing a renewal of its relationship to limits—atmospheric, ecological, and energetic, to name a few—with shifts in the conceptualisation of planetary boundaries heralding significant consequences for experiment and reflection alike.[3] The object of this chapter is to explore our planetary condition in its transition between two organising philosophies: finitude and cosmopolitics. That is, the transition from the delimited, situated, gravity-bound mode of planetarity, as it has been largely understood in occidental philosophy, to the broader, expansive cosmopolitical arrangements stimulated by extra-planetary exploration and space technologies. Referencing cultural works that explore threshold conditions alongside philosophical works concerned with planetary and cosmopolitical frameworks of thought, this chapter looks to understand the place of the human, sundered as it is in various states of cosmopolitical vertigo incited by new modes of interfacing with extra-human/planetary systems.

What is at stake in the shift from finitude to cosmopolitics is the possibility of evolving beyond a philosophical-political mode of planetarity organised around the human and its binary systematic division of subject and object, nature and culture, world and representation, etc., into a cosmopolitical mode of ontological and epistemological pluralism. "Cosmopolitics overcomes what Alfred North Whitehead names 'the bifurcation of nature,' which separates the material world from the world of knowledge and ideas."[4] Cosmopolitics, as the "ecology of everything," according to Isabelle Stengers, serves as "an integrative practice for navigating today's fractured landscape of knowledge," a generative, embracive practice of resolving various bifurcations organised by the human.[5]

1 Aesthetics after Finitude, ed. by Baylee Brits, Prudence Gibson, and Amy Ireland (Melbourne: re:press, 2016) <http://xenopraxis.net/readings/ireland_noise.pdf>. pg. 8.
2 Slavoj Žižek, Sex and the Failed Absolute, 1st edn (London: Bloomsbury Academic, 2019), pg. 174.
3 Brits, Gibson, and Ireland.
4 Alfred North Whitehead, The Concept of Nature (Cambridge: Cambridge University Press, 1964) <https://doi.org/10.1017/cbo9781316286654>. pg. 21.
5 Isabelle Stengers, Cosmopolitics I, trans. by Robert Bononno (Minneapolis: University of Minnesota Press, 2020) <https://doi.org/10.5422/fordham/9780823288519.003.0008>. pg. vii.

In fact, cosmopolitics throws into sharp relief the very problem of relations in general in its refusal to dissociate the "domains of aesthetics, values and subjects" from that of "facts, objects and data."[6] To pursue cosmopolitics is to "acknowledge our participation in multiple, irreducible worlds—not just at the level of knowledge and concepts (epistemological pluralism) but at the level of being itself (ontological pluralism)."[7] Cosmopolitics acts as a corrective to this bifurcation of nature by continually demanding that we think of values and facts, culture and nature, and political-philosophical and astronomic modes of planetarity together.[8]

Abyss of words and things

Shakespeare, quoted at the outset, provides an illustrative account of the dualistic mode of thinking typical of the philosophy of finitude. This philosophy manifests in Shakespeare's conception of ontology, with the finite and imperfectible human serving as a shorthand for reality itself. The human is conjugated between two distinct properties: his "god"-like powers of thought and a "quintessence of dust" referring to his material condition. We have an account of the world divided into the two separate spheres of nature and culture. "We have an account of the world divided into the two separate spheres of nature and culture – an account in which the gap between human knowledge and world is reified, and the precedence of the human in this dualistic structure is firmly established."

Across art, science, and philosophy, the separation between a life of earthbound finitude and the illimitable possibility of man's capacity for thought and representation has determined a gap constitutive of the human experience. 'Being' has also been understood inversely—as much by what and where it is not, how it cannot, where this 'not' operates as both material condition and floating, an inchoate signifier through which being co-articulates itself. Critics like Jessica Dubow and John Llewelyn describes this "making ready of a philosophical place for the negative" as a kind of 'negative phenomenology'".[9] An immense pressure has been exerted on the world of thought and ideas to represent an entire world despite life itself being the site of a formidable lacuna that neither existence nor epistemic inquiry cannot readily fill.

"[T]he immense abyss separating words and things can be found everywhere," writes Bruno Latour, and in this abyss the human discovers an inexhaustible source for creative abstraction.[10] The human, in the mode of the artist-inventor, seeks "to exceed the finitude of the physical world and imbue its works with virtual potential."[11] The tendency towards a symbolical, conceptual rendering of the world necessitates a violent act of abstraction as it demotes the concrete, localised relations been human and non-human, that together construct reality in favour of a world rendered at human scale and on human terms.

Bifurcation of nature

The philosophy of finitude is implicated in the bifurcation of "facts and values, subjects and objects, nature and society, time and history, or world and representation."[12] Fred Polak's "typical dualism" complements Whitehead's notion of the "bifurcation of nature,[13] as it illustrates how the human's dualistic mode of constructing reality runs parallel to the bifurcation of human and world, nature and culture, etc.

> Man is the one animal able to cross the frontier of present reality. Man is the only living being who consciously splits reality in two; into the existing, concretely observable situation and into another, an inventively conceived, not-existing state of being. Homo sapiens thus is "split man," and in this creative capacity, he distinguishes himself from and rises above a purely animalistic or vitalistic state. He can behave purposefully as a "citizen of two worlds." The development of this typical dualism marks the most significant milestone in the almost unknown process of the birth and early growth of human civilization. It is the main explanation of the progressive bifurcation between nature and nurture. It starts the biological species of homo off on its amazing career as man, the maker of civilization.[14]

6 Adam Robbert and Sam Mickey, 'Cosmopolitics: An Ongoing Question', in Political Theory and Entanglement: Politics at the Overlap of Race, Class, and Gender (The Center for Process Studies, 2013), pp. 1–8, pg. 1.
7 Robbert and Mickey. pg. 1.
8 Ibid. pg. 1.
9 John Llewelyn, The Rigor of a Certain Inhumanity: Toward a Wider Suffrage (Indiana: Indiana University Press, 2021); J Dubow, 'Still-Life, after-Life, Nature Morte, W.G. Sebald and the Demands of Landscape ', Envisioning Landscapes, Making Worlds Geography and the Humanities , 2012, pp. 188–97 <https://doi.org/DOI: 10.4324/9780203839287>.
10 Pandora's Hope: Essays on the Reality of Science Studies (Cambridge, Massachusetts: Harvard University Press, 1999) <https://doi.org/10.1086/384756>, pg. 51.
11 Brits, Gibson, and Ireland, pg. 153.
12 Robbert and Mickey, pg. 1.
13 Fred Polak, The Image of the Future, Frieze (Amsterdam: Elsevier, 1973) <https://frieze.com/article/future-image>.
14 Ibid. pg. 1.

According to Polak, the human's capacity to think in the abstract, "to categorize and reorder reality within the self (present reality) and in relation to perceptions of the not-self (the Other), distributes his ontological being equally between two worlds": "the present and the imagined."[15] This dualistic mode of thinking gives rise to the future, says Polak, as it serves as an "indispensable prerequisite to the movement of events in time, and to the dynamics of historical change."[16] Through the bifurcation of nature and dualistic thinking, "subjects and objects form two separate spheres of reality whilst at the same time colliding everywhere. Knowledge is shaped so as to create a mirror image of an external and unified world. Language, society, and history fall on one side of the line, while the world, as it exists in itself, falls on the other."[17]

Polak's articulation of dynamic, generative capacities systematised into a dualistic mode of thinking has manifold implications; firstly, it outlines how finitude furnishes human life with its material and conceptual conditions of possibility, but also acts as a civilising instrument. This is to say, our purposive capacity for world-building, our ability to negotiate between creative virtualities and material realities, is key to the formation of human societies and political philosophical communities at large.

Secondly, the "bifurcation of nature" is not inevitable and ensured, and is liable to change if we were to pursue an alternative ontology of knowledge. Rather than satisfying ourselves with dualistic thinking, which configures the material world in and through our human thought and ideation, we might "approach knowledge as one of many links that creates association between beings, instead of a unique mode responsible for representing all of them."[18] This would require constant reinterpretation of such key terms as planetarity and cosmopolitics as our ontology of knowledge would be continually open to novel associations and relational effects between human and non-human agents. As atmospheric discontinuities, planetarity boundaries, and terrestrial and extra-terrestrial identities complect and/or dissolve through associative, pluralistic epistemological practices, the stabilising forces for a distinctly human/planetary typology dissolve in turn.

Cosmo-body-politic

Creating an analogue between human and planet Earth, dualistic thinking extends to the planetary scale not only in Shakespeare's framing of the human itself but in the construction of the body-politic in Western philosophy. The Earth, which at its most base appears "a foul and pestilent congregation of vapors," serves as an apparatus of closure vaulted by a "majestical roof." Earthlings amid the foul vapors of the corporeal planetary experience nevertheless look to the heavens above to observe the ethereal transcendence promised there. Essentially, the planet is divided between its elementary material nature and its idealised representation. Elsewhere,[19] I have described space as a realm of idealism, a metaphoric, symbolic space of theological and cosmological projections."[20] In its function as the cosmological background, space has shouldered the burden of human speculative inquiry. Often, the cosmos has been the place where the irrational, sublime, or ineffable is abstracted. Modern and pre-modern cosmologies tend to divide a perfect, heavenly firmament above from the crude, heavy Earth below.

Human and planet Earth are reflexive objects structured through a division of transcendence and finitude. Their mutually reinforcing style is said to form a unitary, governing logic. The relationship between human and planet in their mirrored division between the transcendent and finite in fact forms a philosophical body-politic of a kind. The analogy developed between human and the planet is deliberate, politically charged, and enervates the assertion that the "natural" socio-political order is analogous to the human organism.

Recalling Nietzsche, Jill Marsden writes that "the normative notion of a discrete, functional body is a political prejudice of one part of the said body, an enduring legacy of Enlightenment consciousness, which equates human essence with organic unity, individual freedom and rational agency."[21] In drawing the analogy between the human and Earth, we witness the stabilisation of the philosophical-political meaning of planetarity through the frame of the human

15 Ibid, pg. 9-10.
16 Ibid, pg. 1.
17 Robbert and Mickey, pg. 1.
18 Ibid, pg. 2.
19 Adonis Leboho and others, 'Modes of Planetarity: Deep Synchronisation', in The Terraforming 2021: For Planetary Governance (Moscow: Strelka Institute of Media, Architecture and Design, 2021) <https://www.youtube.com/watch?v=Nqe4SvX4ZNU&ab_channel=TheTerraformingMedia>.
20 See Jorg Matthias Determann, Islam, Science Fiction, and Extraterrestrial Life: The Culture of Astrobiology in the Muslim World (Bloomsbury, 2021); James T. Andrews, Red Kosmos: K. E. Tsiolkovskii, Grandfather of Soviet Rocketry, Red Kosmos: K. E. Tsiolkovskii, Grandfather of Soviet Rocketry, 1st edn (Texas A&M University Press, 2009) <https://doi.org/10.5860/choice.47-3128>; Helge S. Kragh, Conceptions of Kosmos: From Myths to the Accelerating Universe: A History of Cosmology, Conceptions of Kosmos (Oxford: Oxford University Press, 2010) <https://doi.org/10.1093/acprof:oso/9780199209163.001.0001>; Max Scheler, The Human Place in the Kosmos (Evanston: Northwestern University Press, 2009); Kosmos & Culture: Cultural Evolution in a Cosmic Context, ed. by Stephen J. Dick and Mark L. Lupisella (NASA, 2010); Societal Impact of Spaceflight, ed. by Steven J Dick and Roger D Launius, Group (NASA, 2007).
21 Diane Morgan and Gary Banham, 'Cosmopolitics and the Emergence of a Future', Cosmopolitics and the Emergence of a Future, 2007, 1–261 <https://doi.org/10.1057/9780230210684>, pg. 119.

microcosm.

To reference another cultural touchstone, Walt Whitman's 1856 poem articulates the notion of the human/planet correlation starkly: "There can be no theory of any account unless it corroborate the theory of the Earth." A Song of the Rolling Earth maintains that Earth situates the human ethos; the horizons of human knowledge register in Earth's dust, index to the scale of the planet, and are yoked to its gravitational pull. Earth is the one and utter place of immobility that resources and enfolds reason, and out of which distinctly human habits of embodiment and thought are formed.[22]

Subjection to the situated-boundedness of the planetary experience provisions our human "theories," implying that the context Earth provides takes precedence. However, in making planetarity conform to the shape and anatomy of human rationality, a violent act of abstraction takes place in the disappearance of concrete, localised relations in the scaling up of the human micro-cosmic experience as the reference point for planet itself.

Whitman's words are indicative of an orthodoxy in the cultural, political and philosophical history of the human that imagines that Earth and the human, together, are conditioned by finitude and transcendence and their synthesis forms the basis of the philosophical body politic. What we call the body politic derives from a metaphoric exchange between the individual human organism and the polis, or state. With roots in classical philosophy, this long-held reciprocity between the state and the individual has been used to reinforce specific ideological formations of the state and the ideal citizen. According to Marsden, "Central to the notion of the body-politic is the idea that organisms are structured beings in which the parts function reciprocally as ends and means in the service of the whole." In their study, 'The Body Politic as Spatial Metaphor,' Claire Rasmussen and Michael Brown also argue that the effect of spatial metaphor is, firstly, to give "a descriptive and normative account of citizenship."[23] Besides this, they state, the body politic as a spatial metaphor reveals how politics is bound up with geographical space.

In coincidence with visions of the ideal polis, a boundary poetics interested in questions of inside and outside, openness and closedness, developed in Western thinking. As far back as Plato's Republic and Laws, attempts have been made to discern and elaborate the scope of an ideal society that operates through productive tensions between "security" and "opportunity," limit and possibility.[24] The work of Jacques Derrida largely centres on an interrogation of the structuring of Western thought based on such dichotomies; of good and evil; true, false; soul, body; being, nothingness; presence, absence, etc. What Derrida understands as the ethico-theoretical decision of western metaphysics introduced a way of thinking founded upon seemingly fixed and hierarchical oppositions.[25] This is a decision that privileges "univocal meaning" and, to paraphrase Martin Hägglund, "postulates the simple to be before the complex, the pure before the impure […] and so on."[26]

Enforced differentiation and determination at the limits of various types of borders, as we've seen with the bifurcation of nature, has long since naturalised particular identities. In our case here, the human organism integrated into the philosophical-body politic is one such naturalised concept, whose contours are slowly being redefined through the changing definitions of planetary and other limits.

The unsettling of various paradigms of human finitude is well underway through critical animal studies, cosmopolitics, object-oriented ontology, astrobiology, new space studies, AI and other posthuman/inhuman/nonhuman disciplines. While these projects demonstrate what Foucault might describe as "the shattering and annihilation of the [human] subject, the reaching of its limits, its spillage beyond its limits,"[27] this project specifically studies the new cosmological configuration inaugurated through interface with extra-human/planetary systems with a view to articulating the possibilities for the human relative to outer space.

Cosmopolitics

The expansion of our cosmological horizons through space travel makes possible a technologically enabled break away from planetary gravity and, therefore, the originary carceral environment [28]: the humic lifeworld of planet Earth.[29] Current work attempts to demonstrate "how the Earth-as-process is integral to humanity's existence," including Robert Pogue Harrison's "humic foundation of lifeworlds," Caitlin Berrigan's cosmology creation, "Manuel De Landa's concept of Homo sapiens' endoskeletons as mineral invasion, or Jane Bennett's ecopolitics".[30] However, ungrounding—in all its material and conceptual senses—from the terrestrial and metaphysical globe on which we are gravity-bound also demands our attention.

The basic question I hope to address, following Alberto Pirni in Space and the Anthropology of Limit: A Philosophical Perspective, is as follows: what does it mean to be a human being in the new, enlarged, and variable cosmological context?[31] David Valentine further refines the question of what it means to be human in outer space as follows: "What shifts might emerge in theorizations of and debates over 'the human'—as a historically specific entity or as nominating a general species difference—if Earth and its variable conditions no longer form the habitual grounds for these arguments?[32] Pirni lays out what's at stake in even posing this question: "As long as we refer to man in his natural state or 'conventional' condition, namely as an earthly being with a specific biological structure, this peculiarity of the human being is a matter beyond dispute: to assert it is to make a factual statement. It immediately becomes a matter open to contestation, however, when we try to extend it to a new and very different context: space or the Universe, an unspecified expanse outside Earth where man is trying to carve out a new path for his own survival."[33]

In the fields of cosmopolitics and off-world space settlement, the orthodoxies of earthbound finitude that have informed the philosophical body politic have been opened to significant challenge. Given the recent resurgence of astronautics discourse and arguments being made for or against space by Fred Scharmen, Valerie Olson, and others, what is at stake in this chapter is how the expansion of scope and meaning of planetarity invites a renewed conception of the body politic. The ungrounded, posthuman, inhuman, even nonhuman futures theorised by these new cosmopolitical arrangements—the attendant upheavals they promise in the social domain—hold in prospect possibilities for the reshaping of our vocabulary of planetarity. In the event of a cosmopolitical rupture of the governing order of things, what happens to this philosophical-body-politic that has not only been integral to the earthbound human but integrated it into its very form?

"In other places in the cosmos," writes Valentine, conventional terrestrial forms of humanness are "disrupted by new problem sets, formative conditions, and unexpected arrangements of the social, political, and natural that draw explicit attention to a terrestrial habitus as learned and as inadequate for different worlds."[34] Debbora Battaglia, David Valentine, and Valerie Olson are developing "the figure of the extreme" as "an analytic of limits and ever-opening horizons—epistemological and physical—provoking new understandings of humanness, environment, temporality, and of inter-species life as we think we understand it, here on Earth."[35] The growing understanding that life conditions are variable and subject to change based on phenomena that might differ significantly in extreme or extra-terrestrial contexts demands a re-evaluation of the concept of life, as well as the development of novel cosmopolitical frameworks.

If, according to Gayatri Spivak, Sylvia Wynter, and others, human self-images fashion worlds in their likeness, as we've seen in the manifestation of the body-politic, the end of a certain world-historical configuration inaugurates meta-existential speculation. The cosmos is figured as the organisation of relation and habitation at a planetary scale while positing that our historical moment is suspended between "global" configurations of existence and cosmopolitical demands for coexistence. To reimagine the cosmos and its extensity, to rethink who is present and accounted for in the "cosmo-body-politic," is to pull the concept of limit apart at the very seams, because "if cosmos is to mean anything, it must embrace, literally, everything—including all the vast numbers of non-human entities making humans act."[36]

Germs of this work have been springing forth in David Valentine's speculative anthropological studies of space in which he variously attempts to think "the human" through non-terrestrial sites. Since "the globe has contoured every aspect of our material, cultural, and noetic existence,"[37] the spillage over and beyond these limits into the non-terrestrial provides new intellectual challenges. Thinking humanness from elsewhere in the cosmos might offer new anthropological insights concerning theories and practices of embodiment on and off the Earth.[38]

Schreber's cosmopolitical Memoirs

A powerful example of a kind of deterritorialization into broader cosmopolitical conditions, Daniel Paul Schreber's 1903 Memoirs of my Nervous Illness is "one of the most extraordinary discussions of corporeality and cosmic connection ever to impact on occidental history" according to Jill Marsden.[39] Extraordinary because Schreber's is "an account which elaborates unprecedented possibilities for bodily reconfiguration via a unique technology of transhuman contact," and "achieves what very few thinkers in the Western tradition have managed: namely, a sustained meditation on the integration of human life with extra-human systems—a genuinely exploratory rather than a merely reflective philosophy."[40]

Schreber's integration of the human (body) into wider extra-human systems is difficult to summarise briefly but Marsden provides an excellent reading. She writes that Memoirs essentially relies on a description of the human "as connected to the stars by a vastly attenuated nervous system."[41] Schreber builds "a super-system-ic understanding of the fluid boundaries of the human body" and "builds a cosmo-body-politic beyond the modernist presupposition of essential identity, biological destiny and species divides."[42] Holding in mind our previous context of inquiry into the philosophical body-politic and how it supervenes on the discrete human body, Memoirs puts forward an alternative cosmopolitical framework via its spillage beyond the limits of human finitude through a form of interface with extra-human systems.

Early into the novel, and after his senses are intensely charged through a period of insomnia, Schreber develops an acute sensitivity to minute resonances in his immediate surroundings. Late evening sharpens his receptive capacities, and the crackle and hiss of formerly mute walls gradually articulates into an unmistakable whisper from the void. Decoding this new language, Schreber translates previously indistinguishable white noise as the unceasing drone of "departed souls" in the process of migrating to a transcendental state of "Blessedness."[43] These roving souls, Marsden writes, "are able to summon his attention through a complex cosmic circuity composed of what [Schreber] calls 'nerves' and 'rays' that connect his body to the most proximate and distant things."[44]

With the communicative souls' vibration of Schreber's senses, an ungraspable cosmos is rendered legible, articulating a novel "possibility of interfacing with extra-human systems."[45] Embarked souls in transition to a transcendental beyond hijack and reroute Schreber's newly-sensitised tendrils of connection to the beyond, "intercept[ing[and pass[ing] comment on his mental processes."[46] Schreber's body is staged as the "cosmic 'nerve centre' for communication through a hundred speech media."[47] As threads of informatic exchange grow and intersect, Schreber evolves from singular node in the network to a nexus of communication in himself. He ceases to be an element in a quantal world, that is, a singular and autonomous agent in a world composed as and through discrete units. Schreber quivers and resonates in the night, like an instrument wired to a state of high excitation by the nerve-souls within and without his body, as a colonial outpost here on Earth, reverberating information disseminated from transcendental metropolises in the far-off cosmos.

Continually flowing between "human life" and the state Blessedness, the departed souls are "involved in mutating relationships with Schreber's nervous system."[48] No longer simply of the nervous system, no longer merely souls, these "nerve-souls" cannot be taxonomized easily in the familiar categories of organic/inorganic, spiritual/material, part/whole. "Ontologically," Marsden writes, "these nerve-souls defy easy categorisation in terms of the living and the non-living, the spiritual and the material and the one and the many."[49]

As complexity and interrelatedness increases, Schreber is no longer distinguishable from his environment and the environmental elements themselves are "implicated in numerous other combinations and incarnations."[50] Contrary to the mainstream mechanism of evolutionary categorisation in terms of discrete lineages, these nerve-souls, or the hybrid environment composed of nerve-soul, indicate how the synthesis of living beings with their environment defines identity as a matter of interpretation. Rather than trading one model of identity for another, Schreber's text tells several alternative stories about the possibility of interfacing with extra-human systems.

Like viruses, the "nerve-souls … are 'virtually real' and may both attack and protect their host."[51] The virtual, understood as that which exists in effect and not necessarily actuality, becomes, in Schreber's case, the ground of contestation for alternative accounts of cosmology production; resonance with the outside challenges the singularity of Schreber's identity, and produces a virtual, novel, "miraculated" entity. Schreber initially baulks at the enforced communication with the cosmic, viewing it as invasion of "man's natural right to be master of his own nerves."[52] In the shift of understanding the nerve-souls as no longer forces of negativity, but, in fact, forces of life, Schreber renounces the need to defend his essence in recognition of an understanding that "what may be specific to life is its irreducibility to its material components."[53] In direct challenge to the dominant model of evolution, these souls demonstrate how the merging of living beings into new collectives disrupts classification in terms of discrete lineages, providing a direct challenge to the dominant model of evolution:[54]

> "In short, in its predilection for population thinking rather than typology, for its emphasis on the dynamic production of diversity over the recapitulation of identity and in its appeal to the internal invention of new structures rather than external adaptation to environment, Schreber's body-politic resembles the functioning of open systems."[55]

Conclusions, openings

What are the implications of Schreber's cosmopolitical text for our study of finitude at the human and planetary scale? The story of earthbound finitude—reinforced by the philosophy of finitude—cannot be the only one, and yet it continues to frame our ongoing engagement with extra-planetary space exploration. Following David Valentine, we are, of course, keenly aware that there are multiple ways to think "terrestrial humanness —Indigenous, Black, white, colonized and colonizing, capitalist and shamanic, Navajo or European—in and through other gravities."[56] However, because of the narrow, constrained arena of space in which the human is viable and capable of operating, the move to stabilise and reproduce human habituation does not necessarily lend itself to the recognition of such multiplicities.

After all, the space station, shuttle, and orbital satellite, all establish tolerable, if not optimal, conditions for life in extreme environments, conditions which rely on the institution of certain norms and habits—cultural, generational, gendered, etc., techniques of the body, alongside routinised, embodied dispositions that play a part in the reproduction of social, biological, and political orders and regimes of health.[57] Habitability in space is an outcome of narrow definitions of life and human activity, enabled through finely balanced technological, rational calculation. In fact, "arguments about humanness in space habitually seek equivalences and resolution about human commonality and difference by fixing terrestrial conditions— "epistemological" and "ontological"—in non-terrestrial places."[58]

Moreover, the need to stabilise the conditions of possibility for life in outer space environments constrains not only the techno-scientific conditions, but also the conceptual vocabulary available to us to engage outer space as a subject through alternative perspectives. Today, we bear witness to the stabilisation of the meaning of space in real-time, through twenty-four-hour broadcasts from satellites and orbital stations, from the Control Centre during a launch sequence, during live-streamed interior shots of a Blue Origin sub-orbital flight. The goal-oriented activities communicated that these images are associated with—to return humans to the moon, to set a human on Mars, to outlast the record of consecutive days in space— demand the optimisation and rationalisation of technological processes to achieve their aims; however, they further constrain the possibilities of space. In furnishing our imagination with regularised and regularising images of the 'proper' human archetypes fit for space, framing our perspective on space from the vantage point of oligarchical tech-utopian ambition, and reducing the collective human project of extra-terrestrial exploration to a referendum on planetary exit, space as currently read stretches only as far as the limited framework we have heretofore understood it through.

The work of culture, then, must be to intervene and refuse the narrowing of the field of space and the conditions of possibility for life in it, as well as the absolute prescription of the typologies of viable forms of life, in the service of rational, technological optimisation. Interrogating this anxiety for perfection in outer space and its concomitant effect on borders and limits encourages us to test and explore the kinds of cosmopolitical possibilities outlined in works such as Schreber's. Towards this end, "Schreber's text maps the emergence of symbiotic environments without recourse to the standard iconography of closed systems," be they human, species, planetary, or otherwise[59] Schreber constructs a cosmos composed of agential environments—ecologies of everything—that defy easy typologisation, such that identity is open to interpretation. The key insight in Schreber's text is the engagement of openness and scalar thinking as opposed to reduction and essentialisation as the cosmopolitical mode.

Schreber, presents a human that is no longer a discrete unit, but the locus and target of communication produced through diverse, cosmic, mediatic exchange, and articulates a variant narrative of dialoguing with non-human systems. As Marsden suggests,

> "Schreber's text amply illustrates, what is most vital about the living being is its capacity for disassembling and disorganising that which is most ordered and unified. Indeed, as Schreber comes to recognise, his destiny is not to defend the integrity of his individual being but to acknowledge his vital role in maintaining a complex ecology of interacting elements."[60]

As we move towards a conclusion, we can think about the planet as a cultural object from the perspective of the cosmopolitical, which would be to integrate both human and planet as an effect that is both "active and acted" upon in this complex ecology of interactive elements. Doing so de-prioritises human as the originary living centre around which the 'world' is composed and the framework for political-philosophical body-politic. The urgency of this revision derives from the narrowing conceptual framing of outer space and its rationalisation of the human in order to sustain it in an unforgiving, extreme space environment.

For NASA engineers, "Our great twentieth-century space adventure has become far more than a long journey to the planets. It has become a journey into man."[61] This is a journey deeper into the human as figured in the image of the Vitruvian, the singularity to be resourced, defended, and articulated into symbolic and technical perfection for survival's sake. However, a cosmopolitical approach allows for a figure of the human that, to paraphrase Rob Halpern, has less to do with the body as the sovereign scene of its own invention and actions, and more to do with the body as the scene of disabused mastery. The dream of human spaceflight hopes to transcend human finitude by generating an escape velocity from biological and planetary limits while attempting to retain its vantage point at the centre of things.[62] However, the encapsulated man image of the astronaut, dependent on life-support systems, surrogates, and remote sensing apparatus to see and feel the space he cannot reach, reveals the true nature of the distributed intelligence of sociotechnical systems,[63] like Schreber, a "willing mediator, … a vital conduit in the responsive network."[64] Pirni summarises this situation well when he states that, "By transgressing the Earth's borders, we can finally begin to perceive that, from a situation of complete mastery over the world and over ourselves, we have passed into a state where technology is the master of us and of our decisions."[65]

Adaptation to, and interface with, outer space must allow for the plasticity of the human, even its vitiation as master of its environment, as our venturing into new cosmological horizons entails forms of enmeshment with the alien, extreme, and unprecedented. The cosmopolitical conditions of outer space force engagement with alien futures, to the extent that we must question how productive are techno-rational efforts to move '[t]owards a time of collective self-mastery, and the properly alien future that entails and enables',[66] when alienation, which is "a relation of relationless,"[67] conditions our encounter with these nonidentical futures?

The pressure that the non-expected and alien future holds in reserve forces us to no longer jealously guard a vision of the human as master of himself and environment or of Earth as centre and summit of existence. And "[i]f we can no longer legitimately predicate the autonomy of the human being, then we also lose the ability to affirm one of the fundamental characteristics that distinguish such a being from other Earthly creatures from a biological, neurological and philosophical point of view."[68] In relinquishing the singularity, primacy, and autonomy associated with the Earthly domain of the human and the philosophical body-politic it generates, we then start of on a new cosmopolitical adventure into the ecology of everything.

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The Fire and the Song: Notes on a Planetary Documentary Practice

Solveig Qu Suess

> There is no such thing as documentary.
>
> Trinh T. Minh-ha

In the 1960s, the oil conglomerate Shell set up a Film Unit, which produced a PR documentary series on the plurality of challenges that humanity faces in their endeavor towards modernity. This series included a documentary on the Mekong Project, depicting the United Nations project that aimed to engineer the river for the purposes of redistributing food across the whole of Southeast Asia, as well as the documentary "Rival World", which portrayed shots of a pest-spraying aircraft battling through vast locust swarms in Africa. (Shell Global, 1964) Circulated to audiences across classrooms and institutions all over the Western world, Shell Oil, alongside many others including British Petroleum, the German optical company Zeiss, and U.S. computational conglomerate IBM, leveraged their respective scientific research into the natural world and brought into popular imagination concepts such as the third world and human-induced climate change, their vast infrastructure of global vectors expanded. Since then, rapid changes introduced by these infrastructures of extraction, computation, and communications mark the intertwining of distant places into a new spatialization of the world.

This essay is about artistic research and working with moving-image practices, threaded by critical tools and key references to think with. This essay hopes to build on how documentary filmmaking is a powerful time-based sense-making tool that can enable an understanding of multiple and interrelated temporal scales in contexts where different realities and relations might be obscured. (Davis & Smaill, 2018) To echo filmmaker Trinh T. Minh-ha's provocation, "there is no such thing as documentary". In other words, any claim for objective representation has always been a concoction - an engineered myth. Documentaries, such as those from the Shell Film Unit, did not represent the reality of the world but instead portrayed a world that was largely in contrast to what was actually occurring. The ecological costs ignited by Shell's infrastructures remain indisputable – being amongst a small group of fossil fuel producers who have produced more than 70% of the world's greenhouse gas emissions since 1988, along with ExxonMobil, BP and Chevron. ("100 fossil fuel companies and investors," 2017)

Allan Sekula, photographer and essayist, writes how photography as a medium has the ability to hide the origins of its own production, simultaneously representing a social world while obscuring how that world is made. (Coleman & James, 2021, p. 12) His words serve as a reminder of how the practices of documenting have long been intricately entangled with carbon-heavy and capital-expanding world-systems. Documentaries, whether photographic or cinematic in capture, are not only instrumental to processes of seeing, categorizing and managing nature— they actively cut, divide, and keep relations between geographies and layers of politics separate and obfuscated, such as the contradictions and inherent greenwashing mobilized by Shell Film Unit and other techno-extractive conglomerates during the 60s and onwards. How, then, can we look at the earth from above, from below, and from within, while at the same time insisting on the documentary form as a critical method to research the planetary?

Geocinema

I refer now to my past work under Geocinema, which acted as a collective project as well as a thought experiment for thinking of a planetary cinematic practice.[1] Geocinema considered planetary-scale sensory networks— roving satellites, surveillance cameras, geosensing arrays, billions of cell phones — as a vastly distributed camera. Sensing fragments of the earth, each signal and transfer runs through its own sets of scales and tempos while producing terabytes of raw data. Here, the representation of the earth is the sum of a decentralized editing process with its image anything but whole. (Bazdyreiva & Suess, 2018) It became critical for me and my collaborator Asia Bazdyrieva to understand the implications of earth-sensing operations and outer space practices of image production, and what these operations and practices did to questions of representation, or representing the Earth.

From the moment the first satellite was launched in 1957, remote sensing was designed to focus on signals instead of images. Since that time, the vastly distributed infrastructures that support remote sensing and the further acquisition, transmission and archiving of its data, remain invisible to the human eye and mostly resist the kind of representation brought forth by images such as the famous Blue Marble photograph, loaded with representational power and depicting the world as a solid, total object. Depending on various conditions, such as material— satellite receiving stations, the technical capacities of research and scientific institutions—or sociopolitical—alliances between nation-states which allow for the smoother sharing of geospatial data—as well as cognitive conditions—personnel technically trained for manipulating, analyzing, and interpreting the data sets along with their visual translations—an image contains an abundance of possibilities in the ways in which it could realize its future possibilities. These imaging operations would make visible not only the spectral signatures of minerals, petroleum, and coal resources but also of pollution from urban and oceanic topographies. What Jennifer Gabrys calls the "becoming environmental" of sensory technologies, rather than the environment being a mere backdrop to its operations, the environment shapes and is shaped by ever-ubiquitous computational networks. (Gabrys, 2016) The investigation into environmental and sensing media and how they co-constitute space therefore requires a new perceptual method of how to study them. The act of creating an aesthetic vocabulary to address these spatial conditions becomes an important political task within the documentary form.

When the Geocinema collective began the process of filming *Making of Earths*, we took the Digital Belt and Road (DBAR) as a starting point.[2] The DBAR project was born out of the Chinese Science Academy, with its headquarters based in the newly-built campus of the Institute of Remote Sensing and Digital Earth in Beijing. As we began our research, we interviewed Professor Li Guoqing, head of the DBAR Big Data Working Group, who describes the process by which data is taken from satellites and distributed as knowledge for various uses, public and private. It was there that we quickly learned of the scale of the DBAR project, being overwhelming as well as vastly distributed, involving twenty-seven active satellite missions, and four running satellite ground stations within China's borders with eight representative centers outside the country, established across four continents.

Media theorist Jussi Parikka wrote that imaging and sensor-based techniques that have proliferated over the past few decades are "emblematic, of alternative sense of visuality but also of the political formulation of issues of territory and futurity." (Parikka) This visuality is less about images, but about the architectures, labor, and infrastructures through which operations unfold and what they lay the grounds for. Questions such as *how* the earth was being imaged were much more important than what the images were– how was Big Earth Data gathered, visualized, interpreted, or circuited constellations of ground receiving stations, board rooms, and laboratories? How does it feed back into the business deals of various nation-states and companies from the private sector, and built infrastructure plans of the Belt and Road Initiative (BRI)? (Bazdyreiva and Suess, 2021)

Entering into the many layers of DBAR, there is already an understanding of the prioritized efforts being made in centralizing databases and standardizing protocols for staff and machines. These ecologically informed media developments emerge across the geographies of the Belt and Road, providing knowledge and tools necessary for re-scripting local ecosystems on a global scale. Air and water quality monitoring systems are being installed in expanding cities across Africa while its data is being actively analyzed by the Chinese state towards the design of its own cities. Elsewhere, China provides remote sensing data support to Pacific nations while telecommunications company, Huawei, lays fiber optic cables under the ocean. Long-term leases on resource-rich lands and Chinese-issued loans for coal, oil and gas plants across central Asia continue while China decarbonises its economy internally. When asking the question of whose futures are being considered in these new geographies, what needs to be taken into account is that the imaginary of the Earth's nervous system is not a neutral all-encompassing totality, as promoted by the DBAR project, but rather it is a representation and articulation through a very distinct technological, ideological and geopolitical vantage point. (Bazdyreiva and Suess, 2020) This comes to the forefront when extractive frontiers are expanded through data, each with inherent biases in value metrics. This aligns with what academic Shaoling Ma has written on how the Digital Belt and Road's Science Plan frames the environment, including sovereign territories, peoples, and natural resources as data assets, including the nefarious policies of localized, colonial tracking of Turkic minorities in the Xinjiang Uyghur Autonomous Region (XUAR). (Ma, 2023) The BRI and DBAR follow a legacy of large-scale global projects, each premised on scientific research that is complicit with resource extraction and forms of exploitation within world capitalist-colonial systems.

To echo Jennifer Gabrys' understanding of the planetary, where she thinks alongside postcolonial scholar Gayatri Spivak and anti-colonial novelist Sylvia Wynter, the planetary can be thought of as a praxis of being and becoming, a way to engage the Earth as a non-uniform epistemic representation while emphasizing its potential for transformative action within social structures. (Gabrys, 2018)[3] To hold this in tension with the abstract and totalizing claims to which platforms such as DBAR put forth, thinking through the planetary in this process-led and deeply reflexive way while understanding the inability to fully know the Earth, acted as a potent space for filming, editing, and producing Geocinema's cinematic work.

Rhythm Machines

As outer space views of the planet proliferated, so did networks of sensing back down on Earth. Returning to the opening documentary produced by Shell Film Unit on the Mekong Project, the documentary followed various international teams who contributed to the initial studies of the Mekong, celebrating the unity of 60 nations including Australia, Canada, the Netherlands, India, Israel, Japan and the U.S.. In the film, the river was characterized as rogue and unpredictable, with the inability to forecast its flood pulses noted as the driving reason for their collective efforts to image and map its entirety. Filmed scenes captured various investigations of the plateaus of the basin, probing the mainstream of tributaries, examining the Mekong's entire course from the air, and photographing, mapping and measuring the rainfall, snowmelt, volume bedload, and recorded speeds of flow for a period of around five years. Data that had been collected allowed the creation of foundations for future developmental plans which included the damming of the river. During the Cold War, the construction of dams had been considered a key foreign policy objective for the U.S. who hoped that hydropower irrigation and flood control projects would lift mainland Southeast Asia out of poverty, thereby discouraging Communism while also serving as instrumental in the making of water as a resource. The sensing, mapping and systematization projects supported efforts to turn Southeast Asia from a 'battlefield to marketplace' during the Cold War, where the Mekong Project's inaugural surveys of the entirety of the river drew not only representations of sedimentation, tributaries and landscapes, but underpinned how the river continues to be contested between upstream and downstream nation-states. (Middleton, 2022) The documentary draws to a close with a dramatic line, stating that it is "no small task, even with all the genius, all the vision of the nations, to grapple with that silent primeval force, and remake it in the human image." (Shell Global, 1964)

We can think of how modern nation-states have historically been image-making machines, where their systems of knowledge create worlds in their image. Early cartographic representations of the world were European Imperialisms' main tools for expansion, paralleled often with an expansive ethnographic program that had followed its colonial networks, studying, photographing, and categorizing identities, subjugating peoples and landscapes. This type of expansionist work is continued today through images created through sensing networks, even if its representations differ in form (e.g. modern-day DBAR) which continuously promises and smoothly expands the construction of smarter and more sustainable infrastructures across all seven continents. In the Mekong, the early surveys, measurements, and images made of the river as shown in the Shell documentary, ignited material developments and particular spatial-temporal conditions which have since drastically changed the flood pulse of the Mekong. What was previously framed as rogue was in actuality the river's flood pulse, driven by the region's monsoonal weather patterns, central to the river system's overall biodiversity and ecological fecundity. The Mekong, which begins in the Tibetan Plateau, is now punctuated by hundreds of dams built in China and Laos, sending ripple effects downstream as water levels fluctuate across Myanmar, Thailand, Cambodia and Vietnam. It is striking to see that nothing much has changed in terms of who sets the metronome of development along the river as most of the contested hydroelectric dams that are being secured right now have been laid out since the UN-led Mekong Project. With hydroelectricity framed as fueling the region's sustainable energy transition, current ambitions by the Chinese-led Asian Infrastructure Bank vouched to support a regional homogenization of interconnected energy grids fed largely by hydroelectric dams constructed on the region's main river. Thailand has recently signed a power purchase agreement for the planned Pak Lay and Luang Prabang dams in Laos, further legitimizing their construction and reshuffling downstream geographies in its wake.

Rhythms conjured by the imposition of the hydro-electric dam, where new metronomes, formats and material patterns can be noted—the river's pulse dictated by energy demands from far away cities, which inform when water might or might not be released, rather than from seasonal fluxes. Huge irrigation networks have multiplied as the river's water is redistributed through the dam regime, reshuffling huge swathes of landscapes primed for the expansion of plantations. And with the shifting rhythms of the river, many of those who lived for generations tacitly knowing the river and sensing its pulsations through their everyday practices, are amongst the first to notice.

Around 20 years ago, people who lived by the river in Northern Thailand's Chiang Khong district, noticed that the water level was not stable anymore. When there was no rain, the water level rose. When there was rain, the river had remained dry. People who lived in villages did not know what made these changes, nor were they notified of any change to expect. (Intayouth, 2023) Situated on the Thai-Lao border along the banks of the Mekong River, the Chiang Khong Conservation Group, or the Mekong School for short, sent their member Nopparat Lamun along with another friend to take photos and report first-hand accounts of what had been responsible for the river's sudden change. They traveled upstream, taking photos as they moved from their town by boat and bus along the river and across the mountainous region of Laos and Myanmar until they finally reached Xishuangbanna in China. They ended up finding the source of change, which had been the first mainstream hydropower dam built on the Mekong, the 1350-megawatt Manwan hydroelectric dam located in Yunxian County, Yunnan Province, China. The majority of its power production had been sold to the affluent cities of China's East Coast, with plans to sell electricity to Thailand through new transmission lines. (Nopparat Lamun, 2024)(Dialogue Earth,) Following their return, Nopparat Lamun disseminated their en route photographs, drawings and information collected, distributing them widely to notify villages in the Chiang Rai district. Since then, the School has continued compiling video and image documentation of the river's changes—from dams under construction, and untimely floods, to dried-out river beds—and how the river's pulse is felt, particularly in response to processes of state-led economic exploitation that have disproportionately affected local livelihoods and territories downstream.

The School's documentary practice can be understood as a speculative and anticipatory one, aimed towards educating communities about ongoing impacts as well as documenting for future reference, to challenge destructive top-down future planning and developmental projects. Within their network of villages in Chiang Khong district, the School regularly hosts citizen-science workshops for communities to keep records in case of needing evidence in future claims. These include water sensing and monitoring, for contaminated water from a new factory upstream, to residues of pesticides used in banana plantations in Laos, seeping across the fluvial border.

Currently, more than 160 hydropower dams operate on the Mekong and its tributaries, with 13 on the river's mainstream and hundreds more either planned or under construction that have been constructed on the river. Not only do they exacerbate the effects of climate change and impact the ecosystem, disturb the migratory patterns of fish as well as riverbank plants and birds and local agriculture downstream, but they are increasingly entangled with the regional energy market, where new deals are being agreed for exporting power outside the Mekong region to countries such as Malaysia and Singapore. (Mongabay, 2023) The speculative documentary practice of the Mekong School grapples with living in the ruins of climate and human-induced change by raising awareness for the multiple scales of devastating effects that hydropower infrastructure projects bring forth, particularly on communities who are faced with ruptured lifeworlds and processes of dispossession, flooded landscapes and altered labour-environmental relations. While at the same time actively trying to find innovative ways to negotiate lived conditions, whether through creating potential evidence for future legal pushbacks against destructive development projects, or extending collective memory for future film edits. Documentary here becomes a prism to think with and understand collective experiences as they move across scales. This is not only relevant when thinking about how different publics are wrapped into the image-politics addressed, but also in broadening the scope for collective action and advocating for different ways to live within changing landscapes.

Planetary documentary practices

Understanding the documentaries produced by the Shell Film Unit as early efforts to greenwash the petro-company's image, it becomes very visible that cultural representations of the way scientific knowledge is acquired and used, such as with the sensing operations of the Mekong Project, have historically been ideologically charged, and at times directly implicated in obscuring the responsibilities for environmentally damaging practices. The documentaries produced by the Shell Film Unit supported the idea that the Shell Oil Conglomerate is a patron of progress, democracy, and modernity, at the same time, growing their petro operations and furthering the global economy's dependence on oil. How do we form critical practices that can piece together relationships that have been made obscured? To return to Allan Sekula's quote from the introduction where photography as a medium has the ability to hide the origins of its own production, an important element of a planetary filmmaking practice is the direct engagement of simultaneously representing a world while addressing the epistemic politics in which the world is being made. (Coleman & James, 2021, pg.12) How we image the planet literally changes the Earth. How do we as cultural producers, filmmakers, and scholars working between the sciences and arts create representations of Earth, especially as the planet is undergoing various crises on planetary scale?

In search of an aesthetic vocabulary apt for addressing such planetary transformations, a critical filmmaking practice interrogates the status of reality and truth and identifies how power traverses through visual regimes; DBAR, as well as the UN-funded Mekong Project, belong to a lineage of image-making machines, where their systems of knowledge have and continue to create worlds in their image. By focusing on the politics of knowledge and the mediation of environments– with their image practices that enact and exceed beyond the boundaries of their frames– the many dimensions of injustice related to climate change and how they interact with existing inequalities along lines of gender, race or class, among others, are made more explicit. A critical filmmaking practice counters these visual regimes through a process that investigates the cracks of these projects by trespassing various archives, entering policy meetings and construction sites, assembling data and reinterpreting various sensing and sensory information, so as to continuously attempt to situate and grapple with the forces which compose the world and its becoming.

In the film produced by the Geocinema collective, *Making of Earths*, we engaged through a series of investigations into remote-sensing, asking what is involved in making an "Earth" out of the many worlds that have already existed. This entailed a re-engagement with how the representation of Earth from the vantage of space had fundamentally altered the way the planet is being related to. Rather than images that passively represent the Earth from the outside, Big Earth Data are signals to which layers of information could be extracted, interpreted and translated into images, visualizations, renderings, diagrams, and future forecasts. They contain a multitude of possibilities for knowledge, and whose politics can be detected in how they are being acquired and circulated. The film builds a "continuum of media and nature and the logistical nature of observations" by tracing signal to data to architecture– conference halls in Southern China, SriRacha Ground Station, Tengchong Volcanic Park, Chinese Academy of Sciences— where these spaces frame, manage and organize material worlds, both now and through predictions of a multitude of possible futures they lay grounds for. (Parikka, 2023, pg 55) To situate the filmmaking across clear settings localizes these otherwise seemingly abstract data processes within a distinct technological, ideological and geopolitical vantage point, centering place as a powerful tool for pinning down this enormity and allowing for an imagination of being on/within/alongside, or experiencing the planet. (Messeri, 2016, pg 12)

Critical documentary practices rely on alternative modes of recording and gathering evidence that challenge state and corporate entities such as with the environmental activist group, the Mekong School. Their practice already understands the constructedness of how state-corporate entities use documenting as evidence for scientific and historical realities, such as in environmental studies and surveys which feed into top-down developmental plans, and instead use a plurality of documentary practices to create spaces of negotiating scientific knowledge and their meanings. How the river's new informational and sensorial experiences are being recorded, visualized, and understood is playing an important role in the service of environmental movements in Northern Thailand, especially in collectively documenting and holding accountable much larger forces and their damaging effects such as from the regional energy market fueling the continual construction of hydro-energy dams on the Mekong's mainstream, or Chinese-owned plantations in Laos using mass amounts of chemical fertilizer.

To conclude, I return full circle to Trinh T. Minh-ha. She suggests that to build and unbuild a practice from the peripheries of Western knowledge systems might be more attuned to what Congolese author Tchicaya U Tam Si refers to as "the fire and the song" (Trinh1991, pg 199). Practices where bodies are brought together through the multitudal experience of gathering around the same firelight, or through the transfers of knowledge coded in sound and song. Embracing the notion of practice as both "the fire and the song" underscores the importance of collective affective experiences, and opens up avenues for the imagining of different collective present-pasts and futures, while drawing acute relations across locales when navigating the becoming planet.

1 See https://geocinema.network/

2 See http://dbeltroad.org/

3 See Gayatri Chakravorty Spivak, *An Aesthetic Education in the Era of Globalization* (Harvard University Press, 2015)., and Wynter, Sylvia. "On Being Human as Praxis." Black Knowledges/Black Struggles: Essays in Critical Epistemology, edited by Jason R. Ambroise and Sabine Broeck, Liverpool University Press, 2015, pp. 159-180.

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More-than-Planet *Atlas*

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