Imagining Earth: Concepts of Wholeness in Cultural Constructions of Our Home Planet

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Introduction

Visions of the »Blue Marble«. Technology, Philosophy, Fiction

Solvejg Nitzke, Nicolas Pethes

Almost five decades ago, two photographs of planet Earth, taken by Apollo missions 8 and 17 respectively, marked both the end and the beginning of an era: *Earthrise* (by William Anders, 1968, Nasa-ID AS8-14-2383HR) and *Blue Marble* (by Harrison Schmitt, 1972, AS17-148-22727) seemed but an »afterthought«[1] – at first sight a hardly noteworthy side product of the dramatic ›space race‹ between the United States and the Soviet Union that further deepened the divide between the different worlds the hot and cold wars of the 20th century had created – west and east, ›first‹ and ›third‹ etc. At a time when these divisions seemed insurmountable and nothing appeared more remote than the idea of uniting ›the‹ world as a whole, the photographic constructions of this unity and wholeness were not only perceived as a scientific success of empirical representation, but »yoke[d] Earth back to the center of our attention by insisting on an Earthly eccentricity that not even Copernicus had countenanced.«[2] Although it could have been read as a demonstration of technological superiority on one side of the divide, the space race inadvertently opened an unexpectedly neutral view on Earth from the outside that revealed the unity, the vulnerability as well as the beauty of mankind's home.

1 | Cosgrove 1994, 274: »Ironically, if Earth photography was almost an afterthought in mission planning, it was these low-priority targets of opportunity that would yield some of the most enduring images of the entire Apollo program.« Cosgrove also notes that Soviet Missions did not bring back any photographs of earth similar to those of the Apollo missions (270).

2 | Lazier 2011, 621.

Instead of being received as a proof of American supremacy or as evidence for Earth being a planet like any other, seeing the ›Blue Planet‹ paradoxically created a new and ›global‹ relationship between human beings and their environment in the years and decades to come. In a certain sense, this new ›ecological‹ relationship followed the astronaut's external gaze and rediscovered humanity's connection with its biosphere from the distance of a lifeless satellite: While so many other cartographic or photographic depictions of the globe up to this point had ensured a sense of mankind's superiority over Earth and its nature by marking traces and achievements of human culture – i.e. nations, cities, buildings that were inscribed as artificial names upon the representations of places, regions, and continents – the image of the »naked earth«[3] appeared fragile and in need of protection rather than conquest or colonization. Viewed in awe as a whole by the astronauts of the Apollo missions, Earth seemed to render all human borders, conflicts, and even cultural achievements, indifferent.

So it is no surprise that *Blue Marble* is among the most widely disseminated photographs in human history.[4] It is the ›picture of the world‹ in a twofold sense: an image of the planet as a whole, but also the basis for a collective imaginary of ›our world‹ that as such seems beyond critical reflection.[5] Therefore, precisely because of its omnipresence, it is especially hard to identify Earth-photography as a specific technology of culture, one that created more than represented an entity and that therefore has to be analyzed within its historical, medial, and epistemological contexts instead of being taken for granted or as empirical evidence. »How are we,« Benjamin Lazier asks, »to write a history of something that ›disappears‹ in its ubiquity? How are we to write a history of an imagination that becomes all the more important as it disseminates and fades, as it seeps into the mental architecture that conditions our most basic, everyday experience?«[6]

These questions are also central to the collection of essays in this volume, and yet they have to be taken far beyond the iconic *Blue Marble* image. The present volume doesn't merely regard the »Earth-

3 | Ibid., 609.

4 | Cf. Lazier 2011, 606.

5 | Cf. Cosgrove 1994, 274.

6 | Lazier 2011, 626f.

rise era« as an effect of »the Globalization of the World Picture«[7] in terms of the consequences that the new perspective on our planet had had for the various ecological movements of the late 20th century as well as for contemporary ecocriticism. It suggests taking the photographs of planet Earth as a point of departure that enables us to question the general interconnectedness of concepts of ›wholeness‹ and ›unity‹ of the world on the one hand and graphic representations as well as textual discourse on the other.[8]

From this point of view, Whole Earth-photography, innovative as it was at the time, had been anticipated and prepared for a long time. Apart from Stuart Brand's famous demand to finally provide a view of the earth as whole[9] as well as the subsequent use of whole earth-imagery in the emerging environmental movement, there is a particularly rich and diverse pre-history of drawings and pictures as well as an eminent tradition of philosophical reflection that experiments with and reflects on the possibility of knowing and describing the world as a whole. The various maps and encyclopedias of Early Modern science were an attempt to represent the geographically known earth as well as the world of knowledge ›as a whole‹. But insofar they were medial representations, they were based not on empirical evidence but on what Bruno Latour calls »drawing things together« in his analysis of the construction of scientific truth by the use of media technologies such as pen and paper, notebooks, graphs etc.[10] Since the age of the printing press, this »paperwork« made representations of the world accessible as »immutable mobiles« all over the world and thus created a homogeneous view that

7 | Lazier 2011 focuses mainly on Hannah Arendt, Hans Blumenberg and Martin Heidegger.

8 | This collection thus carries forward Denis Cosgrove's project of a ›cultural history‹ of representations of the globe: »A cultural history of imagining, seeing. and representing the globe – Apollo's Eye – stitches elements of a historically deep geographical imagination to practices of globalization that have helped define the West through continuous reworkings of an expanding archive of global images, narratives, and myths.« Cosgrove 2001, 3.

9 | Stuart Brand, founder of the Whole Earth Catalog, printed his influential question »Why haven't we seen a photograph of the whole earth yet?« on badges in 1966. Cf. Diederichsen/Franke 2013, 6.

10 | Cf. Latour 1990, 19-68.

seemed all the more ›true‹ as it was generalized by an ever growing market for mass media products. In addition, technologies of transport, communication, and warfare in the 19th century further contributed to the idea of being able to cover the world without residue.[11]

The »Earthrise era«[12] is but the tipping point of a long tradition of drawings, maps, and models: taken from space, the furthest frontier of human advancement so far, it also represents a look *back* on the history of human discovery and – at a point in history when all the blank spots on the maps are filled and humanity progresses beyond the limits of maps – it presents its results in a single view.[13] But the »Earthrise era« is also a tipping point in the sense of the paradox alluded to earlier. Insofar this look back on a history of culture, technology, and exploration became an icon of the environmental movement, it marks the end of the assumption that Earth's resources are infinitely exploitable, and it reinstated the notion that what we see from the distance in these photographs is not only an object of research and representation, but also the ›home base‹ for all these endeavors.

Therefore, representations of wholeness are not only epistemologically but also politically significant. Did *Earthrise* and *Blue Marble* indeed open the path for a new ecological awareness as well as for the idea of creating a globalized community? Or was the shot from outer space just another version of the imperial gaze that rather promoted the destruction of our planet and the divergence of human society, in the way Denis Cosgrove analyses the historical relations between aerial photography and geopolitics, by enabling the perception of photography as an objective account »of the Earth ›as it really is‹«[14] as well as the »Contested Global Visions« of the planet as a globalized »One-World« or a united »Whole Earth«?

In his *Cartographic Genealogy of Earth in Western Imagination*[15], Cosgrove traces the origins and precursors of the (seemingly new) at-

11 | Cf. Krajewski 2006.

12 | Lazier 2011, 605.

13 | Ironically the first time the full earth has been photographed (by human beings) has so far been the last time and marks the end of the space program's manned missions outside of Earth's orbit. Cf. Cosgrove 1994, 274.

14 | Cosgrove 1994, 279.

15 | Cosgrove 2001.

tempt to take the whole world into *one* view back to Ptolemy's famous world maps and to representations of the totality of the world in various sacred and scientific as well as imperial and colonial contexts.[16] All those diverse images of the planet depend on what Cosgrove calls the »Apollonian gaze« – a perspective »which pulls diverse life on earth into a vision of unity«[17] and enables the (imagined) beholder to take its entirety and totality into a single view. As such, this Apollonian perspective isn't (and has never been) purely objective. It »is individualized, a divine and mastering view from a single perspective. That view is empowering and visionary, implying ascent from the terrestrial sphere into the zones of planets and stars.«[18] In consequence, Cosgrove concludes that to see the earth as a whole is to actually lift oneself above it – physically and morally.[19] By relating modern photography to ancient mythology, Cosgrove not only hints to the long tradition of medial representations and epistemological reflection that preceded the new perspective of the Apollo mission, but also to the poetic and philosophical implications evoked by its eponym.

Our collection of essays takes on this project by bringing together studies of the conditions and consequences of Whole Earth-images with analyses of fictional attempts to create a perspective of planet Earth as a whole. The discussion of fictional (and non-fictional) texts and their respective perspective on Earth, however, is based on the aforementioned traditions of the imagination of the planet as well as on the long tradition of Western philosophy that discussed the problem of representing wholeness. Opposed to the ancient ontology of *kósmos* (the harmonic order of physical materiality) as well as the metaphysical concepts of *universitas rerum* or *aggregatio corporum* (brought forth,

16 | Cf. Cosgrove 2001 and Brotton 2013.

17 | Cosgrove 2001.

18 | Ibid., xi.

19 | »The Apollonian perspective prompts ethical questions about individual and social life on the globe's surface that have disturbed as often as they have reassured a comfortable Western patriarchy. It also prompts a poetics of global space, an attachment beyond the material and visible surface.« (Cosgrove 2001, 3) It is possible to read the *Genesis-petition*, a finally granted petition that asked the astronauts of Apollo 8 to read – while looking at Earth – the biblical story of creation on Christmas Eve 1968 in accordance with Cosgrove's claim. Cf. also: Poole 2008.

e.g., in Leibniz's *Theodicee*), the rise of empirical science in the course of the 17th and 18th centuries no longer considered totality a proof of truth. In his *Critique of Pure Reason*, Immanuel Kant contrasts the pre-critical notion of the world as an ontological totality with the selective constructions of reality by the human mind and its categories of perception. In consequence, Kant reflects on the two possible notions of »cosmical concepts, partly because [of] this unconditioned totality [that] also underlies the concept [of the world-whole] [which] is itself only an idea [...]; partly because they concern only the synthesis of appearances, therefore are only empirical syntheses.«[20] The world, in other words, can be conceived either transcendentally as an abstract idea of totality, or empirically as an endless series of phenomena and causal relations. But in both cases, it is not representable in its wholeness and therefore merely a regulatory concept.

Eighteenth and nineteenth-century philosophy and science show evidence for both notions of the world. Attempts to classify and measure Earth in its geographical and biological totality include Carl von Linné's *Systema Naturae* or Alexander von Humboldt's *Kosmos,* and such an effort still resonates in the first paragraph of Ludwig Wittgenstein's *Tractatus*: »The world is everything that is the case.«[21] This idealistic approach was most famously elaborated in the objectification of the *Weltgeist* in Hegel's system as well as in Arthur Schopenhauer's *The World as Will and Idea* that radicalized Kant's notion of the subjective construction of reality.

But in the 20th century, both subjectivism and constructivism once again question the possibility of representing the world as whole. In *Being and Time*, Martin Heidegger contradicts metaphysical as well as empirical ontologies by defining human *Dasein* (being-there) as *In-der-Welt-sein* (being-in-the-world), i.e. by being absorbed in the functional interrelations of all actions and perceptions among each other. Therefore, the concept of an empirical world is replaced by a referential notion of worldliness (*Weltlichkeit*). »Dasein« means to merge into the practical and meaningful interrelations of the world as opposed to its theoretical description – a mode of being that Heidegger calls caring (*Sorge*), implying that human life is never isolated or self-satisfied, nor does it objectify

20 | Kant 1929, 385 (my emendations according to the German original, B 434).

21 | Wittgenstein 2001, 5.

the outside world empirically. Rather, it is constantly in the process of using and interpreting what is around, guided by a tacit understanding of the network of relations between its actions and the functional dimension of objects, the caring of other beings, and the process of history. »The referential context that constitutes worldliness as significance,« Heidegger posits, »can be formally understood in the sense of a system of relations.«[22]

Thus, the meaning of the ›wholeness‹ of the world loses all empirical features, but at the same times also rejects idealistic implications. The world is where and what we live in practically and that we only understand as long as we do not try to theoretically describe or explain it. Heidegger's hermeneutical approach is thus based on a notion of the ›world‹ as a frame of reference and meaningful environment in the sense in which his teacher Edmund Husserl borrowed the term »Umwelt« from biologist Jakob von Uexküll.[23] In the same way modern biology describes the specific milieus living beings constitute for themselves, Husserl's concept of »Lebenswelt« also aims at the pre-theoretical pragmatic orientation of everyday human life. And as pre-theoretical and pragmatic, the »life-world«, too, is beyond representation.

But insofar the concept is based on von Uexküll's biological theory of relation between livings systems and their environment that later influenced the description of autopoietic organisms by Humberto Maturana and Francisco Varela[24], this unrepresentability is also related to constructivist theories such as Niklas Luhmann's sociological systems theory. Here, the world also refers to the sphere of meaning that is the basis for communication within social systems. But insofar as social communication means to select from a potentially unlimited pool of possible statements, this reservoir in its entirety is once again beyond availability or representation: the »whole world is thus present at every

22 | Heidegger 1996, 82 (§ 18). Heidegger's highly influential theory of worldliness lost its innocence when he transformed it into the concept of »Weltbild« (world-image) in a lecture that he delivered in Nazi Germany in 1938 and that immediately supported its anti-Semitic ideology. It wasn't until after World War II that Heidegger transformed this lecture into a seemingly anti-fascist essay upon including it into his collection *Holzwege* in 1950.

23 | Cf. Husserl 1970, 108f.

24 | Cf. Maturana/Varela 1980.

moment; not as *plentitudo entis* [fullness of being], however, but as the difference between actualized meaning and the possibilities accessible thence.«[25] Whereas Heidegger concluded that we are always and already merged into an endless network of relations and thus part of the structure we try to explain (which is just another way to define the hermeneutical circle), Luhmann rephrases the same constellation as a problem of observation and theory of difference. The world cannot be observed or represented as a whole because observing and representing necessarily imply a selection (which is what George Spencer-Brown means when he commands to »draw a distinction«). In order to observe the world, we would have to distinguish it from something else, too. But since the world is everything, it would also have to imply what we distinguish it from. »The unity of the world,« Luhmann asserts, »is therefore not a mystery but a paradox.«[26]

This paradox is the unity of a difference. According to Luhmann modern society is functionally differentiated, i.e. there is no center or control of society as a whole but merely a number of social subsystems that operate autopoietically by drawing the distinction between themselves and their environment. And insofar this environment is everything else other than the system, it remains beyond availability or representability from within the system in the same way the world as a pool of possibilities is the unstructured precondition for actual communicative selections. »The world of modern society is a background indeterminacy (»unmarked space«) that allows objects to appear and subjects to act.«[27]

Heidegger's and Luhmann's reflections on the theoretical inaccessibility of the world as a whole might, at first sight, seem far afield from the issues of medial representations of planet Earth and their political consequences, which are the main topics of the present volume. And yet, Luhmann's notion of the world as an unmarked background can be retraced to the same historical constellations that are in question when the human species discovers space as the last frontier within the process of discovering and colonizing the world. Thus, it also enables us to reflect on the relation between the terms ›world‹ and ›earth.‹ In Antiq-

25 | Luhmann 2013, 82.

26 | Ibid., 89.

27 | Ibid., 85.

uity as well as during the Middle Ages the known world could be geographically distinguished from an unknown remainder, it could thus be considered whole in itself. But without such areas beyond the borders, wholeness would have to be applied on the whole world which leads us back to the aforementioned paradox. »Society,« Luhmann states, »thus loses the possibility of a binding representation of the world.«[28] Since, geographically speaking, Earth is known in its empirical entirety, today, the concept of ›world‹ had to be moved from an empirical category to the state of an »unmarked background« that serves as an »overall horizon of all meaningful experience«[29] and as such is present in each act of communication, but absent from any actual »marked« representation.

What Luhmann describes as world society (*Weltgesellschaft*) from a sociological point of view is an immediate consequence of this constructivist process: the functional differentiation of society, supported by the global synchronization of communication by modern mass media, transcends all regional or national borders and establishes a global system of society which is the framework of any social operation and at the same time beyond availability for these operations. So it is precisely the globalized society of today that stands in a way of holistic representations of the world and turns photographic representation of the earth into such an immensely attractive compensation for the loss of the overall »Apollonian gaze.«

But as we have seen, these medial compensation strategies that reenact long lost mythical worldviews are highly controversial themselves. On the one hand, they seem to awaken mankind's awareness for the vulnerability of its home planet and the need to protect it as a unity; on the

28 | Ibid., 87.

29 | Ibid., 88f: »In present-day thinking, the world is neither a beautiful living being nor an *aggregatio corporum*. Nor is it the *universitas rerum*, the totality of visible and invisible objects, things and ideas. Nor is it finally infinity to be filled, absolute space or absolute time. It is not an entity that ›contains‹ everything and therefore ›lasts‹. All these descriptions and many more are provided by the world. The world itself is only the overall horizon of all meaningful experience, whether directed inward or outward or forward in time or backward. It is not closed off by its boundaries but by the meaning that can be activated within it. The world is to be understood not as an aggregate but a correlate of the operations taking place in it.«

other, the camera lenses on board Apollo 8 and 17, combined with the rhetoric of space as the last frontier, reinforce precisely the kind of (imperial, patriarchal, colonial, etc.) order that the Whole Earth-discourse, especially within the environmental movement that sprung from Californian counterculture, hoped to overcome.[30] While for example Buckminster Fuller's metaphor »Spaceship Earth« implied a controllable machine on a planetary scale, many environmentalists preferred to think of Earth or ›the environment‹ as a harmonious organism not thought of in terms of a machine but rather as a ›being.‹

But not all environmentally charged imaginations of Earth necessarily depict Earth as a fragile equilibrium, a peaceful ›Mother Earth.‹ Famously, James Lovelock's theory presents Gaia as quite the opposite: as the super-organism, Gaia is all but helpless in reinstating the disturbed equilibrium by raising the global temperature to a point where life will be annihilated – practically burned from the surface of the planet.[31] Here, the imagination of Earth as a whole is not based on the re-empowerment of an ›Apollonian Gaze,‹ but quite contrary on the disempowerment of humanity by an autonomous ecosystem that has existed and will exist again without its self-proclaimed masters.[32] Gaia and other »apocalyptic twins«[33] of Earth, for example Bill McKibben's *Eaarth*[34], build upon the fears of the so-called nuclear winter that dominated much of mid-twentieth-century discourse and thus update the image of the mushroom cloud that was originally replaced by *Blue Marble*.[35] These and many of the fictional scenarios that recently imagine Earth turning against, annihilating, as well as recovering from its human inhabitants – movies such as *I am Legend* and *2012* or novels such as Frank Schätzing's thriller *Der Schwarm* (*The Swarm*) or Cormac McCarthy's dystopia *The Road* – suggest that the narrative of the Apocalypse has become the last resort to represent wholeness and unity. Thus, imagining Earth can also result

30 | Donna Haraway, for example, criticized this view for being a »god trick« – an only seemingly objective and neutral view that is in fact a disembodied, masculinist, and technoscientific gaze: Haraway 1988, 583.

31 | Cf. for example: Lovelock 1979 and 2006.

32 | Cf. Weisman 2007.

33 | Lazier 2011, 619.

34 | McKibben 2010. Cf. also: Lekan 2014, 171-201.

35 | Lazier 2011, 619. Cf. also Diederichsen/Franke 2013, 6.

in a rather terrifying perspective on an existential conflict between the planet and the species that calls it its home.

Based on this brief outline, the collection will tackle four major distinctions and subsequent questions:
1) Image/Discourse: Which media are used to achieve a representation of Earth as a whole and what effect do different media technologies – from textual descriptions to digital simulations – have on the collective imagination of our home planet?
2) Fact/Fiction: What is the relation between empirical data and individual or collective imagination within representations of Earth, and how does this relation influence both our view of scientific studies as well as our reception of literary fiction that both claim to depict the world as a whole by their own means?
3) Part/Whole: How do both scientific accounts and fictional narratives deal with the problem that wholeness can per definition not be represented as long as the observer is part of the observed, as both Heidegger's and Luhmann's theories suggest?
4) Submission/Autonomy: In which sense are attempts to represent Earth as a whole part of a tradition of both scientific as well as political subjection of the world under man-made categories and how does this tradition relate to concepts of self-sufficiency, autopoiesis, and non-human agency of Earth as an autonomous eco-system?

The following essays explore these questions with respect to imaginations of Earth that center on recent framings of the technological and medial conditions of viewing the *Blue Marble*, the conceptualizations of Earth and its environments, as well as on narrative imaginations of the planet.

Gabriele Gramelsberger analyzes the technological innovations and conditions which allow an orbital view on the original *Blue Marble* (1972) and the narrative dimension of the mathematical construction of NASA's *Blue Marble: Next Generation* (2012). Her approach aims at deconstructing object-oriented notions of the planet in favor of investigating the re-construction of Earth as a process by asking »What is it that mathematics contributes to our global views of the world?« By taking a closer look at the technological and epistemological conditions of current imagery, Gramelsberger lays the foundation for questioning concepts of ›natural‹ wholeness and disarms simplified oppositions of inherent versus manufactured wholeness.

Angela Krewani investigates the visual traditions in which the cartographic and satellite images of Earth are produced and shows to what extent the concept and media practice of geobrowsing in applications such as Google Earth and Google Maps rely on traditionally conceived imagery and structures of visuality. She claims that contrary to the distanced Apollonic (i.e. both the God and the NASA mission) image of Earth, geoweb-applications effectively use Earth as a centralizing force and by repositioning the human position might be able to allow for a genuinely new perspective.

Gazing upon Earth and human life from a distant perspective has been a trope of science fiction well before the emergence of *Blue Marble*. Bruce Clarke's analysis of ›Gaia‹, James Lovelock's renowned rendering of the planet, connects this tradition to the paradigmatic change in the way we understand life and Earth. Behind the displacement of human self-reference and its figuration into an alien observer looms the question that also resounds in the Whole Earth discourse: what makes Earth so exceptional? Why does this planet sustain life and is it the only one? At the same moment it becomes possible to exchange the figurative projection of this gaze for a literal look upon Earth by means of ›technological prostheses,‹ Gaian science emerges to provide answers of a very different quality to these questions. Clarke examines mediations of Gaia in terms of Gaia theory, discourse, and notions of Gaia in popular culture by tracking the development of the theory as well as its fundamental impact on the concept of life. The realization of the »inextricable coupling of life and Earth« is one of the most fundamental effects of the Whole Earth-era. Not least, Clarke proves how closely this scientific conversion is linked to cultural perceptions and premediations of Earth.

Timothy Morton's essay on the »riddle of ecological awareness« or, as he terms it, »Ecognosis« draws a line from the earliest emergence of agriculture to modern »Anthropocene denial.« In his characteristic style, Morton draws on a variety of concepts to illuminate his argument about the problem of conceptualizing Earth, global warming and the Anthropocene when philosophy apparently limits the ability of directly accessing the real. He proposes to use a holistic understanding of Earth as an entity that exists (in loop form) in relation to other entities and in relation to humans to consider the Anthropocene as »the first truly anti-anthropocentric concept.« Morton thereby turns around common notions of the current ›ecological era‹ as one that de-centers the ›an-

thropos‹ by making in part of a species or even rendering it disposable for the planet as a whole. Rather, Morton claims, humans now found a way to both epistemologically and physically become the driving force of the planet's fate. While this seems to echo environmentalist claims, the underlying concept of (whole) Earth differs radically and opens up new perspectives for its discussion.

Roughly 350 years prior to NASA's *Blue Marble*, early science fiction features the view of Earth as a central aspect. Hania Siebenpfeiffer compares imaginary space travel by Cyrano de Bergerac and Francis Godwin in order to investigate the exotic depictions of the »tellurian« to show how those accounts shape modern images of the planet (for example, in the choice of color in the cartographic depiction of continents). Siebenpfeiffer is thus able to provide a tradition that is neither scientific nor religious and which predates and prefigures today's *Blue Marble*. Siebenpfeiffer's look at texts that are not commonly part of the discussion of environmental imagery also references a line of literary research that promises insights into the history of global imagination that has so far been overlooked.

Considering its emphasis on the fragmentary, subjectivity and hybridity, contemporary literature might not immediately come to mind as a source of concepts of wholeness. Using W.G. Sebald's *The Rings of Saturn* as an example, Nicolas Pethes asks »what kind of representation of our home planet results from descriptions in literature that question the possibility of a narrative construction of wholeness and totality?« He argues that it is precisely the seemingly small scope of this narrative that allows for a reconsideration of the means by which wholeness is construed. Sebald's narrator, instead of envisioning an idealized whole, detects interconnectedness and unity in the universal destructibility of all things and is able, drawing on Thomas Browne, to see the »slow turning into dark« of the enlightened planet and its civilization.

The attempt to depict a non-anthropocentric view of Earth has brought forth a remarkable number of human-less narratives. Solvejg Nitzke reads Dietmar Dath's novel *The Abolition of Species* as an example for an understanding of Earth as a product of its inhabitants. Dath's novel explores the idea of the Whole Earth in an extreme way by realizing the perfected version of Earth that *Blue Marble* too often suggests. However when Earth becomes its own monument, it ceases to exist as a living planet and ceases to be ›Earth.‹ Nevertheless, reading Dath's vi-

sion in conjunction with Hans Blumenberg's reflections on the nature of the Whole Earth-images delivers a thorough investigation of the history of (life on) Earth as well as the history of its mediation. Earth, Nitzke argues, forms an archive not only of its natural but also of its cultural history. The monumental scope of Dath's novel achieves a macro perspective that combines the spatial and temporal dimensions of the viewpoint implicit in the Whole Earth-image. Thus, it allows for a narrative realization of the merger of cultural and natural history beyond biological and planetary boundaries.

By bringing together researchers from German and Anglophone backgrounds and research traditions, this collection also aims at continuing a rich and promising line of discussion that began at the »Imagining Earth« conference and doctoral workshop held at the Ruhr-University Bochum in 2014. Thanks are due to Erich Hörl (Leuphana University Lüneburg) whose input and support were invaluable for shaping and organizing the conference in Bochum. Sincere thanks go to all participants of this conference for their contributions both to this volume and to the lively and productive discussions that lead to this book. The editors would also like to acknowledge the Ruhr-University Research School who funded the project and continues to enable doctoral researchers in Bochum to pursue projects on an international level. For their help with editing this volume, the editors would also like to thank Livia Kleinwächter and Daria Leila.

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Mathematical Images of Planet Earth

Gabriele Gramelsberger

Introduction

Since the 1970s we have grown used to the outside view of planet Earth, mediated either by satellite images or simulation images of computer models of the planet's atmosphere and climate. These views from the outside evoke the impression that we see an object, the planet Earth, and that everything we see in these images is representative of real states of the planet. However, this is not the case for most of today's images of Earth. What we really see are images of mathematical narrations of Earth. The reasons for this are the following: today's imaging of Earth always involves enormous amounts of mathematics, either for satellite views like NASA's Blue Marble: Next Generation or for visualized model versions based on the computer simulation known as General Circulation Atmosphere and Ocean Models (AOGCMs).[1] Although satellite images count as empirical data while model visualizations apply as virtual data, both data types share the same mathematical narration of Earth. This mathematical narration is given by physico-mathematical theory, in particular by hydro- and thermodynamics, and is employed in algorithms that drive satellite devices as well as simulation models. Interestingly, advanced measurement technologies like satellite-based Light Detection and Ranging (LIDAR) involve three to four times more software code – and, in turn, mathematics – than atmosphere and ocean models.[2] Thus, the core question of this paper is: How much mathematics do we

1 | Cf. National Aeronautics and Space Administration (NASA) 2014.

2 | See section 5 of this paper.

see in Earth images? Or to put it differently: What does mathematics contribute to our global views of our world?

Understanding today's imaging techniques of Earth is not easy since mathematics, algorithms, and advanced technologies are employed. Thus, this paper aims at a deeper understanding of the increasingly complex constitution of satellite images as well as simulation images of computer models of planet Earth. It will briefly discuss what is seen when Earth is observed from the outside (orbital view). It continues with an outline of the physical and mathematical narration of Earth as a processable entity (physico-mathematical view), followed by a discussion of the shift in measurement devices from photo cameras to spectrometers (decoded view), and the constraints of an algorithmic handling (algorithmic view). Finally, the merging of all these views constructing images of Earth as algorithmic objects will be discussed (merged process view).

The Orbital View of Planet Earth

Fig. 1: Blue Marble (National Aeronautics and Space Administration (NASA), 1972)[3]

The original *Blue Marble* – an image of the earth taken by the crew of the Apollo 17 spacecraft in December 1972 from a distance of 45,000 km – shows a cloud-surrounded sphere embedded in the blackness of space (fig. 1). The photograph was shot with a 70-mm photo camera

3 | Cf. Poole 2008.

and an 80-mm lens. It presents a huge cyclone roaming over the Indian Ocean (white), the land masses of Antarctica (white) and Africa (green-brown), and parts of the Indian and Atlantic Oceans (blue).[4] As 80% of the atmosphere's mass and 99% of its water vapor (clouds) is located in the troposphere (0 to 12 km), the visible sphere has a real diameter of 12,742 km plus 12 km. From this circumstance two implications follow. First, this view of Earth shows one of the main visible weather phenomena, namely cloud cover, indicating the atmosphere's circulation. Usually more than 60% of Earth is covered by clouds – ranging in horizontal size from 30 m to 4,000 km and persisting between 10 minutes and 10 days. Thus, a completely cloud-free view of the entire planet is usually not given and imaging Earth means primarily imaging clouds. Second, depending on the camera and the lens, the orbital view of the whole globe requires a minimum distance of about the geostationary orbit an altitude of 35,786 km.[5] Thus, the International Space Station (ISS) orbits at an altitude of 416 km, and most of the earth observation satellites cover only parts of Earth's surface. For instance, low earth orbit (LEO) satellites usually operating at an altitude of 800 km cover swaths of several hundred to a few thousand kilometers of Earth's surface.[6] Therefore data from various satellites are used to compose a global view.

4 | Due to the convention that the North Pole is at the top of maps the photograph has been rotated.

5 | Geosynchronous orbit satellites (GEO) are located in a circular orbit 35,786 km above the earth's equator following the direction of the earth's rotation. Thus, their position remains the same for an observer on Earth. Cf. European Space Agency (ESA) 2014.

6 | Low earth orbit (LEO) satellites, in general, operate from 160 km (orbital period of about 88 minutes) to 2,000 km altitude (orbital period of about 127 minutes), but most earth observation LEO satellites are located in about 800 km altitude. Cf. Ibid.

	Classification	Altitude	Phenomena/Devices
Moon	Lunar distance to Earth	363,104 to 405,696 km	
Space	Space	>10,000 km	GOS satellites (35,786 km); Van Allen Belt (15,000 to 25,000 km)
Atmosphere	Exosphere	700 to 10,000 km	LEO earth observation satellites (800 km)
	Thermosphere (Ionosphere)	80 to 700 km	ISS (416 km); Aurora borealis
	Mesosphere	50 to 80 km	Noctilucent clouds
	Stratosphere	12 to 50 km	Nacreous clouds; weather balloons; ozone layer
	Troposphere	0 to 12 km	Weather; airplanes
Earth	Earth diameter (Equator)	12,742 km	

Tab. 1: Locating the orbital view (information gathered from NASA and ESA websites)

Nevertheless, the global view of planet Earth was developed long before mankind built air- and spacecraft to explore the sky and atmosphere. This Earth-based global view is composed from a perspective that covers a horizontal length scale on the order of 1,000 to 2,500 km. The so-called synoptic perspective has been developed since the mid-19th century, when meteorological data were gathered systematically by standardized observations from weather stations on the ground, mainly using thermometers (temperature), barometers (air pressure), hygrometers (humidity), and anemometers (wind speed) – data that were internationally communicated via telegraph. This early synoptic view is a purely empirical perspective, which has derived from the shift of local observations into regionally and internationally coordinated data. The appropriate data-gathering tools used to compile this view were synoptic weather maps connecting singular data with isolines, e.g. isobars for equal values of air pressure.[7] Thus, the status of air masses became visible on the

7 | Cf. Schneider/Nocke (ed.) 2014; Gramelsberger 2017.

maps as isobars indicate weather patterns like cyclones – low air pressure systems causing movement in the atmosphere (wind and storms) and precipitation (rain, hail, snow). From very early on, isobar maps like the map of December 1887 (fig. 2) began displaying changes in air pressure systems, thus making visible the dynamics of air masses roaming over large areas. This led to the development of a theory of cyclogenesis often indicated by clouds, but also the desire to forecast the near future of the dynamic behavior of the atmosphere's circulation.[8]

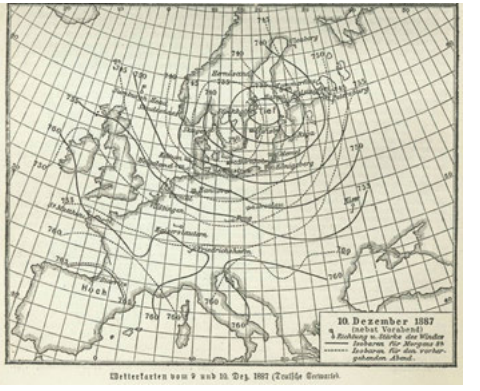

Fig. 2: Synoptic view: isobar map of 9th and 10th December 1887 with high air pressure systems (»hoch«) and low air pressure systems (»tief«) (Deutsche Seewarte, 1887)

The Physico-Mathematical View of Planet Earth

When 60% of Earth is covered by clouds, clouds can bee seen as visible indicators of atmospheric processes, in particular of the global circulation of the atmosphere. Lacking an outside global view before the invention of satellites, such a global view on atmospheric circulation could only be conceptually developed by scientists. Such a view is conceived

8 | For instance, Robert Fitzroy, a British Admiral to the Navy, became very early interested in forecasting storms. He developed a theory of air movement, forces, and duration of motion, which he called ›dynametry‹. His intent was to extract wind forecasts from local measurement data by combining statistical and mathematical methods. Cf. Fitzroy 1863.

physically by taking into account the differences in solar radiation for low and high latitudes[9], the earth's rotation[10], the differences in the speed of rotation at each point on the planet[11], and the Coriolis effect.[12] All these physical causes add up to global circulation patterns that are responsible for regional weather phenomena by moving huge masses of cold and warm, dry and humid air around the globe. In other words, warm air in the tropics expands, becomes lighter, rises, drains off to the side in higher regions of the atmosphere (air pressure falls), and causes a vertical flow, which drives global circulation. Conversely, cold air sinks and becomes heavier (air pressure rises). Differences in temperature result in differences in air pressure, which, in turn, lead to mechanical work, that is, motion based on the air's expansion and contraction. Thus, the atmosphere is scientifically conceived as a giant air mass circulation and heat engine driven by solar radiation and gravitational forces. These forces are expressed in terms of local differences of seven measurable variables: wind velocity (in three directions), air density, air pressure, temperature, and humidity.

The interactions of these seven variables are expressed by hydro- and thermodynamic theory. Hydrodynamic theory goes back to Isaac Newton's second law of motion ($F = m \cdot a$)[13], which was expanded to explain fluids by Leonhard Euler and George G. Stokes.[14] Thermodynamic theory is rooted in Ludwig Boltzmann's statistical theory of heat.[15] The advantage of such a physical theory is that it can be expressed mathematically. Hydrodynamics includes Euler's equation of motion and thus allows for the description of the development of a fluid gaseous system like Earth's atmosphere. Using hydro- and thermodynamic theory turned meteorology into the physics of the atmosphere, not only able to describe the current state of the atmosphere but to forecast future developments – as aptly outlined by Vilhelm Bjerknes in 1904:

9 | Cf. Halley 1686.

10 | Cf. Hadley 1735.

11 | Cf. Dove 1837.

12 | Cf. Ferrel 1858.

13 | The alteration of motion or force (F), respectively, is equal to the mass (m) of an object multiplied by the acceleration (a) of the object. Cf. Newton 1687.

14 | Cf. Euler 1954; Stokes 1980.

15 | Cf. Boltzmann 1896/98.

The necessary and sufficient conditions for a rational solution of the problem of meteorological prediction are the following: 1. One has to know with sufficient accuracy the state of the atmosphere at a certain time [measurements]. 2. One has to know with sufficient accuracy the laws [hydro- and thermodynamics] according to which a certain state of the atmosphere develops from another.[16]

Consequently, Bjerknes developed a first mathematical model of global circulation based on the three hydrodynamic equations of motion (describing the relation between the three velocity components, density and air pressure), the continuity equation (expressing the continuity of mass during motion), the equation of state for the atmosphere (articulating the relation between density, air pressure, temperature and humidity of any air mass), and the two fundamental theorems in the mechanical theory of heat (specifying how the energy and entropy of any air mass change in a change of state). This mathematical model of the air mass circulation and heat engine makes the seven observables (wind velocity in three directions, air density, air pressure, temperature, humidity) computable and thus projectable into future. It constitutes the core of every weather and climate model even today. Furthermore, it offers two additional advantages: First,

while measurements cannot comprise all state variables of the climate system in their full spatio-temporal extension, climate models can represent each state variable at any desired time or location within the model domain. [Second,] like cyberspace, one can navigate through the model data to experience a physically consistent virtual world. While experiments with the climate system are not feasible, climate models are the virtual laboratory of geoscientists.[17]

The Decoded View of Planet Earth

Questions on this physico-mathematical view of Earth's atmosphere have to be expressed in terms of process-indicating state variables, e.g. differences in temperature, air pressure, etc. The answers are delivered empirically by direct measurements using thermometers, barometers, hygrom-

16 | Bjerknes 2009, 663; Cf. Gramelsberger 2009.

17 | Feichter 2011, 216.

eters, etc., which then are presented in tables of figures, simple graphs, or isolines. However, direct measurement methods have been increasingly complemented with indirect methods of remote sensing, ever since Sputnik collected data for the *International Geophysical Year* from 1957 to 1958. As satellite-based measurements cannot probe the atmosphere directly, remote sensing is indispensable to transform empirical data into theory- and assumption-laden data. Why? First, satellite data require a shift to spectrometer devices that record electromagnetic signals remotely. Second, the information contained in electromagnetic signals has to be decoded by mathematical methods. Third, satellite data have become accessible via Graphical User Interfaces (GUIs) and thus manipulatable.

A typical modern signal decoding device is the Infrared Sounder (IRS) of the European Meteosat Third Generation. It is based on an imaging Fourier-interferometer for obtaining information on the atmosphere's temperature and humidity.[18] Fourier interferometry means that raw data are computed from interference in the observed electromagnetic signals.[19] The differences of the amplitudes of the interfering signals contain the information that has to be decoded mathematically by Fourier transform. Based on this mathematical method of signal decoding, increasing information can be read off the raw data. Thus, in recent years more than 50 different Essential Climate Variables (ECV) have become observable with these increasingly sophisticated measurement devices, delivering new answers to new questions about climate change.[20]

Another important signal decoding technology, which is increasingly changing environmental observation, is LIDAR (light detection and ranging) for both air- and space-borne use.[21] LIDAR actively meas-

18 | Cf. World Meteorological Organization (WMO) 2014a.

19 | Cf. Johnston 2001.

20 | Cf. World Meteorological Organization (WMO) 2010.

21 | »Three decades ago, with the incoming of the laser, the world has witnessed its particular evolution and application to the study of the atmosphere. In fact, the atmosphere was one of the first sites where the properties of the laser light (high power, monochromaticity, short pulse duration and collimation), were put on trial. With the invention of ruby lasers, generators of powerful optical pulses in the year of 1962, the use of the laser in remote optical probing was made possible.« (Castrejón-García et al. 2002, 513).

ures differences in wavelengths by sending out short pulses of laser light in the order of nanoseconds and then decoding information about the composite of the atmosphere from these differences. Thus it is possible to monitor the distribution of tiny particles of industrial emissions such as soot, dust, and aerosols–fine solid particles or liquid droplets. The basic assumption is that laser pulses interact with particles and are backscattered with a time delay. The backscattered laser light (number of received photons = intensity) is captured in the LIDAR device by an optical telescope, background radiation is filtered out, and the remaining optical signal is converted by photodiodes into an electrical signal and amplified. Finally the amplified electrical signal is converted by digitizers into a digital signal.

> Typically, lidar systems require a sampling rate on the order of 100 million samples (MS)/s, which leads to a spatial resolution on the order of 1/2 x (300 m/μs)/(100 MS/s) = 1.5 m. […] The required capture time of 100 μs at a sampling rate of 100 MS/s gives a waveform size of 10,000 points. Modern PC-based digitizers with ultrafast PCI transfer speeds are able to capture 10,000-point waveforms at rates in excess of 1000 waveforms per second.[22]

However, because the number of signals is too large, 1,000 to 10,000 single samples are averaged as one measurement and stored as raw data for further algorithm-based data evaluations and visualizations.[23] Nevertheless, LIDAR does not measure single particles, but records an echo of the particle distribution of the atmosphere.

Depending on the size of the particles, the backscattered laser beams undergo changes in wavelength (elastic/inelastic backscattering), which show characteristic signatures: small particles cause Rayleigh scattering (atoms, molecules) while bigger particles cause Mie scattering (aerosol particles).[24] In the age of anthropogenic climate change the vertical distribution of the extinction coefficient of aerosols is of particular interest, because it allows scientists to infer the influence of aerosols on the radiation of sunlight (cooling or warming effect). However, the inference of the particle types, their size, and distribution from the characteristic

22 | Dawson 2005.

23 | Cf. Cornelsen 2005, 5.

24 | Cf. Strutt 1899-1920; Mie 1908.

signature is embedded in the mathematical equation and has to be decoded by deriving a solution for the characteristic signature equation. Unfortunately, the solution of the signature equation – a (Bernoulli type) ordinary differential equation – yields incorrect results. In the words of James D. Klett, one of the leading LIDAR researchers of the 1980s, the signature equation »has a tendency to produce at best marginal results, and in practice has likely been more a source of frustration than a useful tool for analyzing radar or lidar returns. […] Worse yet, others have noted the solution may lead to ›… absurdly large, infinite, or negative values ...‹ and ›... physically meaningless ...‹ results.«[25] Remember that the only information LIDAR provides are numerical values. Thus, it is not easy to evaluate what is physically meaningless and what is meaningful. However, in 1981 Klett found a practical solution for the derivation of the characteristic signature by changing the limits of the integral. Since then the so-called Klett method has been used in most LIDAR systems, but it has the disadvantage that the LIDAR ratio (extinction to backscatter ratio) must be estimated based on assumptions. »The Klett retrieval method requires a reference point, where the atmospheric backscatter value is known. This reference point calibrates the rest of the points in the measurement.«[26] Thus, LIDAR technologies have to be complemented with in-situ measurements or, for satellites, with more complex spectrometric measurements.

The Algorithmic View of Planet Earth

Inversely decoded information from electromagnetic signals, which count as ›empirical‹ data, as well as mathematical models for simulation, which count as ›virtual‹ data, are not only purely mathematical ways of obtaining data – they are solely accessible by computation. Thus, the LIDAR equation as well as the hydro- and thermodynamic model of the atmosphere have to be provided algorithmically. The algorithmic view translates the mathematical general view – describing the interactions between the variables and parameters – into an extensive set of instructions that can be worked through step by step by a computer. What can

25 | Klett 1981, 212. Cf. Klett 1985.

26 | Marchant 2008, 57.

be written down in a short equation has to be transformed into a narratable ›if, then/else‹-plot embedded in ›do/end do‹-loops. An enormous amount of additional knowledge is necessary to create such narratable instructions to make a computer do work like measuring or simulating. Every constant, every variable, every operation has to be specified with exact numbers or instructions, respectively. No ambiguity is allowed, otherwise the program would crash. Interestingly, LIDAR algorithms involve many more lines of code than simulation models for the atmosphere and the ocean. While the LIDAR-equation as well as the hydro- and thermodynamic model of the atmosphere can be written down in one line of mathematical symbols, the algorithms require many more code lines. In raw numbers, the ADM-Aeolus LIDAR measurement products are based on 340,000 code lines, while the ECHAM5 atmosphere model consists of 65,700 code lines.[27]

Furthermore, the general mathematical approach has to be discretized for stepwise calculation. This means that the time has to be fragmented into time steps and space into layers of grid points. This is true both for measurement and for simulation methods. For instance, the »new space-borne lidar and radar [technology] will record profiles continuously every 0.1 s, so for the data to be processed in a satisfactory time, an accurate lidar forward model is required that runs in less than 0.001 s.«[28] For simulating an atmosphere model the globe is discretized into a grid of computing points, which represent an average distance of 500 to 110 km at the equator and up to 60 horizontal layers (fig. 3). Depending on the spatial resolution, an atmosphere model is computed within 10- to 20-min time steps for a time period ranging from a minimum of 30 years up to several hundreds of years.[29]

27 | The Atmospheric Dynamics Mission (ADM-Aeolus) is an ESA satellite of the Earth Explorer Mission series carying a LIDAR system for sounding air currents. ECHAM5 was one of the 22 atmosphere models of the fourth IPCC report. Cf. Reitebuch 2011; ECHAM5 2008.

28 | Hogan 2006, 5984.

29 | Climate is defined by the World Meteorological Organization (WMO) as the average weather for minimum 30 years.

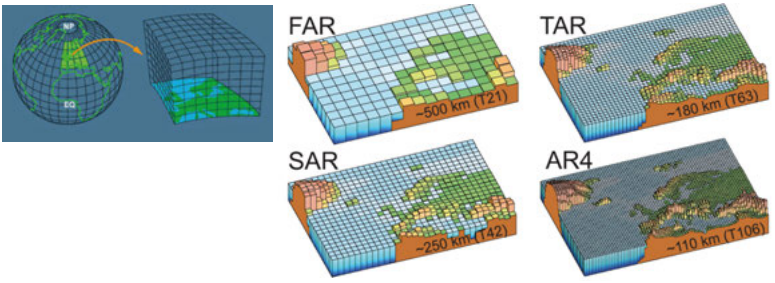

Fig. 3: (left) Digital atmosphere of a climate model (DKRZ, 2005); (middle, right) resolution of scenario calculations for the first (FAR) to the fourth (AR4) IPCC Assessment Reports (left: German Climate Computing Centre (DKRZ) 2005; right: Solomon et al. 2007, 113).

Thus, measurements as well as simulations deliver a discretized view of planet Earth. Whether or not phenomena become visible depends on the pixel size. For instance, an atmosphere model computed for a resolution of 500 km provides a very coarse view, in which small countries are represented by a handful of values for the main variables like temperature, humidity, pressure, etc. It is obvious that such a coarse view does not reveal much. In particular, it does not represent clouds, storms, or other local weather phenomena. Therefore, it is the aim of climate modelers to run their models with increasing resolution down to cloud-resolving size of approximately 2 km. However, increasing resolution requires enormous computing resources. For a cloud-resolving two-kilometer grid, computation of a global atmosphere model would have to increase by an order of 106, which is far beyond today's computer capacities.[30] For current satellite devices like the Flexible Combined Imager (FCI) of the European Meteosat Third Generation imagery standard, a 2-km spatial resolution is achieved for the solar spectral domain (0.4 µm to 2.1 µm) and a 1-km spatial resolution for the thermal spectrum (3.8 µm to 13.3 µm).[31]

This discretized view comes along with another problem, as most of the measurement and simulation grids differ from each other and data have to be assimilated. Projects like the Global Data Assimila-

30 | Cf. Randall et al. 2003.

31 | Cf. European Organisation for the Exploitation of Meteorological Satellite (EUMESAT) 2014.

tion System (GDAS) of the National Climatic Data Center in the U.S. merge heterogeneous observation data from various sources–surface observations, balloon data, wind profiler data, aircraft reports, buoy observations, radar observations, and satellite observations – into a homogeneous gridded space.[32] Therefore, mathematical techniques like interpolation methods, filtering techniques, and other statistical strategies are employed.[33] Data assimilation »merges the observations into the [simulated] model data by optimizing the fit between real observations and data predicted by the model« and thus creating ›data models‹ with the backing of ›model data‹.[34]

Conclusion: The merged view of planet Earth

It is obvious that differences between inversely decoded observations and simulation results are vanishing. Data models (indirect observational data) merge in-situ with in-silico model data (simulation models) of planet Earth due to underlying physical and mathematical principles that are the same for both views. Measurement as well as simulation data increasingly become ›data products‹ based on elaborate visualization algorithms. And these data products are even more heavily interpreted data. For instance NASA's *Blue Marble: Next Generation* image series (2012) shows images spatially composed from data of various satellites and temporally composed by averaging months of measurements (fig. 4). As the aim was to present a ›cloud-free‹ image series, clouds had to be differentiated from ice and supplementary information about the landmasses beneath the clouds had to be added. In NASA's own words:

> From a computer processing standpoint, the major improvement is the development of a new technique for allowing the computer to automatically recognize and remove cloud-contaminated or otherwise bad data – a process that was previously done manually. [... However,] in tropical lowlands, cloud cover during the rainy

32 | Cf. NOAA National Climatic Data Center (NCDC) 2014.

33 | Cf. Edwards 2010; Lahoz/Khattatov/Menard (ed.) 2010.

34 | Feichter 2011, 214.

season can be so extensive that obtaining a cloud-free view of every pixel of the area for a given month may not be possible.[35]

Fig. 4: Blue Marble: Next Generation (NASA, 2012)[36]

Another example is Moderate Resolution Imaging Spectroradiometers (MODIS) data, which were used to compose the cloud-free *Blue Marble: Next Generation* images, but also other ›purified‹ data products.[37] »The

35 | National Aeronautics and Space Administration (NASA) 2012. Furthermore, »deep oceans are not included in the source data; the creator of the Blue Marble uses a uniform blue color for deep ocean regions, and this value has not been completely blended with observations of shallow water in coastal areas. The lack of blending may, in some cases, make the transition between shallow coastal water and deep ocean appear unnatural.« (NASA 2012. Cf. Stöckli et al. 2005).

36 | NASA Earth Observatory 2012.

37 | The Moderate Resolution Imaging Spectroradiometers (MODIS) acquiring atmospheric, oceanic, and terrestrial data in 36 spectral bands cover a range of the electromagnetic spectrum from 0.4 to 14.4 µm. MODIS was developed by NASA starting in the 1980s and was launched in space in 1999 and 2002 on board NASA's Terra and Aqua satellites. Although only two MODIS instruments have been built and launched into space, the success is shown in more than »6,500 scientific papers […] using MODIS data.« (Tucker/Yager 2011, 14. Cf. Salomonson et al. 1989).

atmospheric correction algorithm removes water vapor and aerosols in order to achieve the intrinsic measurement of land surface spectral reflectance as if there were no atmosphere, taking into account atmospheric absorption and scattering, surface bidirectional effects, and surface adjacency effects.«[38] The same holds for LIDAR data, which are used not only for environmental, but also for military and agricultural purposes. For instance, »contours derived directly from lidar data are accurate but not ›clean‹ and often require a level of interpolation, simplification, smoothing, or manual editing to achieve the intuitive product most people are used to.«[39] New visualization methods like ›lidargrammetry‹ use »the intensity values from the lidar points as the ›photo‹ that is processed, using point elevations, into a three-dimensional image.«[40]

Visualization and correction algorithms increasingly present measurement data as 2D and 3D images, concealing the enormous mathematical and theoretical efforts in order to create images from heterogeneous, discretized data.[41] But these 2D and 3D images, although displaying a photographic aesthetic, are by no means photographs. The 1972 Blue Marble image can be called a photograph, but the 2012 Blue Marble: Next Generation image series definitively not. While the Apollo 17 astronauts used a Hasselblad camera, today's satellite-based imagery are multi-purpose spectrometer devices for sensing the entire electromagnetic spectrum – from visible light (VIS) to near-infrared (NIR), short-wave infrared (SWIR), mid-wave infrared (MWIR), and the long-wave infrared (LWIR) range.[42] However, without mathematics the electromagnetic signals do not reveal anything.

Of course, standards have been established to ensure significant evidence that these images represent ›empirical‹ data.[43] But these standards are stretchy and the boundaries to fictional images are fluid. As these merged views exhibit a photographic aesthetics, their fictionality is difficult to sense. What is missing is a theory to approach, describe,

38 | Tucker/Yager 2011, 11.

39 | Schmid et al. 2008, 19.

40 | Ibid.

41 | Cf. Aspey et al. 2008.

42 | Cf. World Meteorological Organization (WMO) 2014b.

43 | Cf. NDEP Guidelines 2004; ASPRS Guidelines 2004; FGDC Guidelines 1998.

and explain these types of photograph-like images. Following Frieder Nake's concept of the surface (visibility) and subface (computability) of computer based images – both mediated by the interface (human-machine interactability) – these images have to be understood as ›algorithmic signs‹ or ›algorithmic objects‹, respectively.

> The screen is the surface, the display buffer is the subface of the algorithmic object [..., which] comes as a visible appearance for us. At the same time, it comes as a computable appearance to the program. [...] It does not make any sense to talk about the computer image without keeping in mind its visibility and computability, i.e. its computable visibility and its visible computability.[44]

Furthermore, as Nake explains, »what is usually called the interface between human and machine appears as the coupling of surface and subface. Both are machine-bound. Both are faces at which one process ends, and another process starts.«[45]

Simulation images of computer models as well as satellite images are algorithmic objects, merging visibility with computability and interactability. In particular interactability turns satellite data into manipulatable objects. Instead of printed tables of figures, graphs, and isolines, Graphical User Interfaces (GUIs) make manipulations to achieve more readable, more instructive, and more accessible data products. The cloud-free Blue Marble: Next Generation images perfectly represent this amendable approach to scientific measurement by removing

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44 | Nake 2008, 105. Kathrin Friedrich has introduced Frieder Nake's concept of ›algorithmic signs‹ for scientific images in the context of computational medicine and biology. »Nake's technical semiotics stresses the fact that computational structures and processes always need to have an aesthetic surface to be amenable by humans. What appears on the computer screen is at the same time computer signal and visible sign. The visible surface is an ›ambiguous figure‹ in that it can be explored by looking at its superficial aesthetics as well as at its ›subface‹ (the algorithmic codes), while both determine each other.« (Friedrich 2013, 219).

45 | Nake 2008, 107. »The human places rather trivial components onto the surface (like mouse positions, or menu selections). [...] Once the surface is transformed into the subface, the program starts its signal processes, which consist of chains of determinations like any other process on a machine.« (Ibid.).

›bad data‹.[46] The plasticity of the mathematical and computational basis makes these images almost arbitrarily interpretable, because, »the program is really behaving just like any other machine: it is carrying out exactly […] what our parameter settings force it to do.«[47] But when the parameter settings tell what should be there, a new type of ›distortion‹ is added to these ›purified‹ images – a purpose-intended ›distortion‹ for imaging reasons, in addition to the common mathematical techniques of extra- and interpolating, composing, averaging, discretizing, and generalizing. This contradicts our expectations of real images when we see these ›photorealistic‹ views of planet Earth. Neither does a cloud-free Earth exist nor are most of the satellite images taken from such a distance that they capture the whole planet. Instead, the outside view of our planet Earth is an illusion created by advanced imagery.

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46 | Cf. Stöckli et al. 2005.

47 | Nake 2008, 105.

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Google Earth

Satellite Images and the Appropriation of the Divine Perspective

Angela Krewani

In the last few years cartography has received considerable interest. Notably with the introduction of Geographical Information Systems (GIS) cartography has merged with social media platforms and communication structures. Geobrowsing has emerged as a new name for this conflation. Apart from being an innovative trait of communication in social networks, geobrowsing applies a variety of traditional media forms, particularly with regard to the transformation of the imagery of the earth, which figures as central in geobrowsing. Traditional cartography, specific forms of film and photography and the satellite image can be counted as important predecessors of the geobrowsing applications.

The view of the earth from heavenly heights, the omniscient view of the earth, was a dream of cartographers and artists, who re-formulated their wish in a religious discourse and subscribed it to God, nonetheless trying to construct it. The view of the earth from space has since been amply documented, beginning following humanity's first successful attempts at space travel. The photograph taken from Apollo 17 in December 1972 using a Hasselblad camera constitutes one of the first ever visual documents of planet Earth and proved to be a highly effective advertisement for the Swedish manufacturer. Since these images were produced, this – once spectacular – view has become a more or less commonplace element of everyday culture.

Fig. 1: The Earth from Apollo 17

One consequence of the centuries-long idealization of this view of Earth is the potential for it to become overcharged with religious meanings, something that is also evident in secular contexts such as discourses about the ›blue planet‹.[1] Its image has since become an iconic symbol warning us of the perils of climate change.

Although both the Apollo photograph and digital satellite imagery were produced for supposed documentary reasons, these images nonetheless carry within them fixed visual conventions and meanings which, as Denis Cosgrove puts it, »have drawn upon and reconstituted a repertoire of sacred and secular, colonial and imperial meanings, and […] these representations have played an especially significant role in the self-representation of the post-war United States and its geo-cultural mission«.[2] The aim in the following is, first, to explore the technical and visual traditions in which cartographic and satellite images have been produced and to show, second, the extent to which the concept and media practice of geobrowsing rely on traditionally conceived imagery and structures of visuality.

In terms of the history of technology, satellite images came about as a result of military interests. With the start of the Cold War and the first attempts at space travel, efforts were also undertaken to study the earth

1 | Cf. Skinner 1999.

2 | Cosgrove 1994, 270.

from space, following on from the military tradition of using either moored balloons or airplanes to produce photographs of landscapes from a higher vantage point. Naturally, military interests and military financial clout played a prominent role here, confirmed in the following comments made by U.S. President Lyndon B. Johnson, who had approved the cessation of regular flights by spy planes in view of the satellite technology being developed in the Soviet Union in the mid-1960s:

> I don't want to be quoted on this, but we've spent thirty-five or forty billion dollars on the space program. And if nothing else had come out of it except the knowledge we've gained from space photography, it would be worth ten times what the whole program cost. Because tonight we know how many missiles the enemy has and, it turned out, our guesses were way off. We were doing things we didn›t need to do. We were building things we didn't need to build. We were harboring fears we didn't need to harbor.[3]

Interestingly, ideas about how to transport data corresponded to communication media technologies available at the time. The satellites worked partly with photographic stills or moving pictures, and the resulting films were physically transported down to Earth in capsules. More modern technology worked similarly to television. A television camera was used, and its images were stored on magnetic tape until the satellite had passed by a receiving station and the images could be passed on as electric signals. This kind of technology was used in satellite transmissions until the end of the 1970s. At that point photography was replaced by a new technology, which recorded and stored light using a sensitive electro-optical technique – just as in the video camera which was to be developed later.[4] Here, too, the analogy between media technology and satellite imaging begins to become apparent.

After the end of the Cold War satellite surveillance gradually began to be used for civilian purposes. The first professionals to recognize the value of panoramic photography were meteorologists.[5] Drawing on photographic techniques and combining these with elements from electronics, optics, and information, remote sensing was developed in

3 | Thaller 1999, 12.

4 | Cf. Dyring 1992, 29.

5 | Cf. Ibid., 34f.

which data on emitted radiation are recorded and transformed into images.[6] From a media theory perspective, this represents a radical change. No longer are we dealing with technical records of the Earth's surface but with digital imaging, which was able to transform data into visual structures. The history of observing Earth from satellites offers clear documentation of military interests in media technologies. Military technologies were apparently able to engage in observation of the earth away from the gaze of a public whose mass media were based on the same technological structures.

However, there is a long-standing tradition of collaboration between media and the military. In War and Cinema, French media philosopher Paul Virilio uses media theory to highlight the parallels between war and cinema, working with a tightly woven technological analogy between the apparatus of war and the film camera:

> It was in 1861, whilst travelling on a paddle-steamer and watching its wheel, that the future Colonel Gatling hit upon the idea of a cylindrical, crank-driven machine-gun. In 1874 the Frenchman Jules Janssen took inspiration from the multi-chambered Colt (patented in 1832) to invent an astronomical revolving unit that could take a series of photographs. On the basis of this idea, Etienne-Jules Marey then perfected his chrono-photographic rifle, which allowed its user to aim at and photograph an object moving through space.[7]

In the course of his subsequent comments on this issue, Virilio emphasizes the efforts made by the military to acquire filmic and photographic aerial shots: still or film cameras were tied to hot air balloons or airships to obtain aerial photographs of strategically important swaths of land. Virilio continues:

> Soon the army was rigging together the most varied combinations: camera-kites, camera-pigeons and camera-balloons predated the intensive use of chronophotography and cinematography on board small reconnaissance aircraft (several million prints were made during the First World War). By 1967 the US Air Force had the whole of South-East Asia covered.[8]

6 | Cf. Ibid., 35.
7 | Virilio 1989, 11.
8 | Ibid.

This theory should not be dismissed out of hand, and indeed it does form part of the proceedings offered here. Nonetheless, Paul Virilio's argument fails to address some important aspects of the origins of visual traditions and of the discursive attributions of media apparatuses. In addition to technical inscriptions of images, there are formative visual traditions and habitualizations of images which serve a wider function. Instead of exploring the formative power of these inscriptions, however, Virilio implicitly takes them as given and is thus able, drawing on historical visual traditions, to formulate his theory of the dominance of technological inscription. In this way, his ideas confirm the persuasive power of images, which has emerged in the course of a long historical process. They are images which, on account of their technical and visual traditions, establish an objective spatial perception.

My assumption – drawing on Cosgrove's comments – is that there are image-related conventions and structures of communication which transform meanings and enable them to function in adjacent discourses beyond the technologies. Accordingly images become modal points for a multitude of different discourses.

Since there are real disadvantages to focusing methodologically on the technical aspects of photographic and filmic imaging, in the following I shall offer a concept of looking that relates both cultural and visual traditions and technical dispositions to one another. This way of proceeding draws on Arjun Appadurai's ideas about strategies of signification that work in different manners, which he calls ›scapes‹. According to Appadurai, a specific way of looking necessarily emerges from the combination of these different discursive spaces.[9]

Interestingly, implicit assumptions regarding photography and its capacity to offer a supposedly objective reflection of the world have remained a part of discourses about digital images. According to Lorraine Daston and Peter Galison this attribution of ›truthful representation‹ to photography arose in the context of the suppression of subjectivity in scientific discourses of the 19th century, at the same time as the shift occurred from drawing to photography. While illustration was still allowed to carry the marks of subjectivity, photography was accorded the role of being both symbol and image of the new objectivity – suggested not least by its mechanical equipment.

9 | Cf. Appadurai 1996.

Apparently, those engaged in military research and civilian use see the need to maintain the scientific claim (to objectivity) of their own images by seeking to perpetuate traditional photographic attributions that have already long become obsolete: in contrast to technological progress, the representations of landscapes as well as the satellite images of the earth follow fixed visual traditions for which clear evidence can be found. Thus the images serve not only as up-to-date documents; they also reveal political and cultural interests which reach much further.

One of the first landscape overviews arose long before any technical means of media recording existed. In the year 1570 Abraham Ortelius's representation of the earth, Teatrum Orbis Terrarum, displays astonishing similarities to contemporary representations.[10] Common to both these images is the way the viewer's gaze is guided from a seemingly divine standpoint down to the landscape below: viewers are equipped with an omniscient eye, giving them total control over the image and what it depicts. A particular gaze is established which later becomes important in military contexts to guarantee an alleged objective perception of landscapes.

Provost's painting Sacred Allegory (1510) clearly links gaze, property and ideological legitimation. Next to the risen Christ stands his mother Mary, elevated to Queen of the World; both appear to float among the clouds while between them, held out by a disembodied hand, is a globe which is exposed to the all-dominating and controlling gaze of God. This scene, a clear representation of imagined power relations, is dominated by the eye of God, which takes up the central viewing position like the sun in a solar system. Here, the eye of God is the ideal point of escape from which to gaze upon the earth. Even though this is not represented explicitly in early modern representations of maps or landscapes, the imaginary gaze of God – that is, the gaze from above – is etched onto the map as an ideal typical position.

This representation also reveals much about the way the landscape is viewed – in a controlled and controlling way. The imaginary eye of God – or some other superior authority gazing down from the heights onto the landscape – is another highly stable tradition of the European visual imagery. Representations that portrayed the seeing and possessing or appropriating eye of God from the outside were especially popular. This

10 | Cf. Cosgrove 1994, 271.

gaze of God is also imitated by the early maps of the Renaissance, which are based on an imagined view from the air.

There is a mutual correspondence here between the views of the controlling eye and the viewing constellations of the eye itself. An external view brings about objectivity and authority, according to Peter Galison and Lorraine Daston this role was taken over by photography in the 19th century[11] and it similarly defined the way in which landscape is represented. Thus we have a tradition of imagery running parallel to the maps and pictures of landscapes, which documents the positioning of the gaze in the form of a media disposition.[12]

According to Cosgrove, landscape representation arose as a mode of seeing the external world in the 15th and 16th centuries and was closely associated with the visual endeavors of the Renaissance and its concept of humanism and space.[13] As Cosgrove shows, representations produced in different disciplines and areas of society, such as in painting and in landscape gardening, adhere to the same demands of the linear perspective as were also used in cartography and land surveying.[14]

Spatial processing, modified according to the discipline concerned, was taught in a special manual.[15] This fact explains the varied usage of conceptions of space in different scientific disciplines. In this sense we can say that cartography and taking possession of the landscape occurred in parallel with one another, while the application of geometry often either made the acquisition of actual space easier or prepared the way for it.

> Implicit in the landscape idea is a visual ideology which was extended from painting to our relationship with the real world whose frame and compass Elizabethans so admired and which Georgian English gentlemen would only approach through the language of landscape painting.[16]

Cartographers were happy to subordinate themselves to this purpose, an understanding that emerged in a comment made by John Dee, the

11 | Cf. Daston/Galison 1992.

12 | Cf. Cosgrove 1994, 272-273.

13 | Cf. Cosgrove 1985, 46.

14 | Cf. Ibid.

15 | Cf. Ibid.

16 | Ibid, 55.

famous Elizabethan mathematician and magician, who underlined the special impact of landscape drawing and its use for military achievements.[17] Bruno Latour even goes so far as to describe the central perspective as a new kind of communication medium in early modernism, whose function was to link different pieces of information together. If we take Latour's ideas seriously, we understand that the central perspective is more than an aesthetic decision: it links the various scientific disciplines and social domains with one another, thereby facilitating the interchangeability of visual representations. Images could now be used within and exchanged between different contexts, such as economic or aesthetic ones, without a hint of disruption.[18]

Against this background it is easy to discern that the visual zoom function provided in *Google Earth* is based on the visual and epistemic history of the images of the earth in cartography and satellite photography. With the introduction of *Google Maps* and *Google Earth*, both released in 2005[19], cartographic images of the world have experienced a surge on social media platforms. And although a variety of Geographic Information Systems (GIS) had been in use before, *Google Maps* and *Google Earth* brought about a new quality and a broader popularization within GIS systems, which can be described as their popular proliferation, as Michael Jones, Chief Executive Officer of *Google Earth*, stated in 2007:

> What's happening now [...] is that instead of just GIS experts talking to each other, or experts making maps for regular people, regular people are talking to each other, and they are making maps for each other. And that's very important [...] the story of the where is very important.[20]

Contrary to classical GIS, *Google Maps* and *Google Earth* combine social communication with cartographic systems and thus shift cartographic competence away from the experts. Furthermore, contemporary cartographic systems can be installed on the personal computer to achieve a division between content and presentation. Data can be stored on a

17 | Cf. Ibid, 58.

18 | Cf. Latour 1990.

19 | Cf. Crampton 2010, 27.

20 | Ibid, 25.

server and the client computer merely requires a browser to enter cartographic systems. Data and modules are loaded onto the client server on demand.[21] This has made the general use of cartographic systems even easier.

In the following, I would like to discriminate between Geographical Information Systems and the Geoweb applications, which combine Web 2.0 characteristics with cartographic information. Geoweb programs such as *Google Maps* and *Google Earth* are open, hybrid systems. Even if not particularly intended, the hybrid form of *Google Maps* was introduced through a hacking event later referred to as mashup, which built the operational basis for Google's cartographic programs. Consecutively, *Google Maps* went online in February 2006, and within hours the program was reverse-engineered, so that rather than Google's intended contents, the programmer's content appeared on the screen. *Google Maps* had been hacked by people who intended to use Google's well-designed maps to display and share their own data. This had been achieved by either exploiting open-source mapping applications or by combining one site's function with another.

The confluence of these factors resulted in a new configuration of digital cartography, the so-called geo web and its myriad locative media platforms, which facilitated different modes of production and consumption of geo-coded data as well as the appropriation of location platforms through social media platforms.

The aforementioned process can be understood by considering the contextual politics of code and appearance. The term for the new media practice is ›mash-up‹, which also offers a central application of *Google Earth*. The appropriation of existing contents is feasible because of the markup language (XML) and Application Programming Interfaces (APIs). XML, a further modification of HTML, allows for the standardization of program parts, thus supporting the swapping of contents even better than HTML. Open source APIs define the connection of parts of the software. They can be thought of as ›public interfaces‹. Many online applications such as *Google* and *Yahoo* accept this form of programming and profit from it. These online web-based applications have brought about an understanding of places as ›experienced space‹, since space can be appropriated and personalized through geo-webbing.

21 | Cf. Abend 2013, 150.

As has been demonstrated, *Google* applications are extremely complex hybrid products, which engage a variety of media practices and visual strategies. In the following I want to focus on the representational aspects of this software to point to the different pragmatic and theoretical aspects of these visual representations of the earth.

As previously argued, rational cartography traces a direct lineage to the early Renaissance and, specifically, Mercator's scientific world map from 1569. *Google Earth* particularly picks up on this perspective in the label of its program and – as one of various meanings – claims the iconic tradition of the ›objective‹, godlike eye. Pragmatically it merges the seemingly omniscient eye with the software's application. Within the software the eye signifies the function and the button with which the virtual planet can be moved around, it controls the zooming into the deeper layers of planetary space.

In the wake of deconstructive philosophy, cartographers turned against the notion of the objective map and began to trace cartographic epistemologies. Brian Hartley in particular applied Michel Foucault's idea of the discourse and Jacques Derrida's concept of deconstruction to the map, reconsidering the traditional rules of cartography as an object to be deconstructed.[22] Hartley's writings, which date from the late 1980s, were thus introduced long before Internet mapping technologies became prevalent.

The Geographic Information Systems (GIS) that proceeded to develop were not influenced by deconstructive critiques of the mapping experience, but instead transported epistemological certainties into digital cartographies. To the contrary, the introduction of GIS brought about critical opposition because of its alleged positivism and its repudiation of critical, discursive, or deconstructive thought. The ensuing discussions between supporters and opponents resulted in a major dispute which lasted a decade. The reference to the negative role of GIS in the first Gulf War was a strong affirmation of its supporters. Theoretical strife began to calm in 2001, with supporters and opponents increasingly leaving the debate behind to produce more socially responsible GIS. Critical GIS today means (1) to contribute to a theory of GIS which is neither technical

22 | Cf. Hartley 1989.

nor instrumental, (2) to show how disciplinary effects operate, and (3) to lay open the epistemological assumptions of GIS.[23]

As soon as the geoweb was introduced in 2005, several conflicting positions have been developed within material and digital cartography. Questions arose immediately after introduction about what geoweb would do to GIS and what the differences between geoweb and GIS were.

The main difference resides in the use of everyday paper maps and the proliferation of amateur maps within geowebbing, especially since *Google* and *Yahoo* are media companies and not cartography suppliers. McMaps is a common term for this kind of popular mapping.[24] Digital technologies have reconfigured mapping into a new experience closely connected to neighboring media practices and technologies. Geowebbing is based on:

- databanks and archives,
- interfaces for data handling and calculations,
- a dashboard for user communication,
- different outputs tailored to a wide variety of users, i.e. Web 2.0 applications or printing, and
- a palimpsestic surface of the geoweb.[25]

Additionally there are inherent factors which provide huge advantages for the geoweb and which rely on the activities of the community. These include:

- ›Crowdsourced‹ data as for example in Wikipedia,
- open source tools and services, and
- participation and syndication (the web as platform).

Against this background we can clearly conceive of the difference in intention and technology between GIS Systems and *Google Earth*, the last one definitely catering for more interests than ›pure‹ cartography. Through the inherent GPS device *Google Earth* also turns into ›locative media', thus relocating global content within situated knowledge.

23 | Cf. Crampton 2010, 98-100.

24 | Cf. Crampton 2010, 130.

25 | Cf. November/Camacho-Hübner/Latour 2010.

From a media theoretical point of view, *Google Earth* applies a range of traditional media technologies that are revamped in a digital surrounding. The difference in media technologies also effects new modes of reception: against the ›navigational‹ use of the traditional map, which allows for a semiotic reading of the map as sign system, the geoweb map combines ›navigational‹ with ›mimetic‹ use: sometimes the user can determine which one to apply, other times the program regulates the modes of reception. This practice underscores Latour's conviction that our specific understanding of images functions contextually. Geoweb applications provide a heterogeneity of polysemic visual structures; and by combining old and new media technologies, they offer new forms and combinations of media practices.

There are a variety of visual and conceptual backgrounds to these developments, notably the moved cartographies in war and propaganda films figure as one of the forerunners of geobrowsing.[26] This technology has been traced through the Panoramio database within *Google Earth*, which provides the system with individual photographs to accompany the traversing of cartographic spaces.

Other important technologies adapted from film are the camera zoom and the virtual camera. When a user opens *Google Earth*, he or she first zooms into the blue planet earth. From here the zoom carries the user into the desired place and a switch to Google Street View once again offers us real filmic images, but here the camera overcomes the limitations of the real camera and turns virtual – a new medially fabricated room is brought about through camera movement called ›zoomscape‹.[27] The virtual camera redefines the cartographic space and, contrary to the classical camera, enables the viewer to move through space since the viewer actively controls it. Thus the mixture of film and active camera resembles the organization of video games, which also shift between ›filmic‹ and ›interactive‹ parts.

As has been mentioned above, photography has been rekindled in *Google Earth*. By letting the user switch to *Google Maps*, it offers the choice between the satellite and the cartographic image. Additionally, individual photographs can be superimposed on the cartographic image. Follow-

26 | Cf. Kreimeier 2005, 89-95.

27 | Cf. Abend 2013, 127.

ing Latour, a mimetic use is added to the navigational use.[28] Practically speaking, these uses cannot be split up, for they merge into each other.

Additionally, *Google Earth* offers a layering of various information which turn the program's surface into a palimpsest. These layered structures prevent the sole navigational traditional use of maps while opening up a variety of modes of reception that are not controlled by the map. The image thus can be charged with a surplus of information – mimetic, cartographic, semiotic – that, through overcharging, turns the image into random visual noise.

Also of importance within the use of *Google Earth* applications are the visual and pragmatic references to video games. The little figure in Street View is called ›Peckman‹, a pun on the name of a character from Pacman, one of the first video games. Peckman navigates through virtual space while providing users with a ›human‹, ›natural‹ or ›central perspective‹ of geowebbing. In terms of mediality, Peckman offers a filmic and, in some ways, documentary approach to the streets.

As previously mentioned, *Google Earth* works with Open Software Protocols and APIs. Thus although not visible on the surface, categories of software connection and digital alliances become important for critical consideration. Referring to the data-mining aspects of *Google Earth*, Carlos Barreneche traces the way images transfer from representation to computational processes.

> Like similar geoweb applications, Google Earth datamines the images of Flickr and other image databanks, in order to populate the street imagery: overlaying physical locations with Flickr's geotagged media layers. This form of visibility is enabled through network protocols and it is critically labeled as ›scopic regimes‹ (Paul Clapan). The transfer of images is controlled by the APIs, which define the categories of exchange. This brings about a hidden agenda of choosing images of places creating social attention as well as exploring places by user generated tags. APIs produce asymmetries of power as they establish descriptions of operations that are allowed and assigned a priority or blocked.[29]

This mechanism can be watched in the collection of images, which usually cater to a tourist or commercial gaze on the respective place. The

28 | Cf. November/Camacho-Hübner/Latour 2010, 582.

29 | Barreneche 2012.

asymmetrical nature of geo-coded information is represented visually by a few centers getting all the attention of a place. We find patterns of uneven representation, with dead zones in.[30]

Facing the massive impact of geowebbing and the organization of hegemonial knowledge through software, Carlos Barreneche hints at the difference in organizational structures: Flickr measures attention along the lines of social relations as they are expressed into the object. Research should go into the underlying structures of these object relations and, in Bernhard Stiegler's words, the ›grammatisation of affect‹. This means that the affective relationship towards the software is organized by standardized software structures.[31]

Following these aspects of software structure, we have to understand that *Google Earth* and other digital cartography services do not follow a critical, discourse-oriented, or deconstructive attitude towards cartography that Hartley formulated in 1989. Although on the surface we can observe a move towards cartographic community structures, the discursive regulations have moved into software and application structures and from there serve has a hidden disciplinary structure.

As we have seen, *Google Maps* and *Google Earth* offer a variety of functions and semiotic and semantic systems. Contrary to the distant planet seen in the Apollo photograph, the planetary image in *Google Earth* serves as a centralizing force: it is the starting point and the target of all searches. Earth itself has lost its metaphoric and symbolic powers to become the browser itself. As opposed to the traditional cartographic intent and the hegemonic perspective on our planet, *Google Earth* disjoins the experience of a planet earth into fractured smithereens of planetary knowledge.

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30 | Cf. Barreneche.

31 | Cf. Stiegler 2012.

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Mediating Gaia

Literature, Space, and Cybernetics in the Dissemination of Gaia Discourse

Bruce Clarke

Introduction

One of science fiction's most striking tropes is the alien gaze upon human life.[1] The alien gaze is at once an irresistible fictive lure and a transparent self-projection, a reverse affirmation of the human and its earthly self-reference. The notion of alien life is already an outward displacement of earthly conditions, and the alien gaze is the return or reflex of that displacement. H. G. Wells's 1898 novel The War of the Worlds opens with an eyewitness character narrating a retrospective overview of his account to follow. For this prologue, he constructs an image of the prior, covetous gaze of the now vanquished Martian invaders:

> No one would have believed in the last years of the nineteenth century that human affairs were being watched keenly and closely by intelligences greater than man's and yet as mortal as his own; that as men busied themselves about their affairs they were scrutinized and studied, perhaps almost as narrowly as a man with a microscope might scrutinize the transient creatures that swarm and multiply in a drop of water.[2]

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1 | Parts of this chapter are based on »Mediations of Gaia,« in Astroculture: Figurations of Cosmology in Media and Arts, ed. Sonja Neef, Henry Sussman, and Dietrich Boschung (Wilhelm Fink, 2014): 119-41. I would like to dedicate this essay to the late Sonja Neef.

2 | Wells 2003, 41.

Wells's brainy Martians inhabit a dying planet: they are gazing upon human affairs so intently not out of disinterested scientific motives but because they are seeking to avoid extinction by finding a new world to inhabit: »And looking across space […] they see […] a morning star of hope, our own warmer planet, green with vegetation and gray with water, with a cloudy atmosphere eloquent of fertility, with glimpses through its drifting cloud-wisps of broad stretches of populous country and narrow navy-crowded seas.«[3]

Envisioning the Martians' envious gaze at an unsuspecting Earth, Wells's narrator prefigures two major signatures of Gaia theory. The first, to which we will return in more detail later, is the planetary role of the microbes – »the transient creatures that swarm and multiply in a drop of water.«[4] Even while advancing the pre-Gaian prejudice that treats microbes as fungible, needless beings, dispensable pests to be exterminated by the hygienic advancement of a scientific civilization, this novel will show an inkling of Gaian intuition: its denouement will give the planetary role of the microbes a proto-Gaian evolutionary twist. The second signature is the image around which this collection is arranged: the earth – »a morning star of hope, our warmer planet«[5] – seen from space. The image of Earth observed from beyond its own precincts can morph from a geographical artifice or science-fiction trope into a Gaian marker once it becomes possible to withdraw the figurative projection and literally attain the gaze from space.

3 | Ibid, 42.

4 | Ibid.

5 | Ibid.

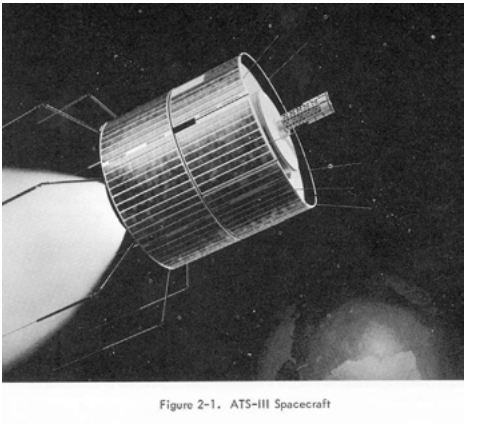

Fig. 1: The NASA ATS-III weather satellite

Gaia theory becomes possible in the same moment that the agent of a gaze taking Earth as its object may return from fictive aliens to human observers applying technological prostheses. A NASA weather satellite transmits the first image of the whole earth at the end of 1967.

Fig. 2: The first color photograph of the whole Earth (western Hemisphere), shot from the ATS-III satellite on 10 November 1967

Media studies' mantra since McLuhan is that the medium encompasses the message. Information per se is constituted and modulated by its mode of transmission.[6] For a narrative instance, in The War of the

6 | Cf. Peters 2015.

Worlds, it makes all the difference to the form and effect of the story that its narrator – the transmitter of its discourse – is a character-bound eyewitness and not a disembodied voice. And in the field of literature and science more broadly, echoes of the media mantra determine rigorous considerations of mediatic conditions, directing the study of scientific and technological practices to their modes of textuality and transmission in relation to the extra-scientific textures of their cultural reconstructions and repercussions, for instance, in novels. This essay maps some prominences within the cultural universe of Gaia theory by placing its putative scientific components in relation to a number of technological, discursive, and iconic mediations.

However, with Gaia in question, especially as refracted through its mediations, the first question has to be, which Gaia? Its contemporary guises are many; they are not necessarily incoherent, taken one by one; nonetheless, as a conceptual whole, they do not cohere. Thus, to begin with, I will state that the Gaia that centers this discussion is the application of this name to an idea the British inventor and atmospheric chemist James Lovelock first conceived in the 1960s, that through a planetary system of negative feedback cycles the biota altogether modulate climatic and geological processes in favor of life's continuation. In 1971, on the suggestion of his colleague at the time, Carl Sagan, Lovelock then submitted his ideas to Sagan's ex-wife, the evolutionary microbiologist Lynn Margulis, who filled in her own formulations for the biological infrastructures implied by Lovelock's scheme. Lovelock and Margulis then co-wrote the first set of papers on the Gaia hypothesis, the first draft of a Gaian science that, under many other, later names, has revolutionized our understanding of the systematic integration of Earth and life.[7]

I will divide my discussion of Gaia's discursive mediations into several categories. The sum of reasonably thoughtful and informed transmissions and receptions of standard Gaian ideas I will call Gaia discourse. On one side of Gaia discourse one can then place Gaia theory, those more technical discussions specifically rooted in the evolving disciplinary claims of Lovelock and Margulis, and so acknowledging some criterion of scientificity. On the other side of Gaia discourse lie what I will call Gaia notions, amateur formulations typical of popular usage and open to the fortuitous cultural associations ultimately arising from

7 | Cf. Clarke 2015.

the mythological substrata from which the name of Gaia was requisitioned for scientific duty.

For instance, on the Internet there are any number of Gaia notions advanced by persons who appear to have little or no detailed grasp of Gaia discourse or theory and yet still want to attach some mention of Gaia to their matter of concern. In these instances, a kind of diffuse popular scientism mediates Gaia for an audience unlikely to be abreast of the scientific headwinds against which the Gaia hypothesis has always had to negotiate its bona fides. Here are two such examples. The first is from the Web site of the magazine Motorcyclist:

> I don't know if there's anything to the Gaia theory – that the world is one living organism with a conscience. But I do know this: The day I rode my Honda VFR home for the first time, the weeds in my garden were doing high-fives. I'm not saying I've neglected *everything* since getting my long-awaited bike, but I'm pretty sure my motorcycle has a lot more hours on it than my lawnmower.[8]

A second is from the Web site of a South African business magazine:

> James Lovelock's Gaia theory – that earth and its entire species constitute one living organism – is applicable to South Africa. Though of different races and cultural origins, we are one big family. If one member of the family is not well, the whole family suffers.[9]

In the first example, a motorcycling homeowner apologizing for neglecting his lawn has a Gaian vision of his weeds as they celebrate their Earthly reprieve. That the idea of Gaia is taken here to say, »the world is one living organism with a conscience,« is classic – a precise articulation of a broadly popular Gaia notion. This manner of moralizing the idea of Gaia is rarely stated so explicitly. And the same conscientious meme recurs in the South African example. Riven by »different races and cultural origins,« human beings cannot feel their »natural« oneness with each other, let alone with the rest of nature. »Gaia« stands in for the principle of a human unity that humanity can never achieve in its actual behavior.

8 | Anderson 2011.

9 | Ntyintyane 2011.

In a portion of the popular mind, then, »Gaia« has come to represent the all-purpose notion of a wholly holistic world. Stress falls on an idea of total unity: it must be »a single organism«; or, as here, »one living organism« taken as »one big family.« The members of this totality, the parts of the holy whole in this Gaia notion, are typically composed entirely of 1) humanity, and 2) »Earth.« Other members of the biotic guild need not apply. All that this popular conception can seem to make out of Gaia is an amorphous planetized human essence that, from some transcendentalized immanent afar, some nearby heaven just beyond the weather, admonishes our selfish squabbling. And the ubiquitous »oneness of Gaia« also finds its way into scholarly conversation, for instance, in a 2004 essay discussing social-systems theorist Niklas Luhmann in relation to the social psychology of the emotions. We read that, »emotional communications have become more and more fundamental to the operations of late modern social systems […]. Even scientists are striving to present themselves as humane and engaged observers of the oneness of Gaia, and to avoid the rational stereotypes of Mr. Spock and Dr. Strangelove.«[10] Even if delivered tongue in cheek, once again the same popular Gaia notion emerges: Gaia is a principle of oneness; to »observe Gaia« is to affirm one's moral humanity. Once again, Lovelock and Margulis' secular Gaia concept undergoes a vulgar theomorphosis, »observed« like a holy day, swaddled in romantic sanctity.[11] It is no wonder that so many otherwise thoughtful people observe Gaia by dismissing the whole notion as so much ersatz religiositude, so much sentimental twaddle.

The Name of Gaia

Nothing could have been farther from the mind of James Lovelock in 1965 when, by his own account, he has his initial intuition of the entity he came to call Gaia. As we noted before, Gaian science begins just as the space technology arrives to enable the making of technical images of our own planet against its cosmic background. Throughout the sixties, technological developments associated with the U.S. space program

10 | Stenner 2004, 182f.

11 | On »secular Gaia«, cf. Latour 2013.

incubate the science of Gaia.[12] The British contractor Lovelock had been involved with NASA since 1961. At the Jet Propulsion Laboratory (JPL) he assisted projects to engineer life-detection instrumentation for Mars landers: »At this time scientists still seemed to think that life flourished on Mars. I recall Carl Sagan enthusing over the wave of darkness that crosses Mars when winter ends. He and many others saw this phenomenon as indicative of the growth of vegetation […] This image of Mars sustained their belief in biological life-detection techniques.«[13] Lovelock refers here to the devices favored at JPL by his biologist colleagues, who assumed that Mars would have Earth-style life in a watery medium, the detection of which demanded probes making contact with Mars' surface. By 1964 a completely different principle stands under his own life-detection scheme – the search for an entropy-reduction, that is, for a signature of some counter-entropic ordering commensurate with the living organization of matter and energy. Entropy is a thermodynamic concept that straddles physics and information theory, so the title of Lovelock's first paper directly on the way to Gaia, A Physical Basis for Life-Detection Experiments, declares an alternative to biological life-detection techniques.[14] Where and how was such a signature to be found?

His next proto-Gaia paper, co-written with philosopher Dian Hitchcock, states the answer explicitly: Life Detection by Atmospheric Analysis.[15] Hitchcock and Lovelock's life-detection argument makes a crucial move out of normal science at JPL. At mid-20th century, Earth's atmosphere is assumed to be almost entirely a geological and hence a fundamentally abiotic phenomenon.[16] Lovelock will venture the countervailing idea – now universally accepted – that the atmosphere of a planet on which life exists will be to a significant extent the product of those living processes – enough so for that atmosphere to present signs of life to be detected and deciphered as such. The brilliance of his scheme, now normal astrobiology, is its economy. One need not go to Mars or any other planet to apply it. For the exoplanets that have been detected in succeeding decades as well as for the planets of our own solar system,

12 | Cf. Strick 2015.

13 | Lovelock 2000, 248.

14 | Cf. Lovelock 1965.

15 | Hitchcock/Lovelock 1967.

16 | Lovelock/Lodge 1972 gives an overview of these doctrinal commitments.

spectrographic analysis here on Earth can assess their atmospheres.[17] The crucial turn toward Gaia proper comes in September 1965 when Lovelock encounters – newly acquired from the 42-inch telescope NASA had installed at the Pic du Midi Observatory in the Pyrenees – infrared spectrographs of the atmospheres of Venus and Mars. They show atmospheric entropies off the charts. Dominated by CO_2, both planets' atmospheres are near maximum entropy, that is, virtually at thermodynamic equilibrium. Chemically inert, whatever combustion or reduction of (lower-entropy) chemical potential had ever been possible there has long since burnt out. According to Lovelock's scheme, the verdict is obvious: Mars harbors no life. When Viking explorers land there a decade later, their probes find what Lovelock predicted – no life.

Born of that prediction of the lifelessness of Mars is a theory regarding the self-regulating nature of a ›living Earth.‹ Lovelock first conceives it in 1965 by turning his atmospheric interrogation of Venus and Mars – as it were, his »alien gaze« – back upon Earth. Now he notes with new eyes how our atmosphere is at a cosmically improbable chemical disequilibrium, and that evidence is abundant for the overall constancy of that imbalance over geological time.[18] Earth's atmosphere has been a highly combustible mixture of reactive gases for hundreds of millions of years, but rather than burning out, it has maintained its low entropy. The idea of Gaia as a self-regulating system responsible for maintaining Earth's atmosphere in a low-entropy state is ignited in the vessel of this conceptual conundrum over atmospheric chemistry, a conundrum largely unrecognized as such before Lovelock does so in the mid-1960s. Then a second problem in cosmic evolution arose for which, Lovelock again surmised, the notion of planetary self-regulation could offer a plausible solution.

In the course of responding skeptically to his colleague's earliest Gaian intuitions, Carl Sagan also informed Lovelock about the »faint young sun paradox.« When the Earth formed, the sun's luminosity (the light it radiates and thus the heat it generates) was up to 30% less than it is now. Nonetheless, during all that time, confronting the sun's normal

17 | In the twenty-second century story world of the novel Fiasco, Stanislaw Lem composed in 1986, this is settled science: »Life-producing planets are recognized by the composition of their atmospheres«. (Lem 1988, 106).

18 | Cf. Lovelock 2000, 253.

evolution toward stronger output, the mean temperature of Earth's surface has never fluctuated so severely as even to threaten to kill it all off. Despite significant extinction events along the way, life has persisted and proliferated for 3500 million years. In the geological scheme of things, while the sun's intensity has increased by a third, the Earth's climate has actually cooled quite significantly. Again, as with the composition of Earth's atmosphere at least since its oxygenation around 2 billion years ago, what can account for such climatic constancy and viability over geological time?

> It dawned on me that somehow life was regulating climate as well as chemistry. Suddenly the image of the Earth as a living organism able to regulate its temperature and chemistry at a comfortable steady state emerged in my mind. At such moments, there is not time or place for such niceties as the qualification ›of course it is not alive – it merely behaves as if it were.‹[19]

If a temporally minimal meteorological event such as a hurricane merits its own name to acknowledge the violent if momentary distinctness by which this weather system cuts itself out of the circumambient atmosphere, then giving his planetary entity a proper name would give due recognition to a vastly more complex and geologically persistent systemic personhood.

By the later 1960s, then, »a planet-sized entity, albeit hypothetical, had been born, with properties which could not be predicted from the sum of its parts. It needed a name.«[20] Still, the science in question could have developed without any title or come forward under some drab and unevocative appellation, perhaps »the planetary climate and atmospheric chemistry self-regulation hypothesis.« Lovelock has told the ensuing story many times, with different emphases, but I think never so charmingly as mediated by a TV interview with Canadian science broadcaster David Suzuki. The incident hangs on the circumstance that at the time, Lovelock's neighbor in the south of England was the novelist William Golding. On a stroll one afternoon in 1967, they were conversing about Lovelock's planetary hypotheses:

19 | Lovelock 2000, 253f.

20 | Lovelock 1979, 10.

William Golding said: »If you're going to have a big idea like that you'd better give it a proper name.« So I said, »Good, what would you call it?« He said, »I'd call it Gaia.« […] And we went on walking for twenty minutes, talking at complete cross-purposes, because I didn't have a classical education. I didn't know anything about Gaia, the Greek goddess. But I did know about g-y-r-e, gyre, the great whirl in the ocean or in the atmosphere, and this made sense of course, this was a fed-back system, and this is what he's talking about. And he said, »No no no no no, I mean the Greek goddess of the earth.« And then it clicked, of course. I'm a bit slow in the uptake.[21]

Lovelock accepted Golding's gift horse of this archaic name and in due time affixed it to his idea of Earth and its biosphere supporting a homeostatic system holding »climate as well as chemistry« within viable parameters. The public debut of the name of Gaia is in 1972, in an two-page letter to the editor of the journal Atmospheric Environment, titled Gaia as Seen through the Atmosphere.[22] He defines it here as »a biological cybernetic system able to homeostat the planet for an optimum physical and chemical state appropriate to its current biosphere.«[23] Two years later, with Lovelock as first author co-writing with Margulis, this basic description receives a more felicitous but also more problematic phrasing:

This paper examines the hypothesis that the total ensemble of living organisms which constitute the biosphere can act as a single entity to regulate chemical composition, surface pH and possibly also climate. The notion of the biosphere as an active adaptive control system able to maintain the Earth in homeostasis we are calling the ›Gaia‹ hypothesis […]. Henceforward the word Gaia will be used to describe the biosphere and all of those parts of the Earth with which it actively interacts to form the hypothetical new entity with properties, that could not be predicted from the sum of its parts.[24]

This presentation manifests a primary conceptual tension in Gaia discourse – an alternation between a cybernetic and a holistic description of Gaia, an oscillation of emphasis between the multiplicity and the unity of the assembled system. Notions about the »oneness of Gaia« certainly

21 | Suzuki 2002.

22 | Lovelock 1972b.

23 | Ibid., 579. For more on the interplay between Lovelock and Margulis at this time, cf. Clarke 2012a.

24 | Lovelock/Margulis 1974a, 3.

have adequate warrant in the annals of the Gaia hypothesis. What has proved to be problematic is the way that placing the stress on the singularity of this »hypothetical new entity« has tended to trivialize the complexity of Gaia's planetary aggregation and to blur the manifold of elemental cycles and ecological subsystems needed to buffer the operations of the »whole system.«[25] The »singleness« of Gaia derives not from any essential holistic status as an ontological unit of being but rather from the emergent cybernetic action of a systemic ensemble: »the biosphere can act as a single entity…as an active adaptive control system.« Lovelock and Margulis state the cybernetic contingency of Gaia's systemic self-constitution, but at the same time, open the door for the holistic reification of the mythic personification already on offer in the name of Gaia. Thus it is helpful to be aware of Lovelock's initial ignorance, by his own admission, of Gaia's classical provenance when Golding first pronounced that name in his presence. It just means that the name of Gaia is a strictly rhetorical mediation. The story of Gaia is a classic case of the mediation becoming the message, the signifier overtaking the signified. Even while the name of Gaia has been powerfully effective as a branding device, nevertheless, it is of very little use for understanding Lovelock and Margulis' concept of Gaia. For that, one must study the details of their discourse.

Gaia Discourse

Gaia's disparate discursive mediations constitute a literature for which the Earth seen from space remains the foremost icon and mandala. Just as the Gaia hypothesis was taking its baby steps, several years before its formal introduction in 1972, the Whole Earth Catalog (WEC) began its initial four-year run from 1968-71.[26] In hindsight, by celebrating a self-referential cosmology of the Earth as seen in the newly-arriving space photographs, the WEC performed a kind of premediation of the idea of Gaia.[27] The outside covers of nearly every iteration of the WEC presented a NASA image of Earth seen from space.

25 | An effective corrective in this regard is Volk 2003.

26 | A small wave of *WEC* scholarship has crested in the last decade. Cf. Turner 2006; Kirk 2007; Poole 2008; Clarke 2011; Diederichsen/Franke 2013.

27 | On premediation cf. Grusin 2010.

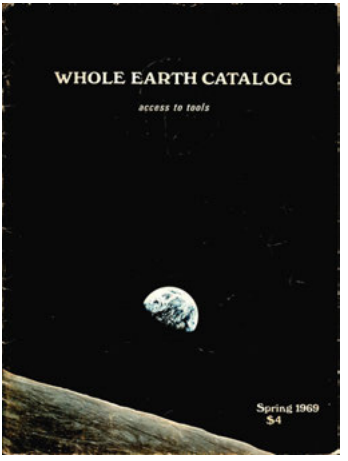

Fig. 3: The outside front cover of the Whole Earth Catalog for Fall 1969

Moreover, in parallel with nascent Gaian science, the WEC was also dedicated to a holistic appreciation of cybernetic thinking. Its every iteration began with or contained a section on ›whole systems‹, under which rubric it retailed reams of first-rate information about systems ranging from biological, mechanical, and computational cybernetics to social-scientific and humanistic applications of systems theory.[28] Both Gaia and the WEC are rooted in a space-oriented technoculture of systems thinking. And given its intense resonance with the WEC's editor Stewart Brand's own interests in cybernetics, systems theory, and ecology, the Gaia hypothesis will make several appearances during the eleven-year span (1974-84) of the WEC's next incarnation, CoEvolution Quarterly (CQ).[29] The outside front cover of the first number of CQ also premediated the unfolding of Gaia's coevolutionary cosmology. While its point of self-reference remained the human observer, in this image the Earth seen from space is exploded into a planetary or cosmic visage made up of microbes and galaxies and everything in between.

28 | Cf. Clarke 2011.

29 | Lovelock 1981a and 1981b; Lovelock/Whitfield 1981; Lovelock 1983.

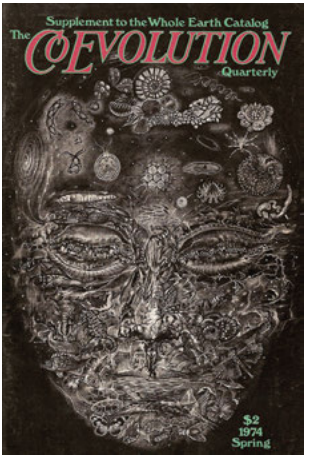

Fig. 4: The outside front cover of the first number of CoEvolution Quarterly (Spring 1974)

A year later, CQ published the first article on Gaia to appear in a non-scientific journal, Margulis and Lovelock's The Atmosphere as Circulatory System of the Biosphere: The Gaia Hypothesis.[30] Previously Lovelock had published recognizably Gaian work mostly in second-tier scientific periodicals.[31] Similarly, his collaborative articles with Margulis, which began to appear shortly after he went public with the name of Gaia in 1972, were rejected by Science and Nature and placed instead in the relatively minor outlets Tellus, Icarus, and Origins of Life.[32] As we learn from the draft of a letter to Lovelock written on board a flight to a speaking engagement in St. Louis, »where I have to discuss the origin & evolution of everything in about ½ hour,« Margulis welcomed the opportunity to publicize the Gaia hypothesis through popular media:

Dear Jim: […] Good news – & I'll need a quick response (sorry to hassle you further) I've spoken today to Alan Ternes, editor of Natural History (a classy glossy job with a circulation of 370,000). He's apparently a friend of Stewart Brand, editor of the *Co-evolution Quarterly*. Brand, who has been pressuring me mightily, claims his

30 | Margulis/Lovelock 1975.

31 | Lovelock/Giffin 1969; Lovelock/Lodge 1972.

32 | Lovelock/Margulis 1974a, 1974b, 1974c. *Icarus* was edited by Carl Sagan, hardly a disinterested referee.

mag. has a circulation of only 17,000. They apparently are in agreement that Nat. Hist. will publish the Gaia II & that appearance (even prior appearance) in Coev. Q. will not jeopardize a full article in Nat. Hist. […] [Brand] is claiming that his journal is responsible and responsive, refuses to compartmentalize science and that my accusation that he's into food faddism & astrology is totally unfounded. At any rate, what he wants from us is permission to excerpt apparently nearly all Gaia II with the statement that [it] is from a full article coming out in Nat. History. I told him that I could not give him permission unilaterally but must consult you. Since he now has a definite commitment from Ternes at Nat. Hist. and since after reading CQ I find myself sympathetic to his goals, I would hope you will agree to this plan.[33]

As matters turned out, the article in question – ›Gaia II‹, which abbreviation may indicate the second Gaia article for which Margulis was the lead author – gets the royal treatment in the low-circulation countercultural outlet CQ but short shrift from the glossy mainstream outlet Natural History. It did appear there, over a year later, not expanded but condensed and reframed, under the obfuscating title »Is Mars a spaceship, too?«[34] Perhaps Natural History turned averse to putting the unscientific name of Gaia into the article's title; in any event, it boxed the presentation of the Gaia hypothesis back into the context of alien life-detection then on the public's mind due to the imminent arrival on Mars that summer of two Viking landers. Margulis and Lovelock's concluding remarks put the best face on a high-circulation debut somewhat muffled for general consumption. Turning Lovelock's original logic around, they note that if the landers do find life on Mars (if that planet is ›a spaceship‹), then that outcome will disprove his circumstantial claim in favor of Gaia, that the presence of active life must leave a detectable signature in the atmosphere of a planet that possesses it:

Failure of the Viking mission to find life on Mars will not prove the existence of Gaia, but it will add support to the hypothesis. Most scientific experiments are designed to disprove a hypothesis; when they fail the hypothesis is thereby strengthened. At great cost and effort, a rare planetary experiment for the Gaia hypothesis is now speeding toward a conclusion.[35]

33 | Margulis to Lovelock, April 29th, 1975.

34 | Margulis/Lovelock 1976.

35 | Ibid., 90.

And put in this fashion, as anticipated, the Viking non-result left the Gaia hypothesis intact.

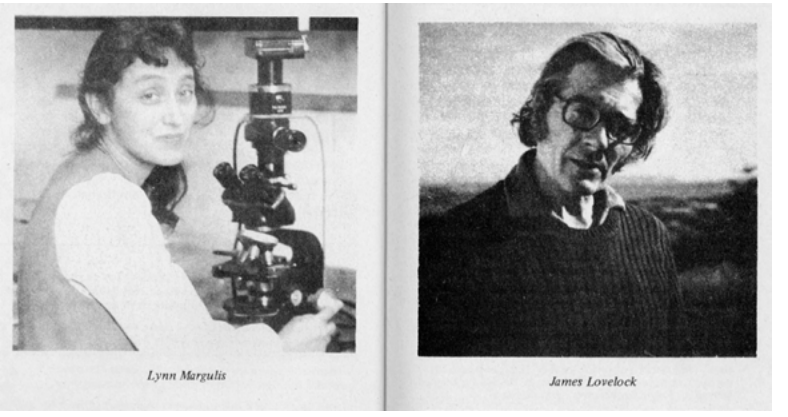

Fig. 5: Lynn Margulis and James Lovelock, from CoEvolution Quarterly (Summer 1975)

Back in the summer of 1975, however, CQ welcomed the Gaia hypothesis with no such muted exposition. The Atmosphere as Circulatory System of the Biosphere: The Gaia Hypothesis sprawls over ten pages including graphics, diagrams, and excerpts from previously published articles. It anchors an »Understanding Whole Systems« section that also includes Earth-seen-from-space articles by Carl Sagan and former astronaut Rusty Schweickart, a glowing review of Margulis' first book, Origin of Eukaryotic Cells, by beat poet Michael McClure, a substantial introduction to and extract from Ramón Margalef's 1968 text Perspectives in Ecological Theory, the resonance of which with the Gaia article that precedes it is captured by its opening section The ecosystem as a cybernetic system.[36] The exposition lead-authored by Margulis is detailed and technical throughout. It breaks the argument for the Gaia hypothesis down into elemental cycles and their relation to living systems. It is worth noting that the original Gaia arguments do not bear on the biosphere as a whole but specifically on the planetary atmosphere enveloping the biosphere as both source and sink for metabolic processes. In this presentation, the complexity and multiplicity of the phenomena under review render all statements toward

36 | Sagan 1975; Schweickart 1975; McClure 1975; Margalef 1975.

a Gaian synthesis hypothetical. For the »major biological elements« (carbon, nitrogen, oxygen, hydrogen, sulphur, and phosphorus), the

> cycling times must be short because biological growth is based on continual cell division that requires the doubling of cell masses in periods of time that are generally less than months and typically, days or hours. On lifeless planets there is no particular reason to expect this phenomenon of atmospheric cycling, nor on the earth is it expected that gases of elements that do not enter metabolism as either metabolites or poisons will cycle rapidly […] Because biological solutions to problems tend to be varied, redundant, and complex, it is likely that all of the mechanisms of atmospheric homeostasis will involve complex feedback loops.[37]

However, the granular rehearsal of Gaian complications can always give way to the same smooth space in which the concrete complexity and numerical immensity of biological forms yield to an encompassing top-down vision of ›life‹. So it is at the beginning of Stewart Brand's headnote to this article, which directly seizes the holistic or ›whole earth‹ potential of the argument. Gaia »treats the anomalous Earth atmosphere as an artifact of life and comprehends the planet itself as a single life.«[38] As editor, Brand reinforced this mode of appreciation a page later by interpolating underneath the main article an excerpt from a philosophical meditation co-authored by Lovelock and Sydney Epton, »The Quest for Gaia,« published earlier in 1975 in The New Scientist. This text bundles together the extreme claims of the early Gaia hypothesis – co-operation, totality, optimality, ›control‹ transferred from the abiotic environment to the biota – that gave fits to the scientific establishment of that moment:

> Prima facie, the atmosphere looked like a contrivance put together co-operatively by the totality of living systems to carry out certain necessary control functions. This led us to the formulation of the proposition that living matter, the air, the oceans, the land surface were parts of a giant system which was able to control temperature, the composition of the air and sea, the pH of the soil and so on so as to be optimum for survival of the biosphere. The system seemed to exhibit the behavior of a single organism, even a living creature.[39]

37 | Margulis/Lovelock 1975, 36.

38 | Ibid. 31.

39 | Ibid, 32.

It may now be evident why the Gaia discourse brilliantly mediated through this 1975 extravaganza would find a dedicated and abiding audience among the peacenik greens and countercultural intelligentsia gathered by CQ. Its promissory counter-vision of life taking care of business in its own house put the »selfish gene« of the same moment – that precious avatar of a game-theoretical, winner-take-all neo-Darwinism in smug resonance with the suppressed aggressiveness of the Cold War era – completely to shame. In 1980, the Next Whole Earth Catalog, an oversized return to the compendious catalog format, affixes the name of Gaia to an image of Earthrise on its outside back cover. Brand's caption provides a further summation of the popular Gaia notion that will take root in ensuing decades: »The Gaia Hypothesis, as proposed by the British scientist James Lovelock, suggests that the Earth's atmosphere and oceans are maintained as highly sophisticated buffering devices by the totality of life on the planet. The whole Earth, in other words, may function as a single self-regulating organism« (see Fig. 6).

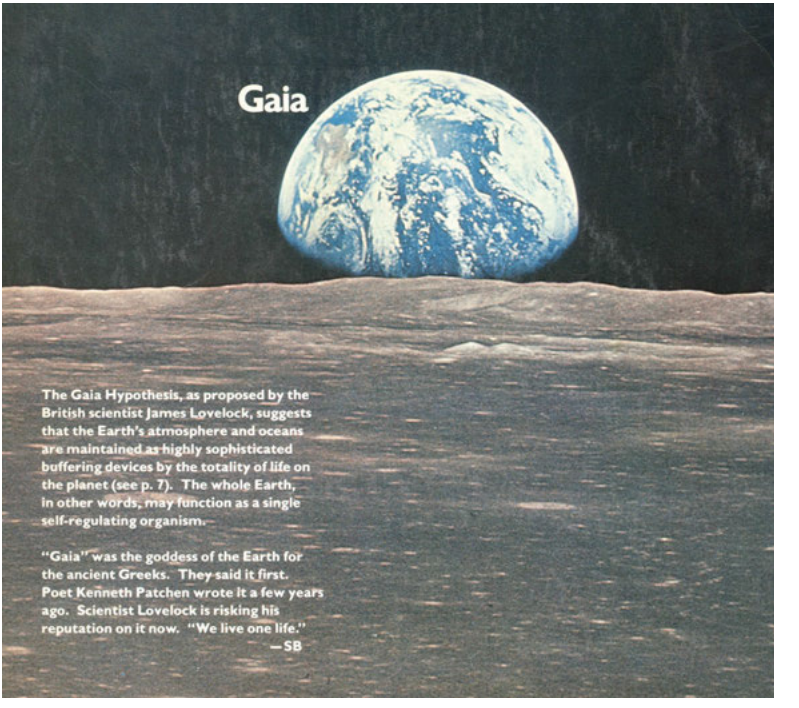

Fig. 6: Detail of the outside back cover of the New Whole Earth Catalog (1980)

Lovelock first popularizes his own science in 1979 in Gaia: A New Look at Life on Earth.[40] With its appearance, the neo-Darwinist opposition to the Gaia hypothesis had a distinct target toward which to aim its critique. The title of W. Ford Doolittle's 1981 article in CQ codified a standard line of attack: Is Nature Really Motherly?[41] In due time Margulis would pen a lampoon of the personification of Gaia giving Doolittle's misconstruction the retort it deserved: Gaia Is a Tough Bitch.[42] With Margulis active behind the scenes enlisting the assistance of the sympathetic and literate medical researcher Lewis Thomas, in 1988 Lovelock followed up his first Gaia book with a substantially improved, strenuously edited volume presenting the mature theory, The Ages of Gaia.[43] Meanwhile, in 1981 the cultural historian William Irwin Thompson, working through contacts with Stewart Brand, invited Lovelock and Margulis to a meeting with fellow biocyberneticians Henri Atlan, Heinz von Foerster, Humberto Maturana, and Francisco Varela, the latter two being the inventors of the concept of autopoiesis defining the form of living systems as self-referential self-production. In due time Margulis will note: »The simplest, smallest known autopoietic entity is a single bacterial cell. The largest is probably Gaia – life and its environment-regulating behavior at the Earth's surface.«[44] Two essay collections edited by Thompson document this seminal phase in the further development of Gaia discourse and are highpoints in the countercultural strand of Gaia discourse and theory.[45]

Planets under Stress

To be sure, Gaia discourse has enjoyed mainstream as well as countercultural mediations. Two MIT Press volumes developed from international conferences provide accessible and balanced scientific discussions of

40 | Lovelock 1979.

41 | Doolittle 1981. Cf. also Lovelock 1981 and Margulis 1981.

42 | Margulis 1996.

43 | Lovelock 1988. Cf. Gribbin/Gribbin 2009, 169f.

44 | Margulis 1997, 267.

45 | Cf. Thompson 1987 and Thompson 1991. Cf. Clarke 2009, 2012b, and 2017b.

Gaia.[46] As Gaia theory's scientific credentials have become more established, these volumes have incrementally opened the discussion up to include the sorts of learned and inspired cultural, philosophical, and ethical considerations previously initiated by Thompson's Gaia editions.[47] MIT Press's third Gaia volume, Gaia in Turmoil, is the first Gaia collection to be developed in full cognizance of the climate crisis.[48] Lovelock's introductory essay argues that we are already beyond the point of drawing back from the extreme climate consequences of our ongoing assault – through fossil fuel consumption and deforestation – on the current regime of Gaian self-regulation of global temperatures. »Is there nothing that we can do to bring back the lush and comfortable Earth of a few hundred years ago? Probably not in times measured on a human scale.«[49] Perhaps Lovelock has uniquely earned the right to occupy a position of such dispassionate reflection on our species' predicament:

> When Darwin came upon the concept of evolution by natural selection, he was almost wholly unaware that much of the environment, especially the atmosphere, was a direct product of living organisms. Had he been aware, I think he would have realized that organisms and their environment form a coupled system and that what evolved was this system, the one that we call Gaia. Organisms and their environment do not evolve separately. If Darwin had known this, Gaia might have been part of his concept of evolution; we would have known sooner the consequences of changing forests to farmland and of adding greenhouse gases to the air.[50]

In any event, Lovelock concludes, as a practical matter, if our efforts at environmental remediation prove inadequate, then we must prepare to adapt through a »sustainable retreat« from our current ways of life. Lovelock's resignation is not shared by other contributors and has since been partially retracted. It may be objected that Lovelock's systems science has rigidified, has become overly deterministic or absolute in its binary choice

46 | Cf. Schneider/Boston 1993 and Schneider et al. 2004.

47 | For the most recent developments in philosophical Gaia discourse, see Clarke 2017.

48 | Cf. Crist/Rinker (ed.) 2009. Lovelock himself already addressed global warming in Lovelock 2005 and Lovelock 2006.

49 | Lovelock 2009, 22.

50 | Ibid.

between orderly regulation and disorderly chaos. Who is to say that some unforeseen concatenation of effects or emergent phenomena might not throw a wrench into his scenario of runaway positive feedback regimes turning Gaia into a vengeful inferno? But it would be a long wager to bet on some unsuspected salvation without doing all we can to shift the odds in our favor. Many other clear-sighted and distinguished authors in the 2009 volume scale the mountain chains of alarming evidence for the climate crisis on the way to their own particular policy proposals and/or prescriptions for socio-political or Earth-ethical reorientations.

Our state of political semi-paralysis confronting the climate crisis is a glaring reminder that the modern West remains largely disconnected from a visceral relation to the material conditions of its own ecological survival. In Wells's The War of the Worlds, our modern detachment from bodily and environmental contingencies is displaced to the aliens. Wells's Martians are – among other things – the projection of a pervasive scientific and social, ultimately theological bias against the contingencies of organic embodiment as that is embedded in its coevolved material and planetary milieu. When the narrator recounts his opportunity to turn the tables on the aliens and be the agent of an active gaze, to be their observer and close scrutinizer, we learn that, »They were huge round bodies – or, rather, heads – about four feet in diameter, each body having in front of it a face […] Entrails they had none. They did not eat, much less digest. Instead, they took the fresh, living blood of other creatures, and injected it into their own veins.«[51] The constriction of embodiment to the head with the elimination of the limbs and torso replicates a more basic if factitious detachment of rational humanity from mindless nature. Indeed, our mindless modern bias against »lower« life forms extends all the way down to the germs: »Micro-organisms, which cause so much disease and pain on earth, have either never appeared upon Mars, or Martian sanitary science eliminated them ages ago.«[52]

Wells's text is strongly imprinted with Louis Pasteur's germ theory of disease and corollary breakthroughs in techniques of immunization, leading to the pervasive modern approach to the microbial realm. Wells's Martian invasion is not just an allegory of the British colonization of what was then Tasmania, which context the narrator makes explicit, but also,

51 | Wells 2003, 143f.

52 | Ibid, 147.

between the lines, an allegory of the germs in Pasteur's theory. And we postmoderns, too, continue to fight the war of the worlds right here on Earth, the war of the macrobes against the microbes. Lynn Margulis has written: »The great successes of modern medicine reinforce the idea of microbes as enemy. Cleanliness, sterilization of surgical instruments, and especially antibiotics are all described as weapons of war against microbial aggressors. The more balanced view of microbe as colleague and ancestor remains almost unexpressed.«[53] Margulis' long campaign to recuperate the dignity of the microbes transmits the soul of Gaian science.

Wells's novel does locate terrestrial bacteria in relation to biological evolution, but largely as aggressive arch-Darwinian competitors, intransigent enemies, by no means as evolutionary precursors. They make themselves known when a plant the Martians import to Earth, the Red Weed, at first enjoys invasive success, but then collapses, signaling the Martians' lack of immunity to Earth life:

In the end the Red Weed succumbed almost as quickly as it had spread. A cankering disease, due, it is believed, to the action of certain bacteria, presently seized upon it. Now by the action of natural selection, all terrestrial plants have acquired a resisting power against bacterial diseases – they never succumb without a severe struggle, but the Red Weed rotted like a thing already dead.[54]

And soon enough, the Martian invasion collapses altogether, as these cerebral blood-suckers, too, are »slain, after all man's devices had failed, by the humblest things that God, in His wisdom, has put upon this earth.«[55] In the midst of his Darwinian summation, in what appears to be a blatant short-circuiting of semantic wires, Wells's narrator reverts to a creationist cliché: only God may know for what reason he suffers the humble and otherwise dispensable bacteria to exist.

The notion of the text appears to be that the bacteria make a suitable meeting place to marry divine creation to evolutionary development. Bacteria would be a natural evil – merely a source of disease – from which the rest of life, culled through natural selection, receives some-

53 | Margulis 1998, 75. For another connection between Pasteur and Gaia theory, cf. Latour 2013.
54 | Wells 2003, 161.
55 | Ibid, 181.

thing good –an evolved immunity. Thus the bacteria represent the naturalization of the diabolical within a larger salvational scheme. And in this sense, when pitted against the Martians, bacteria become our allies in the war to defend human dominion over the Earth:

> These germs of disease have taken toll of humanity since the beginning of things – taken toll of our pre-human ancestors since life began here. But by virtue of this natural selection of our kind we have developed resisting-power […]. But there are no bacteria in Mars, and directly these invaders arrived, directly they drank and fed, our microscopic allies began to work their overthrow.[56]

On the one hand, almost despite itself, The War of the Worlds gets right the fact that microbes are indeed our allies, our colleagues in the Gaian sense, co-workers on the maintenance of a living environment. Inadvertently, it also gets right that there are no bacteria (because no life of any sort) on Mars. But it gets wrong its assumption that »higher« forms of life are possible without the microbial foundation from which they have evolved and to which they remain in perpetual debt for the maintenance of their biosphere. As we have had the occasion to observe, a related conviction regarding the lack of life on Mars looms large in Lovelock's first formulation of the Gaia hypothesis. But on the other planetary hand, much as Wells had imagined, a Martian could have told that Earth has life, just by turning a spectroscope on a random sample of the improbably and continuously far-from-equilibrium state of its atmosphere. As far as we know, only living processes, metabolic activities pumping up reactive organic chemicals moment by moment, eon upon eon, can account for its enduring chemical imbalance rather than inertia.

Related to this insight is one of Lovelock's seminal and most profound Gaian hunches: »Long before Viking set course from Earth I felt intuitively that life could not exist on a planet sparsely; it could not hang on in a few oases [...]. As Gaia theory developed, this intuition grew; now I view it as a fact.«[57] This is where all such notions of the survival of life per se in scattered solitary units, on Mars or elsewhere, go wrong. Once established, living beings depend upon the vast cyclings of atmospheres and hydrospheres to bear the vigorous bioenvironmental – Ga-

56 | Ibid.

57 | Lovelock 1988, 6.

ian – fluxes that provide and replenish their nutrients and flush away their wastes. If life takes and keeps hold of a planet, this bio-logic runs, it will necessarily be planetary in scope. For a living planet such as ours, the by-products of metabolic processes have thoroughly infused and remade the air and the waters into mélanges of abiotic materials and post-biotic residues.[58] And it is not just that life leaves its traces as chemical signatures on our atmosphere. The atmosphere to which we are adapted and within which our tendril of the evolutionary bush is immersed is 99% biogenic, produced by living things over biogeological time. The air we breathe is not just signed by life on Earth: It is itself a signature of the inextricable coupling of life and Earth.

And yet, whether or not life ever existed there, it is evident that Mars and Venus once had water. Why has Earth retained vast oceans and ›a cloudy atmosphere eloquent of fertility‹ when Venus and Mars have not? According to Harding and Margulis, the answer is Gaia:

> [L]ife's populations persist and continue to expand on Earth not because a ›lucky accident‹ has situated our moist planet at an optimal distance from the sun; rather communities of living organisms have actively maintained wet local surroundings. The result has been the retention of moist habitability over geological time. [...] [W]ithout life's involvement in complex geological, atmospheric, and metabolic processes, Earth would long ago have lost its water, becoming a dry and barren world much like Mars and Venus.[59]

These authors parse the science to indicate the range and balance of biological and abiological processes that either desiccate the Earth or replenish or sequester its moisture. Their thesis is that such processes do not regulate the amount of water on Earth directly, but indirectly insure its retention by regulating the circumambient temperatures within ranges that prevent its eventual loss by atmospheric photo-dissociation. They draw their discussion toward a wonderful presentation of interlocking feedback loops that also gathers up the tectonic plates. The very movement and regeneration of the continents upon the surface of the planet may be bound up with Gaian cycles:

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58 | Cf. Volk 2003 and 2004.

59 | Harding/Margulis 2009, 41. Cf. also Chopra/Lineweaver 2016; Grinspoon 2016, 57-81.

> Water infiltrates the laterally moving sea-floor basalt, changing its chemical nature so that it is pliable enough to sink into the Earth's mantle when it collides with the edge of a continent at a subduction zone […] Without subduction, plate tectonics would stop […] Without plate tectonics […] in tens of millions of years all the Earth's land masses would be removed by weathering, with no new granite to replace this loss. The long term carbon cycle would cease, and the Earth would perhaps be plunged into a permanently frozen state […] We therefore propose an interesting and appropriately circular Gaian dynamic here: no life, no water, no water, no plate tectonics, no plate tectonics, no life.[60]

If confirmed, here is another dynamic component to add to the list of fundamental geological processes taken for granted yet actively maintained by Gaian regulatory outcomes. Gaia theory continues to disrupt complacent notions that the atmosphere, the hydrosphere, or the geosphere stand outside the life they harbor. Rather, life and Earth are as co-evolutionarily interlocked as bees and flowers. The profound circular causalities of mature Gaia theory render quaintly anachronistic loose notions of planetary totalities yielding »one living organism«. Gaia's myriad biotic-abiotic loopings are systems theory's legitimate offspring, rightful heirs to the cybernetic conceptualities of the 1960's celebrated by the systems counterculture.

Conclusion

Especially during the first two decades of its scientific course from hypothesis to theory, Gaia's mythological lure loomed as large as its conceptual grounding in cybernetic systems theory. What the name of Gaia was to cover or contain was miscomprehended by scientific critics and New Age enthusiasts alike. However, as Lovelock grew to appreciate, with Golding's literary push the mythic name of ›Gaia‹ generated a kind of magnetic resonance. Whatever it was taken to mean, its meme was unstoppable. Relative to the standard run of scientific concepts, the name of Gaia generated for its hypothesis and theory an uncommon amount of media attention, cultural conversation, and countercultural ferment over and above its share of scientific controversy. After over

60 | Harding/Margulis 2009, 54f.

40 years and a series of theoretical refinements, Lovelock and Margulis' best geobiological insights have taken firm root. With the mainstreaming of Gaia theory in such fields as Earth system science, cosmic evolution, and astrobiology, a deep systemic vision now gathers to new scientific formations the long and global history of premodern intuitions about the intrinsic interconnectedness of Earth and life. Gaia theory now takes its place among wider researches toward ecological and systemic reconstructions of the conditions of knowledge altogether. In the effort to know Gaia, individual intuition surely plays a role.[61] But Gaia discourse provides the common medium of exchange.

Fig. 7: Cosmic Evolution as depicted by the Exobiology program at NASA Ames Research Center, 1986

Befitting both the long participation of Lovelock and Margulis in NASA programs and the funding NASA in its wisdom provided them when other sources were unforthcoming, Gaia discourse is the central subtext of an allegorical tableau of cosmic evolution produced by NASA artists as part of their ongoing program in exobiology, later renamed astrobiology.[62] Although his connection to that program ceased shortly before the landing of the Viking probe on Mars in 1976, for »Lovelock the Viking project was the cradle of his Gaia hypothesis.«[63] We can now appreciate the solid body of scientific effort and technological accomplish-

61 | Cf. Harding 2006.

62 | Cf. Strick 2015.

63 | Dick/Strick 2004, 82.

ment from which this seed of a new scientific cosmology has sprung: »Indeed, under the name Earth system science the core of the modified Gaia theory is now mainstream science, but, say the critics, ›never under the name of Gaia.‹«[64] In like manner, both NASA and academic scientists now do Gaian work – they mediate Gaia – under other cover phrases such as cosmic evolution and astrobiology. Their inspiration is now the vision of a »living universe,« just as Lovelock has plied his metaphor of a living Earth. Following the detailed caption of the exobiology brochure, we wind from »the formation of stars, the production of heavy elements, and the formation of planetary systems, including our own« to »prebiotic molecules, RNA, and DNA […] formed within the first billion years on the primitive Earth.« Then, »the origin and evolution of life leads to increasing complexity, culminating with intelligence, technology, and astronomers […] contemplating the universe.«[65] In the distant conditions of life's cosmic chances we explore those of our own immediate possibility. The sentience that binds the microbe to the astronomer binds both to the evolving cosmos from which they emerge. To render this tableau fully Gaian, we must simply follow its line of development so as to close its loop. The observatory and the radio telescope on the mountain-top of cosmic evolution are pointed back at the Big Bang, while all above them wheel the circular formations of cosmic events. No matter how far we look and listen beyond our world, in those acts we also return to Earth and see ourselves anew.

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64 | Ibid, 117.

65 | NASA's Exobiology Program 1986.

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Why Ecological Awareness is Loopy

Timothy Morton

> »Progress means: humanity emerges from its spell-bound state no longer under the spell of progress as well, itself nature, by becoming aware of its own indigenousness to nature and by halting the mastery over nature through which nature continues its mastery.«
> Theodor W. Adorno

What Is Happening?

The field had already been »opened«; that is to say, a lane a few feet wide had been hand-cut through the wheat along the whole circumference of the field for the first passage of the horses and machine./Two groups, one of men and lads, the other of women, had come down the lane just at the hour when the shadows of the eastern hedge-top struck the west hedge midway, so that the heads of the groups were enjoying sunrise while their feet were still in the dawn. […]/Presently there arose from within a ticking like the love-making of the grasshopper. The machine had begun, and a moving concatenation of three horses and the aforesaid long rickety machine was visible over the gate […]. Along one side of the field the whole wain went, the arms of the mechanical reaper revolving slowly […]./ The narrow lane of stubble encompassing the field grew wider with each circuit, and the standing corn was reduced to a smaller area as the morning wore on. Rabbits, hares, snakes, rats, mice, retreated inwards as into a fastness, unaware of the ephemeral nature of their refuge, and of the doom that awaited them later in the day when, their covert shrinking to a more and more horrible narrowness, they were huddled together, friends and foes, till the last few yards of upright wheat fell also under the teeth of the unerring reaper, and they were every one put to death by the sticks and stones of the harvesters./The reaping-machine left the

> fallen corn behind it in little heaps, each heap being of the quantity for a sheaf; and upon these the active binders in the rear laid their hands – mainly women, but some of them men […]./[The women] were the most interesting of this company of binders, by reason of the charm which is acquired by woman when she becomes part and parcel of outdoor nature, and is not merely an object set down therein as at ordinary times. A field-man is a personality afield; a field-woman is a portion of the field; she had somehow lost her own margin, imbibed the essence of her surrounding, and assimilated herself with it. […]/There was one wearing a pale pink jacket […]. Her binding proceeds with clock-like monotony. From the sheaf last finished she draws a handful of ears, patting their tips with her left palm to bring them even. Then, stooping low, she moves forward, gathering the corn with both hands against her knees, and pushing her left gloved hand under the bundle to meet the right on the other side, holding the corn in an embrace like that of a lover. She brings the ends of the bond together, and kneels on the sheaf while she ties it, beating back her skirts now and then when lifted by the breeze. A bit of her naked arm is visible […] and as the day wears on its feminine smoothness becomes scarified by the stubble and bleeds.[1]

It's the machine age – yet uncannily it isn't: it's fields and wheat. Or are the fields already a kind of machine? People appear as machine-like components working up and down, legs, clothing, arms and hands moving. Tess of the D'Urbervilles, a fictional farming girl from 1891, shows up as a piece of a vast thing, and as a person in her own right, exemplifying a weird contradiction between being and appearance that such vast things force us to see in all things. This seeing, brought on by the machination of steam engines and Kantian code, forces us to think a far, far older machination, still churning. A ten-thousand-year old structure, a structure that seems so real we call it Nature.

This essay is about the riddle of ecological awareness. It is like becoming accustomed to something strange, yet it is also becoming accustomed to strangeness that doesn't become less strange. It is like a knowing that knows itself. Knowing in a loop. A *weird* knowing. *Weird*, from the Old Norse, *urth*, meaning twisted, *in a loop*.[2] The Norns entwine the web of fate with itself. *Weird* can mean *causal*: the spool of fate is winding. And yet *weird* can also mean a certain strangeness of

1 | Hardy 1984, 136-139.

2 | Cf. Oxford English Dictionary: »weird«.

appearance.[3] *Ecological awareness is weird*. Since there is no limit to the scope of ecological beings (biosphere, Solar System), we can infer that things in general have a loop form. But more rigorously, I'm going to argue that ecological awareness is in the form of a loop, because human interference has a loop form, because ecological and biological systems are in the form of a loop, because to exist at all is to assume the form of a loop. The loop form of things means we live in a universe of finitude and fragility. It means that the politics of coexistence are always contingent, fragile and flawed – at least one being is missing. Ecognostic jigsaws are never complete.

There are many kinds of loops. There are positive feedback loops that escalate the potency of the system in which they are operating. Antibiotics versus bacteria. Farmers versus soil, giving rise to The Dustbowl. There are negative feedback loops that cool down the intensity of those systems. Think of thermostats and James Lovelock's Gaia. There are phasing loops. We encounter them in beings such as global warming, so great that they come in and out of phase with human temporality.

Ecognosis is a *strange loop*. There you were, shoveling coal into your steam engine, that great invention patented in 1784 that Marx hails as the driver of industrial capitalism. The very same machine that Paul Crutzen and Eugene Stoermer hail as the instigator of the *Anthropocene*, the decisive intersection between human temporality and geological time.[4] Since the later eighteenth century humans began to deposit layers of carbon in Earth's crust. In 1945 there occurred the *Great Acceleration* of the Anthropocene, marked by a huge data spike in the graph of human involvement in Earth systems.

There you are, turning the ignition of your car. And all of a sudden, at some strange point you don't quite recall, you realize it. You are a member of a massively distributed thing. This thing is called *species*. Every time I start my car or steam engine I don't mean to harm Earth, let alone cause the Sixth Mass Extinction Event in the four-and-a-half billion-year history of life on this planet. But when I scale up these actions to include billions of key turnings and billions of coal shovelings, I realize this is precisely what is happening. I am directly responsible, as a member of this species, for the Anthropocene. I am the criminal.

3 | Ibid.

4 | Cf. Crutzen/Stoermer 2000, 17-18.

And I discover this scientific forensics. Just like in *noir* fiction, I'm the detective *and* the criminal! I'm a person. I'm also part of an entity that is now *a geophysical force on a planetary scale*.[5]

An Inconvenient Anthropocene

Not all of us are ready to feel sufficiently creeped out. Not a day goes by recently without some Humanities scholars becoming quite exercised about the term *Anthropocene*, which has arisen at a most inconvenient moment. *Anthropocene* might sound to posthumanists like an anthropocentric symptom of a sclerotic era. Others may readily recall the close of Foucault's *The Order of Things*: »man« is like a face drawn in sand, eventually wiped away by the ocean tides.[6] Foucault appears less upset than the Matthew Arnold of »Dover Beach« at the prospect of this construct's obliteration. What a weirdly prescient image of global warming, with its rising sea levels and underwater government meetings.[7] But how ironic. There we were, happily getting on with the obliteration business, when *Anthropocene* shows up. The human returns at a far deeper geological level than mere sand. Give a posthumanist a break! This is also an inconvenient truth for those convinced that any hint of talk about reality smacks of reactionary fantasy, as a bullying, know-nothing kick of a pebble, as if the sound of a kick were an argument.

The Sixth Mass Extinction Event, caused by the Anthropocene, caused by humans. Not jellyfish; not dolphins; not coral. The panic seems more than a little disingenuous, given what we know about global warming, and given what we Humanities scholars think we like to say about the role of humans in creating it, as opposed to, say, Pat Robertson or UKIP (the UK Independence Party). A Fredric Jameson might smile somewhat ruefully at the dialectic of scholars refusing the very concept of reality and big pictures, while global megacorporations frack in their backyards.

5 | Cf. Chakrabarty 2009, 197-222.

6 | Cf. Foucault 1994, 387.

7 | I refer to the action performed by the government of the Maldives in 2009.

The Ocean's Silver Screen

The trouble with global warming is that one simply can't just palm it off on one particular group of humans, or insist that the Sixth Mass Extinction Event is just another construct. The Humanities have persistently argued via Foucault via Heidegger or Marx via Hegel via Kant that there are no accessible things in themselves, only thing-positings, or thingings of *Dasein*, or thing discourses, or things posited by the history of spirit, or by (human) economic relations. Only things insofar as they correlate to some version of the (human) subject.[8] But the screen on which these correlations are projected isn't blank after all. It consists of unique, discrete entities with a »life« of their own no matter whether a (human) subject has opened the epistemological refrigerator door to check them. Some entities formerly known as blank screens (and violently treated so) are overwhelming human being itself.

Foucault's face in the sand images the regime of power-knowledge that begins in 1800. To say the least, this is ecologically uncanny. 1800 is the moment of the steam engine, engine of the Anthropocene. 1800 is also the moment of Hume and Kant, who inaugurated correlationism. Hume argued that cause and effect were mental constructs based on interpretations of data: hence modern science, which talks of statistics. Which is why global warming deniers and tobacco companies are able to say, with something like a straight face, that no one has ever proved that humans caused global warming or that smoking causes cancer. In the same way, a post-Humean person is unable to claim that this bullet she is going to fire into my head at point blank range is going to kill me. She can say that it's 99.9% likely, which is actually *better*, since that relies only on data, not on metaphysical factoids culled from Aristotelian arguments about final causes. Thus the Intergovernmental Panel on Climate Change (IPCC) makes it more and more clear that humans have caused global warming, but they need to express this as a statistic: as I'm speaking this it's at 95%. Which leaves an out for conservatives who like to deny global warming by going, »Well, it snowed in Boise Idaho last week, so there's no global warming at all!« In addition to denying global warming, statements such as this deny modern causality theories. Kant grounded Hume's argument in syn-

8 | Cf. Meillassoux 2009, 5.

thetic judgments a priori in a transcendental subject (not »little me«). Only a correlator such as a (human) subject makes reality real. At the very moment at which philosophy says you can't directly access the real, humans are drilling down ever deeper into it.

How I learned to Stop Worrying and Love the Term »Anthropocene«

Let's examine the modes of Anthropocene denial. First, the claim of colonialism: the Anthropocene is the product of Western humans, mostly Americans. It unfairly lumps together the whole human race.

Although the desire for it emerged in America first, it turns out everyone wants air conditioning. On this issue, I'm in perfect accord with Dipesh Chakrabarty, who had the courage to name the concept *species* on which the concept Anthropocene depends, and got into a lot of trouble for it.[9] Likewise obesity isn't simply American, and for the same reason. Desire is logically prior to whatever »need« is, histories of consumerism notwithstanding, histories that tend to repeat Fall narratives not unrelated to ecology: »First we needed things, then at point *x* we wanted things, and that put us into an evil loop.« We think of loops as sin. But loops aren't sinful: there was no Fall, as I shall argue, no transition from »needing« to »wanting.« Neanderthals would have loved Coca Cola Zero™.

Secondly, racism. The user of *Anthropocene* is saying that humans as a species are responsible, and while this really means white humans, they go unmarked.

There is such a thing as the human. But *human* need not be something that is ontically given: we can't see or touch it or designate it as present in some way (as whiteness, or not-blackness, and so on). There is no positive content to the human that I can discern. So *Anthropocene* isn't racist. Racism exists when one fills out the gap between what one can see (beings starting engines and shoveling coal) and what this human thing is: the human considered as a species, that is, as a *hyperobject*, a massively distributed physical entity of which I am and am not a member, simultaneously. (We'll see how there are Darwinian, phenom-

9 | Cf. Chakrabarty 2009, 197-222.

enological and logical reasons for this violation of the »law« of noncontradiction). The racist effectively erases the gap, implicitly reacting as Hume and Kant did against reality. Since Kant, there has been some kind of irreducible rift between what a thing is and how it appears, such that science handles data, not actual things.

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You see? I am myself a correlationist. I don't believe that the finitude of the human – world correlate is incorrect. It can't be burst asunder, for instance by mathematics.[10] It can't be papered over, as in racism. We should merely release the anthropocentric copyright control on correlationism, allowing nonhumans like fish (and perhaps even fish forks) the fun of not being able to access the in-itself.

All right, says the hesitant humanist. *Anthropocene* may not be colonialist or racist, but surely it must be a blatant example of speciesism? Isn't the term claiming that humans are special and different, unique in having created it?

Indeed, humans and not dolphins invented steam engines and drilled for oil. But this isn't a sufficient reason to suppose them special or different. Etymology notwithstanding, *species* and *specialness* are extremely different. Just ask Darwin. Unfortunately he had no recourse to emoticons, for if his masterwork's title had contained a wink emoticon at its end, he could have said it succinctly: there are no species – and yet there are species! And they have no origin – and yet they do! A human is made up of nonhuman components and is directly related to nonhumans. Yet a human is not a fish. A swim bladder, from which lungs derive, is not a lung in waiting. There is nothing remotely lung-like about it.[11] Let alone my bacterial microbiome: there are more bacteria in »me« than »human« components. A lifeform is what Derrida calls *arrivant*, or what I call *strange stranger*: it is itself, yet uncannily not itself at the same time.[12]

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10 | Meillassoux and Ray Brassier hold this position.

11 | Cf. Darwin 1996, 160.

12 | Cf. Derrida 2000, 3-18; Morton 2010, 14-15, 17-19, 38-50.

The Darwinian concept of species is precisely not the Aristotelian one where you can tell teleologically what species are for: ducks are for swimming, Greeks are for enslaving barbarians… Since *species* in this sense doesn't coincide with me, an actual human being as opposed to a pencil or a duck, it isn't speciesist. Like the racist, the speciesist fills out the gap between phenomenon and thing with a kind of paste: the fantasy of an easy-to-identify content. That's precisely what one is incapable of seeing, yet there are ducks and spoonbills, which are not humans.

The seemingly anachronistic and dangerous concept *species* appears superficially easy to think: after all, contemporary media such as *Sesame Street* (»We Are All Earthlings«) appear to convey it.[13] Yet for me to know, through the very reasoning with which I discern the transcendental gap between phenomenon and thing, the being that manifests this reasoning – this might be very strange, like a serpent swallowing its own tail, putting itself in a loop. Isn't it the case then that what appears to be superficially the nearest – my existence qua this actual entity – is phenomenologically the most distant thing in the universe? It's easier for me to think the black hole at the center of the Milky Way. The Muppets and so on *inhibit* the necessary ecological thought: the uncanny realization that every time I turned my car ignition key I was contributing to global warming, and yet was performing actions that were statistically meaningless. When I think myself as a member of the human species, I lose »little me;« yet it wasn't tortoises that caused global warming.

Fourthly, the idea that *Anthropocene* is hubristic. Yet the term deploys the concept *species* as something unconscious, never totally explicit. Humans did it, not jellyfish and not computers. But humans did it with the aid of prostheses and nonhumans such as engines, factories, and cows – let alone viral ideas about agricultural logistics living rent-free in minds. So *Anthropocene* isn't hubristic at all. It means humans – already a mess of lungs and bacteria and nonhuman ancestors and so on – along with their agents such as cows and factories and thoughts, agents that can't be reduced to their merely human use or exchange value. For instance, these assemblages can violently disrupt both use and exchange value in unanticipated (unconscious) ways: one cannot eat a Californian lemon in a drought. Furthermore, »we« did it *unconsciously*. We became a geophysical force on a planetary scale. This means that no matter what

13 | Cf. *Sesame Street* 1985; *USA for Africa* 1985.

you think about it, no matter whether you are aware of it or not, there you are, being that. This distinction is lost on some of those who react against the term. One cannot be hubristic about one's heartbeat or autonomic nervous system.

The fact that it is far from hubristic is also why geoengineers are incorrect, if they think *Anthropocene* means we now have carte blanche to put gigantic mirrors in space or flood the ocean with iron filings. Earth isn't just a blank sheet for the projection of human desire: this desire loop is predicated on entities (Earth, coral, clouds) that also exist in loop form, in relation to one another and in relation to humans. The argument for geoengineering goes like this: »We have always been terraforming, so let's do it consciously from now on.«[14] Yet making something conscious doesn't mean it's nice. We have always been murdering people. How is deliberate murder more moral? Psychopaths are exquisitely aware of the suffering they consciously inflict. In relation to lifeforms and Earth systems, humans have often played the role of the Walrus concerning the oysters:

»I weep for you,« the Walrus said:
»I deeply sympathize.«
With sobs and tears he sorted out
Those of the largest size,
Holding his pocket-handkerchief
Before his streaming eyes.[15]

Consider the Freudian-slippy absurdity of James Lovelock's analogy of Jekyll and Hyde for science and engineering. Lovelock, calls us the »species equivalent« of Jekyll and Hyde: »Only big science can save us. We know big science been like Mr. Hyde for the last two centuries, but please know, we have a kindly inner doctor Jekyll. Let us be Jekyll. Please. Please trust us, *trust us*.«[16] Unaware of its tone, the sentence sounds exactly like Mr. Hyde, as does Jekyll's own self-justification in the novel. We should be screaming.

14 | Cf. for instance Robinson 1993, 1995 and 1997.

15 | Carroll 2000, 187.

16 | Lovelock 2006, 6f.

More deeply, one can't get rid of the unconscious that easily. Here is an analogous sentence: »I know I'm an addict so now I'm going to drink fully aware of that fact.« Being aware of »unconscious biases« (as the Harvard engineering test for interviewers of job candidates puts it) is a contradiction in terms.

Humans made the *Anthropocene* – humans made the logistics of agriculture that now covers most of Earth and is responsible for an alarming amount of global warming emissions all by itself. Not bacteria, not lemons. Such a making had unintentional or unconscious dimensions, if one is in the psychoanalytic trade, or *style* if one is in the phenomenological business. No one likes having their unconscious pointed out, and ecological awareness is all about having it pointed out. Moreover, this unconscious is decidedly *physical* – as in the fact that humans are a geophysical force. The hint that there is an outside untouched by what or how we dispose ourselves intellectually or culturally is taboo and shocking to some Humanities scholars.

There are some substitutes for the term *Anthropocene*. For instance, why not call it Homogenocene? While fitting nicely with Hopkins sonnets about wearing man's smudge and sharing man's smell, this is just a euphemism. The substitute is true: humans have stamped their impression on things they consider as ductile as wax, even if they cry. But in a more urgent sense, the concept is false. It is truly anthropocentric. The iron deposits in Earth's crust made by bacteria are also homogeneous. Oxygen, caused by an unintended consequence of bacterial respiration, is a homogenous part of the air. Humans are not the only homogenizers. The concept of species, upgraded from the absurd teleological and metaphysical concepts of old, not anthropocentric at all. Because it is via this concept, which is open, porous, distant from what is given to my perception, that the human is decisively deracinated from its pampered privileged place apart from all others.

The Anthropocene is the first truly anti-anthropocentric concept. When we think species this way, global warming is seen as a *wicked problem*, or even as a *super wicked problem*. A problem you can rationally diagnose, but to which there is no feasible rational solution. Some kind of irreversibility lies at the heart of the wicked problem. There appears to be no way to solve it—barring some radical letting go of our assumptions about ourselves. Which sounds absurd. But why?

Agrilogistics

In the Golden Age, agriculture was an abomination. In the Silver Age, impiety appeared in the form of agriculture. In the Golden Age, people lived on fruits and roots that were obtained without any labor. For the existence of sin in the form of cultivation, the lifespan of people became shortened.[17]

I have placed a curse on the ground. All your life you will struggle to scratch a living from it. It will grow thorns and thistles for you, though you will eat of its grains. All your life you will sweat to produce food, until your dying day. Then you will return to the ground from which you came. For you were made from dust, and to the dust you will return.[18]

Two ancient texts, written within agricultural time, condemn agriculture. Rather startlingly accurately: the science is on their side.[19] A book about this is called *Paleopathology at the Origins of Agriculture*. As if, for a moment when you read the title, there was *an ancient pathology* (paleopathology), a deployment of a telling term, *paleo*, which names (within agricultural space once more) the Paleolithic, the time before the Neolithic. And as if the origins of agriculture were pathological. As if science couldn't help talking in the terms of agricultural religion, itself caught in agricultural time. Agriculture against agriculture. Agricultural autoimmunity, an agricultural allergy that agriculture can't get rid of. Foundational Axial Age stories of the origin of religion as the beginning of agricultural time. An origin in sin. Religion as such (was there »religion« beforehand?) founded in and as impiety. And the thistles keep growing, the sweat keeps pouring and humans are from dust, not from themselves as later agricultural myths (from the Theban cycle to the Enlightenment) will proclaim. »Religion« itself as a reflective, reflexive mode that puts us into the loop of sin and salvation, with its escalating positive feedback. Like agriculture.

What is this »human« species, instigator of the Anthropocene, fragile sand drawing? Evidently the term as used here is not essentialist, if *essentialist* means metaphysically present – a metaphysics that isn't

17 | The Ramayana of Valmiki 1976.

18 | Genesis 3:17-19.

19 | Cf. the marvelously exhaustive collection of data in Cohen/Armelagos 2013.

thinkable in the lineage of Kant and his subsequent lineage holders, including Heidegger, who inspired Lacan, who taught Foucault. This presence derives ultimately from a default ontology persistent in the long moment in which the Anthropocene is a rather disturbing fluctuation. We are still within this ten-thousand-year »present« moment, a whisker of geological time. What happened in the Fertile Crescent happens »now.« This moment started somewhere, sometime. It is bounded. Yet to think outside it, since that very outside is defined by it, is to think within it. The contemporary phenomenon of the gluten-free diet perfectly embodies this modern, magic bullet solution to modernity – gluten, that abject-sounding, glutinous protein found in wheat. Even Neanderthals made bread. Or the modern hatred of the body combined with a profound unease that »something is wrong,« which is accurate, combined with a primitivism evoked in the »Paleo diet.« We shall need some kind of aikido to traverse it without repeating it.

There's a huge elephant in the room. And you are a cone in one of its eyes. When you are sufficiently creeped out by the human species, you see something even bigger than the Anthropocene looming in the background, hiding in plain sight in the prose of Thomas Hardy, the piles of fruit in the supermarket, the gigantic parking lots. What on Earth is this structure that looms even larger than the age of steam and oil? Isn't it enough that we have to deal with cars and drills? Thomas Hardy provides a sufficiently widescreen way of seeing agricultural production, sufficient that is to glimpse in his description not only the immiseration of women in particular and the rural working class in general, in the later Victorian period, but also the gigantic machinery of agriculture – machinery before the Industrial Revolution, before the Agricultural Revolution – *the machine that is agriculture as such*. Without doubt, industrial scale agribusiness is now responsible for an alarming amount of global warming emissions. But before the web of fate began to be woven on a power loom, machinery was already whirring away.

I call this ten-thousand-year machination *agrilogistics*, the time of a certain logistics of agriculture that arose in the Fertile Crescent and went viral, eventually requiring steam engines and industry to endure.[20] Logistics, because it is a technical, planned, and perfectly logical ap-

20 | Cf. Morton 2015.

proach to built space. Logistics, because it proceeds without the need, so it thinks, for stepping back and rethinking the logic.

A climate catastrophe about 12,500 years ago pushed humans to find a solution to their anxiety concerning where the next meal was coming from. It was the reverse of the thaw after the Ice Age. A drought lasting more than a thousand years compelled humans to travel farther. It happened that in the Fertile Crescent of Mesopotamia, barley and wheat were growing wild beneath the trees. The same can be said for rice growing in China, corn, squash and beans growing in America, and sorghum and yam in Africa. Significantly, the taro of New Guinea is hard to harvest and low in protein, not to mention hard to plant (you have to do it one by one), and so the farmers in the highlands never »moved on« from hunter-gathering. The taro cannot be *broadcast* – so many terms from agrilogistics have become terms in media (*field* among them), not to mention the development of that very significant medium, writing.

Humans in Mesopotamia set up villages with granaries. The storage and selection of grain exerted evolutionary pressure upon it. Humans and grain coevolved. Grain was selected for its tastiness, ease of harvesting, and so on. Scaled up this pressure was vast. Nine thousand years ago humans began to domesticate animals to mitigate season variations in game. To keep the kettle boiling, as it were, the kettle of agrilogistics.[21] Now the number of domesticated animals on Earth far outweighs (literally outweighs) the number of non-domesticated ones. Humans represent roughly 32% of vertebrate biomass. The other 65% is creatures we keep to eat. Vertebrate wildlife counts for less than 3%. The term *cattle* speaks to this immensity and to a too-easy ontology humming away in its background. This agrilogistical boiling is done *for its own sake* – there were no other great reasons, as we shall see. This loop, reminding one of the aestheticism of »art for art's sake,« is strange and compelling. It is, as it were, an aestheticism of utility, *an aestheticism of the non-aesthetic*.

The idea that humans began »civilization« here is a retroactive positing par excellence. As if civilization had emerged like the goddess Athena from the head of the human, without any support. Without coexistence. »Civilization« was a collaboration between humans and wheat,

21 | In New Guinea, native pigs can't plough—so agrilogistics was stymied there again.

humans and rock, humans and soil, out of something like desperation, spread over long tracts of time. The human hyperobject (the human as geophysical species) became a machine for the generation of hyperobjects. We are living in one now – global warming. Precisely because of this, »civilizations« are inherently fragile. Just as World War II was the viral code that broke the computation of a certain imperialism, one wonders whether global warming will be the viral code that breaks the machinations of a certain neoliberal capitalism. One wonders.

The Three Axioms of Agrilogistics

The logistical algorithm of Fertile Crescent agriculture consists of numerous subroutines: eliminate contradiction and anomaly, establish boundaries between the human and the nonhuman, maximize existence over and above any quality of existing. Now that the logistics covers most of Earth's surface, we can see its effects as in a polymerase chain reaction: they are catastrophic. Humans invented a form of agriculture that became so successful that it is now wiping out lifeforms in the most efficient way imaginable.

Agrilogistical space is saturated with three philosophical axioms. We are living inside a philosophy, along with worms, plows, cats and stagnant pools. But the philosophy is silent. It mimes itself in the movements of Tess in the field. It mimes itself in the field. But to all intents and purposes, it's a dumbshow, so familiar that it's almost invisible. The silent functioning of the world. Let's make agrilogistical space speak:

(1) The law of noncontradiction is inviolable.
(2) Existing means to be constantly present.
(3) Existing is always better than any quality of existing. Or as the philosophy teacher in Tom Stoppard's *Darkside* puts it, being alive instead of dead.

We begin with Axiom (1). There is no good reason for it. There are plenty of ways to violate this law, otherwise we wouldn't need a rule. This means that Axiom (1) is a prescriptive statement disguised as a descriptive one. Formulated rightly, Axiom (1) actually states: *Thou shalt not violate the law of noncontradiction*. Axiom (1) works by excluding (domesticated)

lifeforms that aren't part of your agrilogistical project. These lifeforms are now defined as pests if they scuttle about, or weeds if they appear to the human eye to be inanimate and static.

It also results in the long history of *the Easy Think Substance*. Agrilogistical ontology, formalized by Aristotle seven thousand years, thinks that a being consists of a bland lump of whatever, decorated with accidents. It's the Easy Think Substance because it resembles what comes out of an Easy Bake Oven, which one subsequently decorates with sprinkles. This non-description of Easy Think passengers implies an unexamined thought that gives no heed to the qualities of the people on board. Only their number counts, *the fact that they merely exist*. Indeed, existing is better than any quality of existing, according to Axiom (3). It doesn't even matter how many more people than one there are. Even the sheer quantity of existing is treated as a lump of whatever. Counting doesn't count. For a social form whose early invention, writing, was so preoccupied with sheer counting (in surviving Linear B texts for instance), this is ironic. Consider the familiar problem of the train. To save the people on the train, by stopping the train from going on broken tracks over a cliff, it is necessary to divert it towards a boy tied to a safer railway track. Now amplify the problem. Say there were three hundred people on the track, and three hundred and one people in the train. The train should divert and run over the people on the track. This isn't even a fully mathematizable world, just a lump, an amazing pudding of stuff.

So this implies Axiom (2): to exist is to be constantly present: the *metaphysics of presence*. The metaphysics of presence is intimately caught in the history of global warming. Here is the field, I can plough it, sow it with this or that, or nothing, farm cattle, yet it remains, constantly the same. The entire system is construed as constantly present, rigidly bounded, separated from nonhuman systems – despite the obvious existence of beings who show up to maintain it (for instance the cats and their helpful culling of rodents chewing at the corn). Thus the ambiguous status of cats is not quite the »companion species« Haraway generalizes about through dogs. They stand for the ontological ambiguity of lifeforms, and indeed of things at all. They are a *neighbor* species. »Companion« is already too conceptual. Their penetrating gaze is thus used as the gaze of the extraterrestrial alien. Because they are the intraterrestrial alien.

Well, the agrilogistical engineer must try to ignore the cats as best as he (underline *he*) can, and if that doesn't work, kick them upstairs into deity status. Meanwhile, he asserts instead that he could plant anything in this agrilogistical field and underneath it remains the same field, constantly. A field is a substance underlying its accidents. Agrilogistical space is a war against the accidental. Weeds and pests are a good example of something supposedly accidental – a nasty accident you have to minimize or eliminate. As is said, *a weed is a flower in the wrong place.*

Consider the accident of epidemics, commonly known in ancient Greek culture as miasma. The first hyperobject thinkable, yet not directly visible, to humans. Since you are settled and stable, you can observe these phenomena floating about. You see them as *para,* as accidental. And you try to get rid of them. For instance, you move to America and start washing your hands to get rid of germs. Then you suffer from an epidemic of polio, from which you were protected by not doing so much washing. This is the subject of Philip Roth's novel *Nemesis*.[22] Here is a good example of a strange loop. Agrilogistics itself actually works against itself, thus defying the law of noncontradiction in spite of itself! At least when you think it at an appropriate ecological and geological timescale.

To achieve constant presence, not just in thought but also in social and physical space requires persistent acts of violence, and such an achievement is itself violence.[23] Why? Because it goes against the grain of (ecological) reality, which consists of porous boundaries and interlinked loops, rather like the open-ended play of marks and signs that underwrites the very scripts that underwrite agrilogistical space, with its neatly ploughed lines of words, many of their first lines pertaining to accounting for cattle – a lazy term for anything a (male) human owns. No, I'm not saying that pre-agrilogistical social forms were more present because they were oral. I'm saying that they weren't. Logocentrism – the idea that full presence is achievable within language – is an agrilogistical myth. This is why its deconstruction, in Heidegger and then in Derrida, is a way to start finding the exit route.

Agrilogistical existing means just being there, in a totally uncomplicated sense. No matter what the appearances might be, essence lives

22 | Cf. Roth 2011.

23 | Cf. Derrida 1978, 151f.

on. Ontologically, agrilogistics is immiseration. And socially. Immiserating conditions were the almost immediate consequence of its inception, yet the virus persisted, like an earworm or a chair, no matter how destructive to the humans who had devised it.[24] Or indeed private property, based on settled ownership and use of land, a certain kind of house and so on – the nonhuman basis of the contemporary concept of self, no matter how much we want to think ourselves out of that. Agrilogistics led rapidly to patriarchy, the impoverishment of all but a very few, a massive and rigid social hierarchy, and feedback loops of human–nonhuman interaction, such as epidemics. Appearance, phenomena, is of no consequence. What matters is knowing where your next meal is coming from, no matter what the appearances are. The physical embodiment of this thought takes the form of fields that surround the city-state. These fields now underlie all other modes of production from feudalism to capitalism to Soviet economies.

Without paying too much attention to the cats, you have broken things down to pure simplicity, and now you are ready for Axiom (3):
(3) Existing is always better than any quality of existing.

Actually, we need to give it its properly anthropocentric form, because – screw the other lifeforms, right?
(3) Human existing is always better than any quality of existing.

Axiom (3) generates an Easy Think Ethics to match the Easy Think Substance. A default utilitarianism, hardwired into agrilogistical space. Since existing is better than anything, more existing must be what we should aim for. Everything else is just accidental. No matter whether I am hungrier, or sicker, or more oppressed, underlying these phenomena, I and my brethren remain constantly, down the generations.

Jared Diamond has called Fertile Crescent agriculture »the worst mistake in the history of the human race.«[25] It's worse than a mistake. Because of its underlying logical structure, agrilogistics now plays out at the temporal scale of global warming. Agrilogistics supplied the conditions for the Agricultural Revolution, which swiftly provided the conditions for the Industrial Revolution. Which is why there is a good reaction to the »modernity once more with feeling« solutions to global warming – bioengineering, geoengineering, and other forms of what I

24 | Cf. Diamond 1987, 64-66.

25 | Ibid.

shall call *happy nihilism*. Happy nihilism reduces things to bland substances that can be manipulated at will, without regard to unintended consequences. The right reaction is a scream.

Now agrilogistics covers most of Earth's surface, we can see its effects as one can see patterns of DNA in a polymerase chain reaction: they are catastrophic. Planning for the next few years means you know where the next meal is coming from, for a long time. Who doesn't want that? And existing is good, right? So let's have more of it. Yes, I have just touched the third rail, the population rail. You are now thinking I might be a Nazi. Courting this reaction is just one of first ridiculous, impossible things that ecognosis does. So much ridicule, so little time.

It was based on increasing happiness: eliminating anxiety about where the next meal is coming from. But within the first quarter of its duration so far, agrilogistics resulted in a drastic *reduction* in happiness. People starved, which accounts for shocking decreases in average human size in the Fertile Crescent. Within three thousand years, patriarchy emerged. Within three thousand years, what is now called the 1% emerged, or in fact the 0.1%, which in those days was called King. Agrilogistics exerted downward pressure on evolution. Within three thousand years, farmers' leg bones went from ripped hunter-gatherer to semi-sedentary forerunner of the couch potato. Let's not forget deserts. Agrilogistics was already a disaster early on. It was repeated throughout Earth. There is a good Freudian term for this destructive repetition: death drive.

There was something wrong with the code from the beginning. *We define happiness as a state of well-being, starting with being alive instead of dead*. And that more happiness is better, such that more existing, despite how I appear (starving, oppressed) is better. We could compress this idea: *happiness as existing for the sake of existing*. A *for its own sake* that, in other domains such as the aesthetic, is often seen as superfluous, or evil, or evil because superfluous. It sounds so right, an Easy Think Ethics based on existing for the sake of existing. Yet if you scale up this argument a very strange thing happens, observed by Derek Parfit, who subjects this kind of utilitarianism to stress tests based on the Prisoner's Dilemma. (Two prisoners in two rooms, they can't communicate. If they both confess they get a short sentence. If one narks on the other, the other gets a longer sentence and one goes free. What do they do?) Easy Think Ethics fails under sufficient spatiotemporal pressure. Parfit was

trying to think about what to do with pollution, radioactive materials, and the human species. At Earth magnitude, the magnitude at which there is no »away,« we ask this childish question: *What does »go free« mean? What on Earth, quite literally?*

Let's say we have trillions of humans, spread throughout the galaxy. They are all living at what Parfit calls *the bad level*, which is not far from Agamben's idea of *bare life*. Trillions of nearly dead people, trillions of beings like the Muselmänner in the concentration camps, zombies totally resigned to their fate. This will always be absurdly better than even billions and billions of humans living in a state of bliss. Because more people is better than happier people. Because bliss is an accident, and existing is a substance. Easy Think Ethics. Let's colonize space – that'll solve our problem! Let's double down! But we now know that it doesn't take trillions of humans spread throughout the Galaxy. It only takes a few billion operating under agrilogistical algorithms at Earth magnitude. In short: to avoid the consequences of the last global warming, humans devised a logistics that has resulted in global warming. Mary Daly is correct that we live in a death culture.[26]

Nature

Agrilogistics gives us the concept of Nature definitively outside of the human. So the normative concept of Nature that tells you what's »in« and what is »out« as surely as a jaded fashion magazine is deeply troubled. Normative Nature simply can't cover absolutely everything, because Nature depends on specifying the unnatural. But this is just what we moderns are incapable of doing in advance of the data. The concept Nature is a flicker of resistance to the oncoming metal army of industrialization, like a fake medieval sword made of rubber.

But this concept isn't only untrue; it's responsible for global warming. Nature is defined within agrilogistics as a harmonious periodic cycling. Carbon dioxide fluctuated in a harmonious-seeming periodic cycle for 10,000 years – until it didn't.[27] We've grown used to calling nice periodic cycling Earth systems *Nature*. The term's ecological val-

26 | Cf. Daly 1990, 40-46.

27 | Cf. Zalasiewicz 2013.

ue is dangerously overrated. Nature as such is a 10,000-year-old human product, not only discursive, but also geological. Its wavy elegance was simply revealed as inherently violent, as when in a seizure one's brain waves become smooth right up until one goes into seizure. You wash rinse repeat the agrilogistics, and suddenly you reach a tipping point, which emerges with the steam engine that improves agrilogistical functioning. The Anthropocene doesn't destroy Nature. It *is* Nature, in its fully toxic, nightmare form.

Agrilogistics is a strange loop because in its very attempt to smooth out the physical world and to smooth out anxiety, it has doubled down on that physical world and on anxiety itself. Just like how washing your hands forces bacteria to adapt. What we need to do, then, is investigate with great urgency the reasons for the arising of this particular loop. But that is the subject of future work.

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»Again, the Earth (which ever I held in mine eye) did as it were mask it selfe with a kind of brightness like another Moone.«

Inventing ›Blue Marble‹ in 17th century literature and astronomy[1]

Hania Siebenpfeiffer

Defining Celestial Sublimity

Even though *Blue Marble* (fig. 1) did not appear on the front-pages of international newspapers and magazines in 1972, the majestic image of the full Earth's globe shot at a distance of only 45,000 km and published by NASA shortly after the safe return of Apollo 17 is one of the most famous space photographs ever taken. Its degree of popularity may only be matched by the equally famous picture of *Earthrise*, taken by chance by the astronaut William Anders during the Apollo 8 mission on December 24th 1968.[2] Nevertheless, it was *Blue Marble* that became »the image of the Earth par excellence,«[3] as Horst Bredekamp recently coined it, last but not least due to its omnipresence in mass media within the political context of the growing ecological and antinuclear power movement in the 1970s, where it instantly became a powerful symbol of Earth's fragility. The image was soon so well-known that in the years following

1 | This paper is part of a larger study on *Exploring outer space. Literature and Astronomy (1593 and 1771)* that will be published in Winter 2017/18. I am grateful to Solvejg Nitzke and Nicolas Pethes for the opportunity to present some of my arguments in this volume.

2 | Cf. Poole 2008.

3 | Bredekamp 2011, 221.

its first publication expressions were born such as »Erdsicht,«[4] the German term for a view of the Earth as seen from a non-Earthly – that is to say, cosmic – viewpoint, as well as »overview-effect,«[5] which defines the emotional impact of ›Erdsichten‹ as an unexpected and sudden feeling of being ›swept off one's feet‹.

Fig. 1: Blue Marble (digitally enhanced)

The overwhelming effect, supposedly a natural and therefore ›true‹ reaction to these images, is not so much indicated by the *compositum* itself, even though it speaks of an effect, but by the notably successful coping strategies implemented in the aesthetics of *Blue Marble* itself. These have been dominating the global media images of ›Erdsichten‹ ever since, while at the same time they follow an aesthetic choreography outlined in the 18th century to field the sudden view of a stupendous nature such as the tremendous Rhine Falls at Schaffhausen or the frightfully ice crusted mountain massif of the Mont Blanc. Being overwhelmed by nature – or

4 | Cf. the correspondent lemma in *Outer Space* (ed. Kunst- und Ausstellungshalle der Bundesrepublik Deutschland) 2014, 50.

5 | The expression »overview-effect« was first used in 1987 in the title of a book by Frank White based on the stories of 29 astronauts, among them Alexejewitsch Gagarin and Alan Shepard, remembering their ›first encounter‹ with the Earth viewed from outer space. (White 1998).

to put it more correctly, being overwhelmed by the unpredicted perception of a stunning natural phenomenon – is not very different from the experience of ›Erhabenheit,[6] by which the 18th century found a powerful answer to the internal sentiment of the sublime, propagating the aesthetic as well as sacral dimension of its external ›natural‹ cause. Following the well-known definition by Friedrich Schiller at the beginning of his essay *Vom Erhabenen* (1793), ›Erhabenheit‹ means to become aware of the double-bound relation a human being maintains with nature, being part *and* counterpart at the same time. Following Schiller – and up to a specific point also Kant and his concept of ›Erhabenheit‹ outlined 1790 in his *Kritik der Urteilskraft* (»Critique of Judgement«) –, the confrontation with a stupendous and threatening, even though distant, natural phenomenon sets human beings at the interface of nature and culture, thereby evoking the simultaneous sentiment of dependency and autonomy, ›Ohnmacht‹ (*impotence*) and ›Ermächtigung‹ (*empowerment*). It is this ambiguity towards the natural that enables the subject to rise above nature while externalizing its cause by the means of reason:

> *Sublime* we name an object, at whose conceptualization our sensuous nature feels its limits, but our rational nature its superiority, its freedom from limits; in the face of this we thus derive *physically* our brevity, which we surmount but morally, i.e. through ideas./Only as sensuous beings are we dependent, as rational beings we are free.
>
> The sublime subject matter gives us *firstly*, as beings of Nature, to feel our dependence, while *secondly* acquainting us with the independence that we as rational beings maintain over Nature, *within* ourselves as well as *without* ourselves.[7]

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6 | I prefer the German expression ›Erhabenheit‹ as it was defined by Schiller and Kant in the 1790s in contrast to English concept of the sublime that was invented by Edmund Burke in *A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful* in 1756. For further distinctions see the lemma »Erhaben, das Erhabene« in Homann/Müller/Tonelli 1972.

7 | The German original reads as follows: »*Erhaben* nennen wir ein Objekt, bey dessen Vorstellung unsre sinnliche Natur ihre Schranken, unsre vernünftige Natur aber ihre Überlegenheit, ihre Freiheit von Schranken fühlt; gegen das wir also *physisch* den Kürzern ziehen, über welches wir uns aber *moralisch* d. i. durch Ideen erheben. Nur als Sinnenwesen sind wir abhängig, als Vernunftwesen

In the eyes of late 18th century viewers, the adequate answer to the experience cited above was to sublimate the emotional paradox by aestheticizing its natural cause and transcending it into an object worthy of admiration. *Blue Marble* not only proves the still powerful impact of this specific aesthetic program, it also tells us that the experience of ›Erhabenheit‹ is not necessarily restricted to nature itself, for it applies to man-made reproductions of natural phenomena as well. In 1972, the visual code of *Blue Marble* set the patterns for a cosmic image of the globe that was still to come. It pictured the Earth as a perfectly round three-dimensional sphere brightly gleaming against the pitch black background of a frightfully empty cosmic space, dressed in the royal colors of blue and green, coated by some white hazes and interspersed with just enough patches of brown needed to remind its beholders of the familiar materiality that gave Earth its name.

Descriptions by astronauts repeat, that being exposed to this view for the very first time, they experienced a sudden and unexpected revelation of a submissive and almost religious admiration, which comes very close to Schiller and Kant's concept of ›Erhabenheit‹. With only a few adjustments the aesthetic paradigm of the sublime has been incorporated in the image of *Blue Marble* to a degree that even more than 40 years later it is still largely unknown, that the picture we know is *not* the picture taken by Harrison »Jack« Schmitt through the bull-eye of Apollo 17 on

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sind wir frey./Der erhabene Gegenstand gibt uns *erstlich*: als Naturwesen unsre Abhängigkeit zu empfinden, indem er uns *zweitens*: mit der Unabhängigkeit bekannt macht, die wir als Vernunftwesen über die Natur, sowohl *in* uns als *außer* uns behaupten.« (Schiller 2008, 395). Schiller's essay is at the same time an answer to Kant's concept of ›Erhabenheit‹ outlined 1790 in Part II of the *Kritik der Urteilskraft*. He deepened his theoretical discussion of the sublime in his subsequent essay *On the Sublime* (first published in 1801). Here, the sublime is differentiated further from the moral: »In the presence of the sublime, on the contrary, reason and the sensuous are not in harmony, and it is precisely this contradiction between the two which makes the charm of the sublime – its irresistible action on our minds. Here the physical man and the moral man separate in the most marked manner; for it is exactly in the presence of objects that make us feel at once how limited the former is that the other makes the experience of its force. The very thing that lowers one to the Earth is precisely that which raises the other to the infinite.« (Schiller 1902, 141).

that famous day December 7th 1972 at 10:39 UTC. To facilitate spatial orientation, to enhance the public's ability to visually identify with the image, and to create a powerful impression of authenticity, Schmitt's photograph was turned ›downside up‹. I in order to match our familiar system of cardinal points, we now see the cloud covered South Pole in the south, Madagascar in the east and northern Africa in the north (fig. 2).

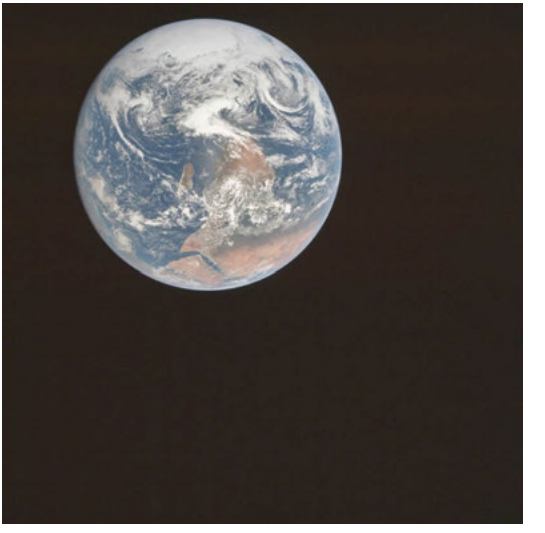

Fig. 2: Full Earth showing Africa and Antarctica taken on December 7, 1972 at 10:39 UCT by Harrison Schmitt on board of Apollo 17 (original position)

In addition, the brightness and colors of Earth were technically enhanced to stimulate the effect that the planet seems to float from the deep black space towards us, her contemplating inhibitors. By means of disjunction, *Blue Marble* became in its perfect proportional harmony the ultimate evidence that the universe itself obeys the rules of beauty. Also mostly forgotten is the fact that *Blue Marble* was not at all the first space photograph of Earth. In 1969, Neil Armstrong and Edwin Eugene Aldrin had shot several spectacular pictures of the Earth while standing on the Moon's surface, some of which are quiet well known. And even prior to those images, ATS I and II satellites had already produced half a dozen serials of Earth photographs, including some full shots. As a glimpse in the online database *ATS-II Image Collection* at the Schwerdtfeger Library of the University of Wisconsin-Madison reveals, 69 full

picture shots had been taken in the period between November 10th 1967 and March 21st 1969.[8] And not even those were the first photographic ›Erdsichten‹, since the first cosmic photograph of Earth had already been shot by *Lunar Orbiter 1* on August 23rd 1966 (fig. 3). But in contrast to *Blue Marble,* all those pictures never managed to capture the Earth without being partly shadowed by the Moon.

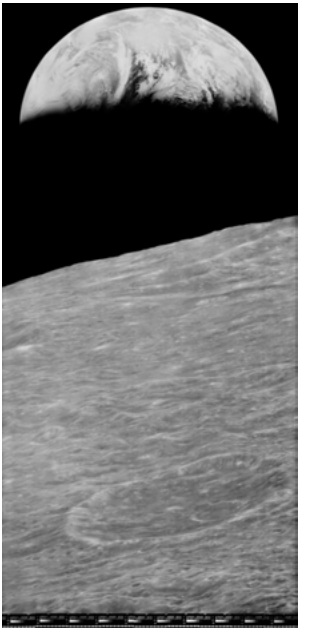

Fig. 3: Earth floating in space taken by Lunar Orbiter 1 on August 23rd, 1966 (digitally enhanced recovery by the Lunar Orbiter Image Recovery Project in 2008)

Nonetheless, all these photographic images make one thing clear: They show the tremendous importance of human perception in the concept of ›Erhabenheit‹. It is not the photographed object itself that evokes the sentiment of the sublime; it is the fact that the photograph in person proves the Earth's appearance while transforming it into an aesthetic object. In other words, the fundament of the sublime is human eye witnessing, the fact that while looking at *Blue Marble* we can say: »Wow,

8 | Cf. Schwerdtfeger Library 2015.

this is how Earth *really* looks and we know it because someone had seen it *just like this*«. This is why a more than 40-year old photograph of Earth is still met with awe; and this is why it seems as if Schmitt with his famous and unrivalled picture had given humankind the very first image of its home planet.

Yet the theatrical, and of course also sexual, metaphor of ›the first time‹ that occurs in almost every article about *Blue Marble*[9] hides the fact that like Schmitt's picture and its visual improvement according to the aesthetic concept of ›Erhabenheit‹, the twentieth-century image of Earth seen from outer space is neither maiden-like nor new. It is the picture itself that reveals the long aesthetic history of imaginary Earth sights that goes back as far as early 17th Century and of which *Blue Marble* is just a very prominent example. A tradition so influential that seen from the backdrop of visual and literary history, *Blue Marble* becomes a subsequent evidence of a visual and rhetorical invention leading back to times when manned space flight was still a dream. The importance of early modern anticipations of the cosmic view and its impact on today's images are the main subject of my article. And as I will show in the course of my argument literary imagination especially played an important role by creating what we perceive as our visual knowledge of our cosmos.

Inventing the Cosmic Eyewitness

The history of ›naturalistic‹ space images of Earth begins with Francis Godwin's novel *The Man in the Moone or a Discourse of a Voyage thither.*[10] First published in 1638 under the pseudonym of its protagonist Domingo Gonzales, its author, the Bishop of Llandaff and Hereford, had been dead for almost six years. Despite the pseudonymous publication, he was soon revealed as the originator; the second edition of that same

9 | I refer once again to the publication of Bredekamp, who stresses the fact that mankind had never seen Earth before in this way and that sight of *Blue Marble* altered the understanding of the Earth as our home planet fundamentally and proved to be of major importance for the newly founded ecological movement. Cf. Bredekamp 2011, 371f.

10 | Gonsales [alias Godwin] 1638.

year already carried his given name. Translated into French in 1648 in a strongly modified, if not to say corrupted version[11], Godwin's novel became the decisive founding narrative of early modern science-fiction with two more English and three more French editions in the 17th century followed by translations into Dutch in 1651[12], German in 1659[13], and Spanish before 1731.[14] In 1718 altogether 12 continental and 4 English editions had appeared; not counting the misprints, abridged and corrupted versions as well as the unofficial serials that circulated among the European erudite elites.[15]

The Man in the Moone tells the adventurous space travel undertaken by chance in the late 16th century by a picaresque though educated Spaniard »of noble parentage«[16] named Domingo Gonzales who serves as protagonist, narrator, and author of his cosmic ›road novel‹. Being accidentally stranded on Tenerife, Gonzales tries to escape with the help of a flying engine drawn by a flock of tamed geese (fig. 4). Much to his surprise he finds himself not drawn to the coast of Spain, but the Moon.

11 | The French translation by Jean Baudoin excised first and foremost the narrative's sections on the Christian belief of the Lunarians. Cf. Godwin 1648.

12 | Godwin 1651.

13 | Godwin 1659. Due to the printer, the Nürnberg family Felßecker, the German translation was wrongly dedicated to Hans Jakob Christoffel von Grimmelshausen until 1924. The true translator is not yet identified; characteristics in style and wording indicate it might have been Balthasar Venator.

14 | I can only give an indirect and imprecise dating based on the French edition by Antoine De Heuqueville in 1731 that in turn refers to a Spanish edition. Unfortunately I haven't achieved to find a copy or the original of the first Spanish translation yet.

15 | For a detailed account on the publication history cf. Janssen 1981.

16 | Gonsales [alias Godwin] 1638, 1.

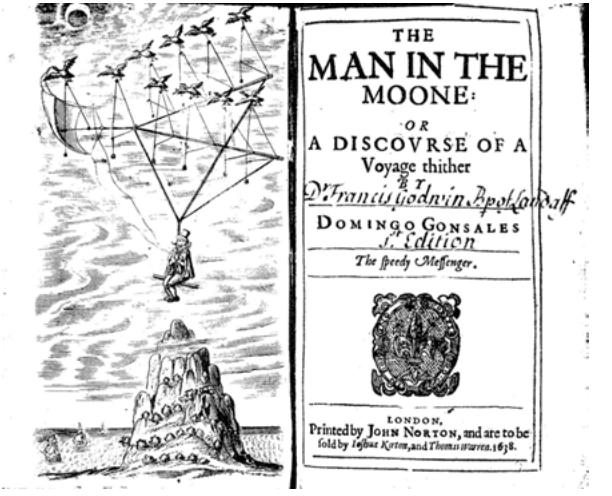

Fig. 4: Frontispiece of the first edition of Godwin's »Man in the Moone« (1638)

But much to his surprise he finds himself not drawn to the coast of Spain, but to the Moon. Because his escape from the island by chance coincides with the habit of his »gansas«[17] to hibernate on the Moon, he is carried into space involuntarily. During his unanticipated celestial journey, Gonzales witnesses a whole range of physical and astronomical phenomena related to a cosmic order that is unmistakably based on the writings of Johann Copernicus and Johannes Kepler, who are mentioned by name[18], as well as of Galileo Galilei, to whose *Sidereus Nuncius* Gonzales alludes several times.[19] While travelling through space he recalls their theories, which, of course, he knows by heart; thus substantiating by his own eyesight some of their most debated hypotheses such as the coldness of cosmic ether, the perpetual self-rotation of Earth, and the slanted position of its axis.[20] But having left orbit behind and looking down on Earth, Gonzales stunningly perceives the globe's cosmic shape and bright appearance from far above:

17 | Ibid., 36.

18 | Cf. Ibid., 53 and 60.

19 | Gonzales's novel furthermore includes aspects of William Gilbert's theory of magnetism and a pre-Cartesian concept of ether.

20 | Cf. Ibid., 53-56.

> Again, the earth (which ever I held in mine eye) did as it were mask it selfe with a kind of brightness like another Moone; and even as in the Moone we discerned certain spots or Clouds, as it were, so did I then in the Earth. […] I should at first see in the middle of the body of this new starre a spot like unto a Peare that had amorsell bitten out upon the one side; after certaine howers, I should see that spot slide away to the *East* side. This no doubt was the maine of *Afrike*./Then I should perceive a great shining brightness to occupy that room, during the like time (which was undoubtly none other then the great *Atlantick Ocean*). After that succeeded a spot almost of an Ovall form, even just such as we see *America* to have in our Mapps. Then another vast cleernesse representing the *West Ocean*; and a lastly a medly of spots, like the countries of the *East Indies*.[21]

With *Blue Marble*, Gonzales' description shares not only the qualities attributed to Earth's outer appearance (e.g. first and foremost its shining brightness of an even form occasionally covered with clouds and partly riddled with some patches of Earth rightfully identified as the continents), but it also shares the mode and spatial position of perception itself. Like Harrison Schmitt, Godwin's protagonist is situated some one thousand miles above the Earth's surface, looking straight down on the globe below him. And like him, he does not leave her out of sight – »(which ever I held in mine eye)« – knowing that by watching Earth from a point of view somewhere in the empty cosmic space between the Earth and the Moon for the first time, he is not only describing the appearance of a »new starre«, but he is responsible for its discovery, if not to say for its performative ›birth‹.

The exactness of his account as well as the emphatic description of the observation itself and its circumstances therefore give evidence to the truthfulness of the perception and unmask Gonzales as a narrator who is conscious of the imaginative power his cosmic picture will have on his readers. In doing so, labelling the Earth a *star* doubtlessly underlines the theorems of the *nova astronomia* which proclaimed the truth of Copernican order, including the equivalence of all celestial bodies moving directly around the sun. But labelling her a *new* star – a proposition that makes no sense whatsoever, given the fact that the Earth is not only the oldest celestial body, but also the most familiar to mankind – shows that he is well aware of his own narrative power; his visual evidence of the Earth's

21 | Ibid., 56f.

appearance and position in the modern Copernican space is based on the conviction that from now on she will never be seen in the same way.

Still, there is one obvious distinction between *Blue Marble* and Gonzales' ›new star‹ which has to do with the media differences between a photograph and a narrative. In contrast to *Blue Marble* (1972), the ›Blue Marble‹ (1638) moves, and it moves in a very distinctive way:

> So that it seemed unto me no other than a huge Mathematical Globe, leisurely turned before me, wherein successively, all the countries of our earthly world within the compasse of 24 howers were represented to my sight.[22]

If this were a quotation from a twentieth-century novel, one would classify it as a typical reference to cinematic narration; but being taken from a novel that was written almost 400 years ago, the appropriate media reference doubtlessly is not film but early modern cartography. The importance of cartography becomes even more obvious as Gonzales directly refers to his media precursors when he parallels his view with that of »our Mapps« and compares the celestial body of the Earth floating in space to that of a »huge Mathematical Globe«.

Depicting the Earth as Another Star

Early modern globes were the first media artefacts presenting a full view of Earth from a distant point of observation. With the invention of the refracting telescope by Hans Lipperhey between 1606 and 1608[23] and its use within the astronomical studies of Galileo Galilei in 1609[24], not only the cartographic knowledge incorporated in celestial globes improved, but in terrestrial ones as well. In seafaring, for instance, telescopes were used to scrutinize coastlines and other prominent geographical features such as solitary mountains or mountain ranges. The most sophisticated example in the early days of telescopic perception

22 | Ibid., 57f.

23 | Lipperheys assertion of creatorship was immediately challenged by similar assertions from his fellow Dutch spectacle-makers Adriaan Metius and Zacharias Janssen. For the 17th-century debate cf. Borel 1655 [1656].

24 | Cf. Mann 2000 and Schmitz 1982. For Galileis telescope(s) cf. Learner 1991.

is the elaborate cartographic oeuvre of Willem Janszoon Blaeu. Blaeu had studied with Tycho Brahe and worked as an astronomer before he became the official cartographer of the *Vereenigde Oostindische Compagnie* (VOC) in 1633, at that time the most prestigious cartographic position in the Netherlands. In cooperation with his son, Joan Blaeu, who would eventually succeed him to the post at the VOC in 1638, Willem Blaeu, who had bought several printing plates from the inheritance of Jodocus Hondius (who himself had been in the possession of the printing plates of Mercator), published the first edition of his famous *Atlas novus* in 1634. It later became known as the *Atlas Maior*[25]; its 1662 edition was the most expensive book printed in seventeenth-century Europe containing almost 600 maps and 3000 pages of descriptions.[26]

The intellectually and technically unparalleled maps of Willem Blaeu were superseded only by those of his son. In 1648, Joan Blaeu published the first world map that took Copernican astronomy into account, thereby replacing the map his father had drawn 43 years earlier. His *Nova et Accuratissima Terrarum Orbis Tabula* (fig. 5) depicted the celestial order in accordance to the heliocentric system of Copernicus. While the two hemispheres of Earth are displayed in the characteristic manner of an open book, thus paralleling once again the reading of *scriptura* with that of nature, the upper margin shows an allegorical system of the then known planets with Apollo sitting in the center and Mercury, Venus, Earth (accompanied by the Moon as a small cherubim figure in the gap between the two hemispheres), Jupiter, Mars, and Saturn devoutly turning around him. The figures of an astronomer and a geographer armed with their typical instruments, an armillary sphere and a circle for measuring the Earth, who are displayed at the far left and far right margin of the map, transform the engraving of Earth's surface into an elaborate demonstration of the whole cosmos, including the scientific techniques of its perception and construction.

25 | The first edition of the *Atlas* was published in 1634 in a very small number. It contained 60 maps, from which 37 were taken from Hondius. An augmented edition appeared in 1635 under the full title *Theatrum orbis terrarum, sive, Atlas novus*. For the history of early modern cosmographic knowledge cf. Vogel 2006.

26 | Joan and Willem Blaeu 1662. The *Atlas maior* was translated into French, Dutch, German and Spanish. Cf. the article on the Blaeu family in Kupčík 2011, 93-107.

Fig. 5: Joan Blaeu's Nova et Accuratissima Terrarum Orbis Tabula (1648; ED 1662)

In doing so, Joan Blaeu's cartographic (re)presentation of Earth is the first example of an early modern visualization that takes into account our planet's decenterd astronomical position in space. Nevertheless, it still remains a depiction not only taken from a point of view close to Earth's surface but one altogether uninterested in her cosmic appearance. The major difference to Godwin's description, even though his protagonist cites the importance of »our Mapps,« lies in this divergent ›Bildinteresse‹ (the image's intention) between a cartographer and a space traveler *avant la lettre*. Whereas Gonzales is fascinated by the Earth's appearance as a »new star,« that is to say as a celestial body among other celestial bodies within the universe, the ›Bildinteresse‹ of Blaeus *mappa mundi* focuses on the most accurate geographical (re)presentation of the Earth's constitution, primarily with the exact reproduction of its continents and islands. This was partly due to the buyers of his works, mostly wealthy Dutch trading merchants with a global perspective of the world that fit the global depiction in Blaeu's maps, and partly due to the entirely different impact of knowledge that separated those interested in geography from those interested in cosmography.

Until the early 17th century (re)presentation of the cosmic order had been strictly reduced to the Christianized version of Ptolemy's *Megalé Mathēmatikē Syntaxis*, better known as *Almagest*.[27] The cosmographic

27 | Probably the best example for a Christianized Ptolemaic astronomy of late 16th century is Apian 1574.

order of space began to change with the growing acceptance of Copernicus' and Kepler's astronomical theories in the course of the 17th century, thus giving way to a more accurate and elaborate depiction of the universe. In general, cosmography certainly owed more to the invention of the telescope than cartography, and as is undoubted, that the telescope enabled cartographers to see better what they could see already, in the realm of cosmography it created a whole new world to be observed, ordered, and displayed for the first time ever. It is therefore no wonder that from the mid-17th century onward celestial atlases and globes experienced a remarkable rise as mediators and illustrators of the new astronomical knowledge.

Andreas Cellarius' *Harmonia macrocosmica seu Atlas universalis et novus*[28] appeared in 1660 and is one the most famous cosmographies of the 17th century. It contained 350 pages as well as 29 extremely elaborately engraved and artfully colored double-page copperplates by Jan van Loon and was published by Jan Janszoon, who ran the leading Dutch (if not European) publishing house for cartographic imprints and globes. The celestial atlas is divided into three chapters: Chapter A depicts the main world systems beginning with Ptolemy and ending with Tycho Brahe including the first ten engravings; Chapter B presents the next ten engravings picturing the most important details of the astronomical order of the solar system beginning again with Ptolemy and ending with Tycho Brahe; Chapter C finally includes the last eight engravings and is dedicated to mostly Christian astrological constellations. Even though the Dutch atlases and globes printed by Janszoon and Blaeu set the technical standard and defined the aesthetic norms for the visual capturing of cosmic space in early modern Europe, cosmographies such as Cellarius' *Harmonia macrocosmica* were first and foremost targeted at a public that enjoyed gloating over the skillful engravings while adapting the well instructed explanations. The atlas was not intended for scientific use by professional astronomers. In fact, Cellarius' cosmography was not at all well received among the erudite astronomy of the day. Athana-

28 | Cellarius 1660. For further technical information see the commentary by Robert van Gent in his facsimile edition. (Cellarius 2006).

sius Kircher[29] and Christiaan Huygens[30] criticized the complete lack of astronomical calculation tables, further pointing out that the celestial maps were also less accurate even than those in Johann Bayer's *Uranometria* from 1603. In addition, Huygens observed that the astronomical knowledge distributed was in no way up to date, i.e. recently made discoveries such as Galileo Galilei's four Jupiter Moons from 1610, his own telescopic observation of the rings of Saturn and its Moon from 1655 and Johann Hevelius' cartography of the Moon's surface from 1647 just as the newest results in mathematical astronomy outlined by Johannes Kepler[31] were missing or only taken into account marginally.

Nevertheless, the last plates of Cellarius' cosmography are striking for the topic of this article. While the engravings in the first chapter present distinctly schematized views of different concepts of cosmic order and the rotation of the celestial bodies[32], and while the various stellar constellations of the second chapter are depicted in richly decorated figurative illustrations, the last engravings offer a different perspective. Here, Earth is displayed in a so-called orthographic observatory projection. Orthographic projections, or orthogonal projections as they are also called, project three-dimensional bodies onto a two-dimensional surface using a perspective that is similar to a photograph shot with a telephoto lens from very large distances – for instance, 45,000 km above Earth. The impact on the beholder of

29 | Despite his criticism, Kircher recommended the publication for the collection of the *Collegium Romanum* in a letter to the *Seminario Romano* on July 4th in 1660. In the same letter he also voted against the atlas being set on the *Index Librorum Prohibitorum*. Cf. Cellarius 2006.

30 | For Christiaan Huygens see his last publication dedicated to his brother Constantijn (Huygens 1698). Cf. also van Helden 1980 as well as articles based on the Nantes symposium on »The Jovian System after Galileo. The Saturnian System before Cassini-Huygens«. (Gautier [ed.] 1999/2000). For the general background on early modern astronomy cf. Donahue 2006.

31 | E.g., for aesthetic reasons the majority of the depicted planets' orbits is perfectly circular, which was wrong astronomically as Kepler had shown in 1609 in his *Astronomia Nova ΑΙΤΙΟΛΟΓΗΤΟΣ seu physica coelestis*, and not elliptical, which would have been correct, but aesthetically would have been less attractive.

32 | With the exception of plates #2 and #4 that combine a week orthographic projection with a schematized presentation.

the *Harmonia macrocosmica* is evident. After having become familiar with the pros and cons of the Ptolemaic, the Copernican, as well as the Tychonic cosmic systems in chapter one and an expert in the details of astronomic observation in chapter 2, the now well trained reader looks straight down onto Earth from a fixed point in cosmic space and through various stellar constellations that unfold below him in a richly ornamented pictorial manner. As seen exemplarily in plate 25, *Hemisphaerii borealis coeli et terrae sphaerica scenographia* (fig. 6), the etching's composition forces the viewer to penetrate the densely populated spherical circle of the universe until his/her eye reaches Earth's globe floating in a perfectly round space. Beneath the colored crowd of animals, mythological figures, astronomical instruments and other ›objects,‹ the viewer can detect Earth's northern hemisphere with the coastline of northern Africa turned towards the spectator. The multi-layered cosmic space that unfolds figuratively in the last five engravings of Cellarius' *Harmonia* comes close to the cosmic image of Earth outlined in Godwin's *Man in the Moone*.

Fig. 6: Andreas Cellarius Harmonia macrocosmica (1660). Plate 25: Hemisphaerii borealis coeli et terrae sphaerica scenographia.

But in contrast to Gonzales' literary autopsy, that excluded any encompassing description of space itself, Cellarius' depicts the universe as a limited three-dimensional sphere, which has the same clear contours and perfectly round shape as the body of Earth's globe it contains. At first glance, Cellarius' ostensible point of view therefore seems to be even

more artificial than the one incorporated by Gonzales, because it refers to a position that is not just situated somewhere above Earth, a position that was at that time clearly fictional in itself, but outside the whole universe; in other words, a position that can only be imagined as either godlike or non-evident.

The astronomical perception provided by orthographic projection threatens to undermine the scientific impact nevertheless intended by Cellarius and Janszoon, if it were not surrounded by equally skilfully designed margins. As soon as they are taken into account, the full complexity of the viewer's gaze set out in this engraving unveils, because it unmasks the alleged transcendental viewpoint as the result of two entirely incongruous perspectives conflated in a visual simultaneity. With regard to Earth's position, the point of the beholder's perception moves even farther away from the planet than that of Gonzales, while at the same time this view-point remains strictly terrestrial in regard to the stellar constellation. This simultaneous display of two different points of observation explains why we perceive Earth floating in space with the cosmos encompassing and protecting it like a celestial womb while, at the same time, the latter mirrors the astronomical gaze into the sky of the northern hemisphere – the same gaze of the group of astronomers who can be identified as the visual guides of the celestial order presented in this etching standing in the lower left and right corners of the margins. By means of astronomical observation working in tandem with astronomical imagination, the beholder of Cellarius' *Harmonia macrocosmica* is enabled to be on and above Earth at the same time. By doing so, the viewer simultaneously incorporates a fictitious and a factual viewpoint without any difference.

Narrating Earth Within Cosmic Order(s)

The view of Earth from outer space Godwin invented was gratefully adapted not only by the makers of early modern cosmographies, where it became the stepping stone for a new pictorial semiotic of space as Cellarius' example has illustrated. This view was even more appreciated in the realm of literature. One does not exaggerate in claiming that Gonzales' description of his voyage to the Moon marked the birth

of the new literary genre of early modern science-fiction[33], which increased remarkably beginning in the mid-17th century.[34] Besides auto-diegetic narration with the main character simultaneously serving as the protagonist, narrator, and author (and sometimes even editor), structural elements such as initial astronomical hypotheses waiting to be empirically proved, the extrapolation of scientific knowledge into new ›realities‹, the exact description of the preparation and execution of space explorations, and the detailed matter-of-fact portrayal of observed celestial phenomena have remained part of the generic narrative framework of science-fiction since that time.

The first evidence of a direct reception is found in Cyrano's *Les États et Empires de la Lune*, published posthumously in 1657.[35] The topos of Earth seen from outer space as it is outlined in the *Man in the Moone*, and the aesthetic and astronomical dimensions of which are still present in our popular cosmic imagination *Blue Marble*, is iterated in this first French early modern space travel. However in contrast to Gonzales Dyrcona, as the novel's auto-diegetic protagonist is called in an obvious anagram of Cyrano de Bergerac himself[36], he undertakes his journey to the

33 | A short, but complete overview on the discussion of when to date the beginning of SF and how to define its most prominent features is given by Roberts 2006. Godwin's impact on early modern SF is among others discussed by Nate 2001, 120-129.

34 | With Godwin's novel as starting point, a hundred years later there were already more than 100 outer space narrations published in England, France, and Germany. For the 18th century cf. Gove 1961.

35 | It was supposedly written in the late 1640s/early 1650s together with its second part, the twin novel *Les États et Empires du Soleil*. Both were published two years after Cyrano's death by his friend Henry Le Bret, who then became secretary of the archbishop of Montauban, later chief provost of the cathedral of Montauban. Le Bret generously ›altered‹ the original manuscript censoring sequences that were offending catholic doctrines such as the privileged position of the Earth and human mankind within God's creation. For the publication history of Cyrano's novels cf. Cyrano 2006, ci-cl. For further reading on Cyrano's philosophical thinking cf. Alcover 1970; Blanchot 1962; Darmon 2002 as well as Romanowski 1998.

36 | The name is first displayed at the beginning of the second novel *Les États et Empires du Soleil*. (Cyrano 2006b, 175).

Moon voluntarily. His first aim is to eyewitness the alleged astronomical equivalence of the Earth and Moon.[37] He succeeds by using a rocket-like flying engine for his trip into space, whereupon he then aims to prove that the sun is inhabited like the Earth and Moon. For this purpose, he undertakes a second journey enhancing the visual experience of the first, during which he had been too occupied mastering his flying engine to notice the details of the Earth's globe underneath him. Dyrcona doesn't realize the Earth's cosmic appearance until it is nothing more than »a huge golden plate«[38]. As an experienced traveler, he is not only able to reflect on the general challenges of space exploration, he also gives detailed evidence to his initial hypothesis of Earth's rotation and the Moon's alikeness. Dyrcona's second report seizes Gonzales' description of the Earth's appearance in many aspects even though Gonzales' noticeable aestheticization is substituted by a matter-of-fact description that privileges observational evidence to the astronomical hypothesis in question rather than to outline its aesthetic components. In Dyrcona's gaze Earth appears as an object of cosmographic devotion:

> I clearly saw, as I had anticipated earlier during my voyage to the moon, that it was in fact the Earth turning around the Sun from the West to the East, and not the Sun around her, because I saw France followed by the boot-like shape of Italy, hereupon the Mediterranean Sea, then Greece, further the Bosporus, the Black Sea, India, China and finally Japan passing in front of the little peephole of my lodge, and a few hours after my descend, when the Southern Sea had turned beneath me, the continent of America took his place.[39]

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37 | »Et moi, dis-je, je souhaites mêler mes enthousiasmes aux vôtres, je crois, sans m'amuser aux imaginations pointues dont vous chatouilles les temps pour faire marcher plus vite, que la lune est un monde comme celui-ci, à qui le nôtre sert de lune.« La compagnie me régala d'un grand éclat de rire. »Ainsi peut-être, leur dis-je, se moque-t-on maintenant dans la lune de quelques d'autre, qui souhaitent que ce gobe-ci est un monde.« (Cyrano 2006a, 6).

38 | »[…] une grande plaque d'or«. (Cyrano 2006a, 31).

39 | »Je connus très distinctement, comme autrefois j'avais soupçonné, en montant à la Lune, qu'en effet c'est la Terre qui tourne d'orient en occident à l'entour du Soleil, et non pas le Soleil autour d'elle; car je voyais, en suite de la France, le pied de la botte d'Italie, puis la mer Méditerranée, puis la Grèce, puis le Bosphore, le Pont-Euxin, la Perse, les Indes, la Chine, et enfin le Japon, passer

One of the peculiarities in the early modern relation between natural philosophy and literature is that they frequently exchanged their modes and tones of description. What reads like a matter-of-fact report in a narrative that is clearly marked as not being a disquisition on early modern astronomy, is paralleled and in a way complemented by poetic descriptions found in treatises of natural philosopher's like the previously mentioned Christiaan Huygens, who in 1655 discovered the first Moon of Saturn and rightly identified its nebula as rings.[40] Huygens' realm of observational, experimental, mechanical, and inventive activities expanded from the theory of probability to the measurement of time and from the perfectibility of lens' grinding to the question of extra-terrestrial life. His last treatise, the *Cosmotheoros*, appeared in 1698[41], three years after his death, and even by early modern standards, who are much more unstinting in regard to the intersection between science and literature, its two books are a hybrid disquisition that owes much to the poetic knowledge issued in early modern science-fiction. At times it prefers rhetorically enhanced narration over factual description, especially when it comes to astronomical questions such as the plurality of worlds.[42] Whereas Huygens in the first book outlined the former arguments for and against the existence of

successivement vis-à-vis du trou de ma loge ; et, quelques heures après mon élévation, toute la mer du Sud, ayant tourné, laissa mettre à sa place le continent de l'Amérique.« (Cyrano 2006b, 212f., my translation, HS).

40 | First mentioned in his correspondence with his Paris colleagues Ismael Boulliau and Gilles Personne de Roberval, Huygens published his complete observations including the corresponding mathematical calculus in 1659. Cf. Huygens 1659.

41 | Huygens 1698a. It was translated into English in 1698 and Dutch in 1699. Till mid-18th century, translations appeared in French (1702), German (1703), Russian (1717) and in Swedish (1774). The title of the English translation reads as follow: *Cosmotheoros. The celestial worlds discover'd: or, Conjectures concerning the inhabitants, plants and productions of the worlds in the planets.* Written in Latin by Christianus Huygens, and inscrib'd to his brother Constantine Huygens. London: printed for Timothy Childe at the white hart at the west-end of St. Paul's church-yard MDCXCVIII [1698] (Huygens 1698b).

42 | In regard to the much debated topic of the »pluralité des mondes« cf. Guthke 1983; Bezzola Lambert 2002 and Campbell 2004 (on Godwin and Cyrano see 151-180).

extra-terrestrial species, the second book is devoted to the different cosmic orders that arise when the point of observation varies within the order of the then known planets. To the inhabitants of Venus, for instance, »the things in the sky« appear in an almost identical shape and position than they do for the Mercurians, except that they never can see Mercury in opposition to the sun and the sun being one and a half times larger in diameter compared to its appearance seen from Earth.[43]

The perception from outer space does not stop but includes the sight of Earth seen by a conjectural intelligent species living on the Moon. In fact, the sheer beauty of Earth's appearance in space is one of Huygens's strongest arguments in favour of extra-terrestrial life, especially on the Moon:

> What then, shall this Ball [the Moon; HS] be made for, nothing but to give us a little puny light in the Night-time, or to raise our Tides in the Sea? Shall not we plant some People there that may have the great pleasure of seeing our Earth turn upon itself, presenting them some times with a prospect of *Europe* and *Africa*, and then of *Asia* and *America*; sometimes half, and sometimes full?[44]

In the 17th century the »great pleasure« in observing the Earth slowly revolving in the vast space of an unlimited universe was clearly restricted to adventurous literary space travelers or fictitious inhabitants of the Moon and other planets. Three hundred years later it has become a second-hand visual experience for everybody by looking at photographs like *Blue Marble* or watching documentaries like *Unsere Erde aus dem All*[45] and *Das*

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43 | »In Veneris globo politis, eadem fere in caelo apparere necesse est quae Mercurio diximus, nisi quod hunc nunquam Soli oppositum […]. Sol vero illis major apparet quam nobis, diametro sescupla, orbe plus quam duplo […].« (Huygens 1698a, 50). The English translation reads as follows: »The Inhabitants of *Venus* have much the same face of things as those in *Mercury*, only they never see him in opposition to the Sun […]. The Sun appears to them by half larger in his Diameter, and above twice in his Circumference […].« (Huygens 1698b, 108f.).

44 | Huygens 1698b, 108f. »Anne igitur credendum, tantae magnitudinis globum in hoc conditum esse ut noctu lucem tenuem largiatur, aut aestus maris cieat? Nemo erit qui pulcherrimo inde spectaculo fruatur Telluris nostrae in se revolutae, & nunc cum Europa Africam, nunc Asiam, nunc Americam ostentatis; nunc plene, nunc dimidio orbe lucentis?« (Huygens 1698a, 60f.).

45 | National Geographic 2015.

Universum[46]. Comparing our cosmic images of Earth with the narrations, descriptions, and engravings outlined in this paper, it becomes evident that the 17th century was not only an era that institutionalized modern science and leveraged Copernican astronomy, it was also the time that provided us with ›Erdsichten‹ whose impressive visual semiotics and powerful aesthetics still echo in our contemporary visual notion of Earth in outer space.

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46 | Discovery Channel 2015.

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»earth's slow turning into the dark«

Global Networks of Decay in W.G. Sebalds *The Rings of Saturn*

Nicolas Pethes

What is the role that literary fiction plays when it comes to imagining earth and concepts of global wholeness? One might think that in an age of advanced media technologies and scientific theories, in the age of Google Earth and Ecocriticism, narrative prose no longer provides a relevant perspective of our home planet. The rise of geodesy in the course of the 18th century established scientific methods to measure planet Earth[1], and perhaps it is not by coincidence that literary fiction switched from holistic representations of the external world and the adventurous perils it provided to the internal psychology of fictional characters during the same time.[2] But until then, narrative literature had strongly contributed to what was known as ›the world‹ at a given time; and the age of colonialism produced a vast archive of travel literature: more or less empirical reports such as Georg Forster's *Voyage Around the World* that he conducted with James Cook and published in 1777, but epic fiction from Homer's *Odyssee* to Jules Verne's *Travel Around the World in 80 Days* also created physical as well as mental maps of the known world by circumtraveling its boundaries and linking geographical places with individual biographies of the travelers on the one hand and the topology of newly discovered cultures on the other.[3]

In these texts, one might say that the complexity of the world is reduced by temporalization, individualization, and localization. The im-

1 | Cf. Karnath/Sharrer 2008, 125, as well as Daniel Kehlmann's popular novel *Measuring the World* 2007.

2 | Cf. Watt 2001.

3 | Cf. Speake (ed.) 2003.

possibility of an external viewpoint on the world's totality is compensated by a step-by-step exploration of the traveling subject. And yet the unity of the world's complex structure is maintained within the travel's teleological setting, i.e. the fact that the traveling protagonists from Ulysses to Phileas Fogg return home in the end and thus close the circle.

But can contemporary literature still claim the stability of these geographical and hermeneutical circles when it attempts to imagine earth as a whole? Considering that avant-garde and postmodern aesthetics emphasize the fragmentary, subjective, and hybrid natures of the artwork as well as of the recipient, the answer will have to be negative. Therefore, my initial question has to be rephrased slightly: what kinds of representation of our home planet result from descriptions in literature that question narrative constructions of wholeness and totality?

The example I am going to use to tackle these questions is W.G. Sebald's semi-autobiographical novel *Die Ringe des Saturn* (*The Rings of Saturn*), published in 1995 with the subtitle *Eine englische Wallfahrt* (*An English Pilgrimage*). Thus, Sebald quotes the tradition of travel reports but at the same time dramatically reduces the scope and significance of the genre insofar as *The Rings of Saturn* takes the narrator on a walk along the coast of Norfolk and Suffolk.[4] This setting is unspectacular, to say the least. The walk is slow, the narrator who recovers from depression is weary and contemplative, the fog rises from the ocean, and there are hardly any sights or landmarks along the way. And yet, as I will try to elaborate, it is precisely this atmosphere of contemplation and banality – a prosaicness of both the landscape and the text, as it were – that serves as groundwork for the conception of the world as a whole in Sebald's text.

In order to reconstruct this concept, I will start with a quote from chapter four, in which the narrator spends an evening at the coast and refers to a specific constellation between the dawn's growing darkness and his perception of planet earth:

> As I sat there that evening in Southwold overlooking the German Ocean, I sensed quite clearly the earth's slow turning into the dark. The huntsmen are up in America, writes Thomas Browne in *The Garden of Cyrus*, and they are already past their

4 | For the route, cf. Schütte 2011, 126-175, and Christian Wirth's cartographic and photographic illustrations: www.wgsebald.de/wege/ringe.html. See also Patt (ed.) 2007, as well as Grant Gee's film *Patience (After Sebald).*

first sleep in Persia. The shadow of night is drawn like a black veil across the earth, and since almost all creatures, from one meridian to the next, lie down after the sun has set, so, he continues, one might, in following the setting sun, see on our globe nothing but prone bodies, row upon row, as if levelled by the scythe of Saturn – an endless graveyard for a humanity struck by falling sickness. I gazed farther and farther out to sea, to where the darkness was thickest and where there extended a cloudbank of the most curious shape, which I could barely make out any longer, the rearward view, I presume, of the storm that had broken over Southwold in the late afternoon.[5]

Although *The Rings of Saturn* seems to be reduced to an insignificant portion of northeastern England, the narrator does extend this limited view to a globalized vision of planet Earth. This extension refers to space and time: although he cannot see the opposite shore, he knows that on the other side of the ocean lies Germany, his home country and England's enemy in World War II – the war during which planes took off from airfields in Norfolk to fly to Germany across the very coastline the narrator walks along. Parallel to this manmade catastrophe, he reads the shape of the clouds as remainders of a storm earlier in the day which – on a smaller scale when compared to war – alludes to destruction, too.

In this way the ›darkness‹ of the vision is not only due to the setting sun but also to the catastrophic dimension of nature (the storm) and history (World War II). This metaphorical dimension corresponds with the allegorical vision of earth viewed from an outside perspective that the narrator takes from Thomas Browne's essay *The Garden of Cyrus* from 1658. Browne's account of the time difference between Native Americans, English scientists, and inhabitants of Persia might be one of the earliest examples of an attempt to imagine earth as a configuration of global time zones.[6]

Sebald's narrator, of course, is rather interested in the image of the wandering shadow that covers the hemisphere averted from the sun as the world turns. Imagining earth presupposes an extraterrestrial observer here who is not restricted to his relative viewpoint in America, Persia, or

5 | Sebald 1998, 78f. All page numbers after quotes in the following refer to this edition.

6 | For similar examples from Early Modern Science Fiction, cf. Hania Siebenpfeiffer's contribution to this volume.

along the Norfolk coast, for that matter. This extraterrestrial observer does indeed have a total image of »our globe«. But this total image is not one of colorful beauty, but rather one of permanent darkening: to see »our globe« in its entirety means to perceive of the wandering shadow that darkens the earth and rules human life. Before the invention of electric light humanity would lay down at sunset, so that the image of »our globe« as permanent darkening corresponds with the vision of a ›reclining‹ mankind: as in the case of domino stones, the outside observer who follows the wandering shadow sees humans only in the state of recumbence – and therefore, insofar as sleep is a brother to death, in a deadlike state, struck by falling sickness and creating the image of a permanent graveyard.

The price for a holistic vision of the globe, in other words, is the death of earth's inhabitants. Taking into account the metaphor »scythe of Saturn« that refers to the god as well as the planet of melancholy that the title of Sebald's book recalls from the beginning[7], one might consider the vision of the globe as a graveyard as part of a baroque topos of *vanitas* and transitoriness – in the sense that Walter Benjamin pointed to the significance of saturnic melancholy within the ruinous world of seventeenth-century German tragedies.[8] And indeed, Thomas Browne, whom Sebald allegedly quotes here, was a natural philosopher in the 17th century who lived as a medical practitioner in Norwich from 1636 to 1682.

Thus, Sebald's reference to Browne is not accidental but located within the geographical region of his walk that starts and ends in Norwich where Sebald himself lived and taught at the University of East Anglia from 1970 to his death in 2001. Thus, *The Rings of Saturn* explores the relevance of Browne's metaphysical reflections for the narrators perception of Norfolk through the entire book, and Sebald subsequently refers to Browne's collection of essays entitled *Hydriotaphia, or: Urn-Burial* and *Garden of Cyrus* from 1658. Interestingly, however, upon looking into the latter, one only finds the first part of the quote cited above. The last chapter of Browne's *Garden of Cyrus* closes with the observation:

7 | Cf. Klibansky et al. (ed.) 1968.

8 | Cf. Benjamin [1928] and [1929]. Sebald's interest in the theory and iconography of melancholy as well as in Benjamin's theory of history has been analyzed intensively: Cf. the editors' contributions in Niehaus/Öhlschläger (ed.) 2006, as well as Barzilai 2007, 73-89; Mosbach 2008, 122-156; Schmucker 2012, 240-354.

The huntsmen are up in America, and they are already past their first sleep in Persia. But who can be drowsy at that hour which freed us from everlasting sleep? or have slumbering thoughts at that time, when sleep itself must end, and as some conjecture all shall awake again?[9]

Significant as this quote might be, Browne does not »continue«, as Sebald continues in *The Rings of Saturn*, with the vision of a ›falling‹ humanity following the shadow of darkness. But indeed Browne, in other parts of his work, provides extensive material for Sebald's interest in the earth's turning into the darkness. As we read in *The Rings of Saturn*:

Much as in this continuous process of consuming and being consumed, nothing endures, in Thomas Browne's view. On every new thing lies already the shadow of annihilation. For the history of every individual, of every social order, indeed of the whole world, does not describe an ever-widening, more and more wonderful arc, but rather follows a course which, once the meridian is reached, leads without fail into the dark. (23f.)

The reason for this destructive essence of nature in general is that, according to Browne, the entire world is structured by one single and recurring pattern, the

quincunx, which is composed by using the corners of a regular quadrilateral and the point at which its diagonals intersect. Browne identifies this structure everywhere, in animate and inanimate matter: in certain crystalline forms, in starfish and sea urchins, in the vertebrae of mammals and the backbones of birds and fish […]; and in the creations of mankind, in the pyramids of Egypt and the mausoleum of Augustus as in the garden of King Solomon, which was planted with mathematical precision with pomegranate trees and white lilies. Examples might be multiplied without end, says Browne, and one might demonstrate *ad infinitum* the elegant geometrical designs of Nature; however – thus, with a fine turn of phrase and image he concludes his treatise – the constellation of Hyades, the Quincunx of Heaven, is already sinking beneath the horizon, and so 'tis time to close the five ports of knowledge. (19ff.)

9 | Browne 1852, 489-563, quoted from 563. The quincunx-pattern that Sebald reprints in *The Rings of Saturn* (p. 20) can be found on page 490. On the influence of the quincunx on the narrative structure of Sebald's text, cf. Horstkotte 2005, 25-44, esp. 33.

To put it somewhat simpler, in Browne's view everything is connected, but the element that establishes this connection is the universal destructibility of all things. Thus, the world is the unity of the opposition of structure and dissolution: Everything is structured according to the quincunx, but the quincunx itself is already in decline.

That is why the only way to perceive of the wholeness of the earth is through the process of darkening as well as the image of mankind as falling. But as I want to argue here, the constellation of universal pattern and universal dissolution is also the structure of Sebald's travel report that, by its own means, attempts to create a different view of the world. Instead of searching for geographical and historical elements that account for the significance of ›the world‹, Sebald chooses the opposite method: starting out from an insignificant point, he reconstructs the network of references that nevertheless connects this insignificant point with the geographical and historical entirety of the world. This results, of course, in an entirety that exists beneath the sign of destruction and darkness. The walk along the English coast represents the quincunx of modern history.

Thus, *The Rings of Saturn* stage the quincunx as a geo-historiographical network: due to its interconnectedness, one might start at any given point in space or time to reach any other. At the beginning of chapter six, e.g., the narrator crosses the river Blyth, a passage that seems unspectacular and insignificant in itself. But the narrator remarks:

> The bridge over the Blyth was built in 1875 for a narrow-gauge railway that linked Halesworth and Southwold. According to local historians, the train that ran on it had originally been built for the Emperor of China. (138)

Thus, the Norfolk province suddenly turns out to be global. Though the train was never actually delivered to China, it still establishes a connection between northeastern England and the Chinese Empire – an empire that displays an intense tendency towards destruction, as the narrator recollects with regard to the siege of Nanking and the mass suicide of its inhabitants in 1864, fostered by the British East India Company. Both the eastern empire and its western colonizers display immense cruelty that results in the annihilation of Chinese culture. On the one hand we learn:

> The mass suicide of the Taipingis is without historical parallel. When their enemies broke through the gates on the morning of the 19th of July, they found not a soul alive.

But the city was filled with the humming of flies. The King of the Celestial Realm of Eternal Peace, according to a despatch sent to Peking, lay face-down in a gutter. (141)

On the other hand, the reign of terror of the emperor's widow a decade later is reported:

Travellers who were in China between 1876 and 1879 report that, in the drought that had continued for years, whole provinces gave the impression of expiring under prisons of glass. Between seven and twenty million people – no precise estimates have ever been calculated – are said to have died of starvation and exhaustion. (150)

The murderous destruction that connects Britain and China thus goes both ways. On the one hand, there is colonial invasion of the East India Company; on the other hand there is a decadent monarchy that prefers to feed its silk worms than its human subjects:

These pale, almost transparent creatures, which would presently give their lives for the fine thread they were spinning, she saw as her true loyal followers. (151)

Moreover, this decadent status of the silk industry has a feedback effect on the colonizers insofar silk worms have been imported to Europe ever since modern times – and in England especially to Norfolk, with Norwich being the silk capital of England and Thomas Browne the son of a breeder of silk worms in the 17th century. Random as they seemed at first glance, the dots of the narrator's seemingly free-floating associations start to connect like the pattern of a quincunx – or the texture of a silk worm's web.

Thus, reading *The Rings of Saturn* means to follow the many threads that connect the Norfolk coast with global history. But by following these threads it becomes clear that the aspect that connects this global reference network is the ubiquitous tendency of destruction of mankind throughout history as well as in the evolution of nature. Dunwich, another center of the English silk production that the narrator passes on its way south, is a town that in the meantime »has gone under, quite literally, and is now below the sea, beneath alluvial sand and gravel, over an area of two or three square miles«, so that for a long time the shafts of what once were the city's wells rose »like the chimney stacks of some subterranean smithy, as various chroniclers report, until in due course these symbols of the vanished town also fell down.« (155f.)

A little further down the coast, among the ruins of the former military station of Orford Ness, the narrator imagines himself »amidst the remains of our own civilization after its extinction in some future catastrophe.« (237) And earlier on, shortly before his vision of the earth turning into the darkness in the bay of Southwold, he recalls the horrible destruction during England's battle against the Dutch fleet in 1672 at the same place:

> The agony that was endured and the enormity of the havoc wrought defeat our powers of comprehension, just as we cannot conceive the vastness of the effort that must have been required – from felling and preparing the timber, mining and smelting the ore, and forging the iron, to weaving and sewing the sailcloth – to build and equip vessels that were almost all predestined for destruction. (78)

That is to say every human effort to construct aims at destruction. This observation is not reduced to seventeenth-century ship-building. It is part of the colonial history of imperial Europe, present at the English coast, beside the train for China, due to Joseph Conrad's landing in Lowestoft in 1878 – a voyage that preceded Conrad's subsequent travels to the Belgian colonies in central Africa and into what he later labeled the *Heart of Darkness*. And it is most evidently visible through World War II that the narrator evokes by referring to the airfields of Norwich that served as a basis for the Royal Air Force in the bombing of Germany. Based on an article from an officer who was part of the liberation of the concentration camp at Bergen-Belsen and who now lives in Suffolk that Sebald retrieves from a local newspaper and reproduces in the text (63), the scenery is also connected to the Holocaust – a connection that is underlined by the notorious montage of two photographs in chapter three, the first of which shows heaps of dead herring to document the cruelty of fishery in the North Sea (54), whereas the second shows bodies in the birch groves of Bergen-Belsen (60f.), thus subsuming both pictures to general human history and the economy of mass murder.[10]

Along these lines, the narrator finally links the Norfolk silkworm-industry with his recollections of an educational film on herring fishing produced in a series of educational films from the late 1930s that he watched in elementary school.[11] This series also contained a documen-

10 | Cf. Öhlschläger 2006, 187.

11 | Cf. Friedrichsmeyer 2007, 11-26.

tary on the silkworm industry. Upon looking it up while visiting Germany, the narrator finds an accompanying pamphlet that connects silk production with German preparations for war:

> According to Professor Lange, the author of the educational pamphlet F213/1939, the significance of silk cultivation in Germany lay not only in obviating the need to buy from abroad, and so easing the pressure on foreign currency reserves, but also in the importance silk would have in the dawning area of aerial warfare and hence in the formation of a self-sufficient economy of national defense. (293)

Thus, the seemingly harmless economy of silk cultivation is infected by its relation to imperial cruelties, the suffering of laborers in nineteenth-century factories the narrator recalled somewhat earlier, and modern militarism that exploits both humans and animals for its destructive ends. It is therefore no accident that *The Rings of Saturn* quotes the term »holocaust« (25) from Thomas Browne's writings very early in the book. And in consequence to the literal meaning of the term holocaust, in another passage that again envisions an external perspective on planet earth, it appears as a place of permanent consumption by fire ever since the first human civilization was established by the clearing away of primeval forests.[12]

> In Norfolk and Suffolk, it was chiefly oaks and elms that grew on the flatlands, spreading in unbroken waves across the gently undulating country right down to the coast. This phase of evolution was halted when the first settlers burnt off the forests along those drier stretches of the eastern coast where the light soil could be tilled. Just as the woods had once colonized the earth in irregular patterns, gradually growing together, so ever more extensive fields of ash and cinders now ate their way into that grean-leafed world in a similarly haphazard fashion. If today one flies over the Amazon basin or over Borneo and sees the mountainous palls of smok[e] hanging, seemingly motionless, over the forest canopy, which from above resembles a mere patch of moss, then perhaps one can imagine what those fires, which sometimes burned on for months, would leave in their wake. Whatever was spared by the flames in prehistoric Europe was later felled for construction and ship-building, and to make the charcoal which the smelting of iron required in vast quantities. […] Our spread over the earth was fuelled by reducing higher species

12 | Cf. Harrison 1993.

> of vegetation to charcoal, by incessantly burning whatever would burn. […] Combustion is the hidden principle behind every artefact we create. The making of a fish-hook, manufacture of a china-cup, or production of a television programme, all depend on the same process of combustion. [...] From the earliest times, human civilization has been no more than a strange luminescence growing more intense by the hour, of which no one can say when it will begin to wane and when it will fade away. For the time being, our cities still shine through the night, and the fires still spread. In Italy, France and Spain, in Hungary, Poland and Lithuania, in Canada and California, summer fires consume whole forests, not to mention the great conflagration in the tropics that is never extinguished. (169ff.)

The unifying principle of earth is its glowing demise. There is no positive principle of ›wholeness‹; rather, Sebald's travel report stages Thomas Browne's cosmological vision in contemporary terminology (and also by means of the airplane and technology) and thus establishes a constellation between pre- and postmodern worldviews that is similar to the one Walter Benjamin emphasizes in his aforementioned study on seventeenth-century German drama. Instead of anticipating or trusting the *grand récit* of progress from the 18th and 19th century, early and late modern literature coincides in their melancholic reflection of the loss of wholeness and transitoriness.

The reference to Benjamin is not only helpful for understanding the premodern poetics of a postmodern novel such as Sebald's *The Rings of Saturn* because as thesis VII of Benjamin's posthumous *On the Concept of History* claims: »There is no document of civilization which is not at the same time a document of barbarism.«[13] More importantly, Benjamin conceptualizes his theory of culture's permanent decay as a »movement from history to nature« in his earlier work.[14] *Origin of the German Tragic Drama* from 1925 introduces allegory as the key element of seventeenth-century literature because it implies the transitoriness of both natural life and cultural meaning. Opposed to symbolic art of the 18th and 19th century which presupposes the presence of meaning within the symbol, the fragmented and ruinous character that is typical for allegorical representation refers to the mortality of every natural being and cultural construction alike:

13 | Benjamin [1940], 389-400, quoted from 392.

14 | Benjamin [1928], 182.

And although such a thing lacks all ›symbolic‹ freedom of expression, all classical proportion, all humanity – nevertheless, this is the form in which man's subjection to nature is most obvious and it significantly gives rise not only to the enigmatic question of the nature of human existence as such, but also of the biographical historicity of the individual. This is the heart of the allegorical way of seeing, of the baroque, secular explanation of history as the Passion of the world; its importance resides solely in the stations of its decline. The greater the significance, the greater the subjection to death, because death digs most deeply the jagged line of demarcation between physical nature and significance. But if nature has always been subject to the power of death, it is also true that it has always been allegorical.[15]

From this point of view, neither artworks nor history partake in a teleological development, but are to be considered ongoing processes of dissolution, dying, and fading away. Closely following Benjamin's analysis, Theodor W. Adorno deduces in his essay on *The Idea of Natural History* from 1932:

The basic quality of the transience of the earthly signifies nothing but just such a relationship between nature and history: all being or everything existing is to be grasped as the interweaving of historical and natural being. As transience, all original-history is absolutely present. It is present in the form of signification. ›Signification‹ means that the elements of nature and history are not fused with each other; rather, they break apart and interweave at the same time in such a fashion that the natural appears as a sign for history and history, where it seems to be most historical, appears as a sign for nature.[16]

Adorno's observation that the attempt to distinguish nature and history along the lines of biological processes and cultural formations is no longer valid in the light of the destructive energies of modern civilization is especially helpful to understand Sebald's image of the world illuminated by continuous combustion. This image serves as an allegory for the destructive tendencies of human civilization that reverse the distinction and relation between nature and history. In the course of the 20th century, World War II is the most evident example for this reversion. In his lectures on the role of aerial warfare in German literature from 1999, Sebald quotes Solly Zuckerman, a British war correspondent

15 | Ibid., 166.

16 | Adorno 1984, 104-124, quoted from 121.

who had planned an essay on *The Natural History of Destruction* after witnessing the bombings of German cities in 1945. Musing about this unwritten essay, Sebald defines »natural history of destruction« as the reverse process of human civilization, i.e. the takeover of nature in shape of creaturely life – similar to the humming flies over the human bodies in *The Rings of Saturn* when recalling »the mass-suicide of the Taipingis«, but explicitly implying counter-civilizing tendencies in the context of modern warfare:

> Apart from the distraught behavior of the people themselves, the most striking change in the natural order of the cities during the weeks after a devastating raid was undoubtedly the sudden and alarming increase in the parasitical creatures thriving on the unburied bodies. […] This is the necropolis of a foreign, mysterious people, torn from its civil existence and its history, thrown back to the evolutionary stage of nomadic gatherers.[17]

The regression of humans and the rule of lower animals are accompanied by the regrowth of plants and trees in Sebald's vision – the very features that were once extinguished in favor of settlements and artifacts and that now seem favored by the fiercest of all fires of human history:

> At the end of the war, some of the bomb sites of Cologne had already been transformed by the dense green vegetation growing over them [...]. In contrast to the effect of the catastrophes insidiously creeping up on us today, nature's ability to regenerate did not seem to have been impaired by the firestorms. In fact, many trees and bushes, particularly chestnuts and lilacs, had a second flowering in Hamburg in the autumn of 1943, a few months after the great fire. If the Morgenthau-Plan had ever been implemented, how long would it have taken for woodland to cover the mountains of ruins all over the country?[18]

In this vision, the concept of history as a process of natural decay is intensified by its dialectical counterpart, the replacement of human civilization by the exuberant growth of organic nature. It is a vision familiar also from fictional movies like *I am Legend* (USA 2007) that presents actor Will Smith in the jungle that grows back on Times Square after

17 | Sebald 2004, 34 and 36.

18 | Ibid., 39. Cf. Pethes 2009, 169-187.

New York has been abandoned by humanity due to a virus. And popular science journalist Alan Weisman dedicated an entire book as well as a TV series to similar thought experiments about *The World Without Us* – a study that explores scenarios of nature's reaction to the supposed end of humanity:

> [T]hings will begin to fall apart during the first month of March after humans vacate Manhattan. […] As pavement separates, weeds like mustard, shamrock and goosegrass blow in from Central Park and work their way down the new cracks, which widen further. In the current world, before they get too far, city maintenance usually shows up, kills the weeds, and fills the fissures. But in the post-people world, there's no one left to continually patch New York.[19]

Whether this is a realistic scenario or not, what connects Benjamin's and Adorno's concept of natural history with Sebald's and Weisman's imaginations of the comeback of nature is the fact that they all introduce a specific narrative of decay in order to present a holistic image of the earth that is freed from the myth of progression. In all four scenarios, the unity of the world is represented by the omnipresence of its destruction.

What makes Sebald's contribution so remarkable within this discourse on destructibility is the way *The Rings of Saturn* highlights the dialectical structure of the process in question: Human history is not simply overcome by the forces of nature, nor is it subdued to some fateful revenge of the forces it exploited and fought for so long. Rather, the forces of human civilization themselves – mainly military and industrial – keep fueling the fire that, on the one hand, burns away the forests and plants and is to be accounted for the exploitation of silkworms, the heaps of dead herring, and the enslavement of humans.

But on the other hand, the fire of civilization not only burns away nature as its counterpart but in doing so also destroys itself. The history of human civilization is a self-destructive process that by the very means that replace nature creates space for nature's regrowth. The illumination of planet earth that makes it visible from space results in the famous photograph of the ›Blue Marble‹ from the Apollo 17 mission on account of the same fires and technological devices that also account for our home planet's »slow turning into the dark«, insofar everything that

19 | Weisman 2007, 30f.

humanity builds rests upon and leads to exploitation and destruction. As a whole, earth is a dark place because of its history of illumination.

Therefore, the view that Thomas Browne's unnamed extraterrestrial visitor is presented when he approaches our home planet is the view of a planet continually turned into darkness by the very attempt of its inhabitants to enlighten it – by charcoal and reason.

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A Whole Earth Monument

Planetary Mediation in Dietmar Dath's *The Abolition of Species*

Solvejg Nitzke

> »I have discovered an iron law hidden in the chronicles: that it is very dangerous to sweep aside a way of life – even the Monotonous way of life – before you have made your peace with the idea that there is no point in missing this life once it is dead and gone.«[1]

Almost fifty years ago, the Whole Earth-photographs realized a perspective that up until that point necessarily remained fictional. Nevertheless, the replacement of the figurative projection in favor of a technologically achieved literal self-reflection of the Blue Planet and its inhabitants did everything but stop the production of artificial Earths. One of the most striking examples can be encountered at the end of Dietmar Dath's monumental science fiction novel *The Abolition of Species*. After a plot that spans roughly three millennia of post-human history, two descendants of originally terrestrial species follow the longing gaze of their exiled ancestors and travel (back) to Earth. What they encounter, although it looks like (a version of) Earth, is a thoroughly transformed object barred from evolution and, ultimately, the flow of time. Although it contains everything that ever existed on the planet in the form of physical memories, the expulsion of any being capable of language and the planet's exclusion from evolution respectively, can be read as a critique of the Whole Earth discourse. Dath's peculiar version, I will argue, is a monument to as well as an archive of the Whole Earth that offers a vision

1 | Dath 2013, 214.

of Earth as the artistic product of its inhabitants. Read in conjunction with Hans Blumenberg, who regards Earth as a (metabolic) product of its own life forms and humanity's »fate«[2] and Tobias Boes' understanding of Earth as a »medium for human inscription,«[3] Dath's monument becomes the ultimate Whole Earth.

Whether characterized as the god-like Apollonian gaze[4] of the cartographer or imagined as a look at Earth and its inhabitants through the foreign eyes of an alien visitor,[5] to view the planet in its entirety required a viewpoint that was everything but human. However fictional, scientific, and philosophical »premediations«[6] have built up to this moment for centuries.[7] This might explain at least part of the excitement still palpable today, and at the same time lessen the apparent surprise felt at the height of the space race, when the moon was reached: it was the gaze *back* that caught and, more importantly, held most of our attention. At the core of this defining moment in the history of »planetary mediation« (Boes) lies a story that allowed for the Whole Earth to become the driving force in a number of narratives. It goes something like this: When mankind finally was able to move away from its home planet, it came to realize that human beings would never be able to leave Earth behind. In other words, an advanced technological emancipation was required to reveal the (seemingly) basic truth that there is only one Earth and that human beings are but one species among many whose fate is intertwined with the apparently singular conditions on this and only this planet. Earth's *Totalgegenwart*[8] (absolute presence) revealed its preciousness as well as its precariousness to the astronaut who finally caught Earth in one gaze and thus acted as humanity's representative. It also revealed a complex relationship between the visibility of human beings (on Earth), their bounded-ness (to Earth), and their vision (of

2 | Blumenberg 1997, 433.

3 | Boes 2014, 158.

4 | Cf. Cosgrove 2001.

5 | Cf. Blumenberg 1997, 340f.

6 | Cf. Grusin 2010.

7 | Cf. Cosgrove 2001.

8 | Blumenberg 1997, 439.

Earth). While it took a human being in space[9] to finally deliver the first photographs of ›our home planet‹, the sense of immediacy associated with Whole Earth-images depends largely on the apparent absence of all human traces while suggesting to containing past and future of the human species, even holding the promise – or rather, imperative – for all human beings to act as part of this species.

In this paper, I aim to investigate the apparent paradoxes that are connected to the underlying narrative of the Whole Earth-image. Apart from its function in environmental, economic, and political discourses[10], I will argue that its role as a myth at the core of a network of narratives constitutes its importance. Reading the Whole Earth as a myth, that is as a semiological system which serves to naturalize something that is in fact an artifact[11], in conjunction with Hans Blumenberg's reflections of the Blue planet, allows for a careful analyses of the interest and ideologies which form the contexts of specific representation of ›our‹ planet as Whole Earth.

›Species Thinking‹ is, according to environmental scholars[12], inevitable when we are faced with the view of the Whole Earth in all its beauty and yet, the very same beings who are confronted with Earth's preciousness are those who threaten its existence. However, the image of the Blue Marble as an icon of environmentalism failed to stop the ongoing destruction of natural habitats and exploitation of natural resources. To the contrary, the forces it was hoped it would be stopped, or at least slow down courtesy of a planetary awareness[13], accelerated in an unprecedented manner. This observation alone serves to question the relationship between Whole Earth, Species Thinking, and the environmentalist mantra to ›Save the Planet.‹ German author Dietmar Dath's novel *The Abolition of Species* takes Species Thinking to a new level by designing a world after the end of human dominance. It is, however, not the emergence of new lifeforms beyond the biological restrictions

9 | And a whole host of professionals and experts working on the ground together to allow that one person the chance to snap a photo of the earth.

10 | Cf. Lazier 2011, 602-630.

11 | Cf. Barthes 1993 [1957], 111.

12 | Cf. Chakrabarty 2009, 197-222.

13 | For more on the problems of environmental awareness see Timothy Morton's article »Why Ecological Awareness is Loopy« in this volume.

of species, but the connection of all lifeforms to Earth and the different Earths they produce that distinguish this novel and promise insights into the significance of Whole Earth-imagery for the imagination of Earth. In the course of the novel, as I will show, *The Abolition of Species* makes Earth an archive of planetary mediation and, moreover, a monument to itself.

Whole Earth-Myth

Hans Blumenberg's term *Totalgegenwart* (absolute presence) captures the suddenness with which all perceptions of the planet seemed to change at once. According to Blumenberg, the concurrence of institutionalized *Umweltschutz* (environmental protection) and *Mondbezwingung* (the conquering of the Moon) is far from coincidental.[14] Instead, this concurrence testifies to the recognition that the assumption that human beings were able to leave anything behind by leaving their home planet proved impossible.[15] According to Blumenberg, to view the contrast, captured in the Earthrise image, between the barren moonscape and the vivid sight of Earth[16] that caused the sudden realization of its total or absolute presence as the only cause of the image's impact misses the point. Another cause, at least as important, is the sudden realization of the irrefutable bond between human beings and their home planet, Blumenberg claims, which becomes most apparent on the one hand in the poor visibility conditions on the Apollo mission's spacecraft and, on the other, the sight of the Earth itself. He points to the disruption of the view by the spaceship's wastewater which crystallized and clung to the vessel, thus hindering the astronauts from remaining focused on Earth – an experience well-known to everyone who has ever tried to escape

14 | Cf. Blumenberg 1997, 439.

15 | Cf. Ibid., 434-435.

16 | Boes 2014, 158: »Indeed, the very barrenness of the lunar surface in the foreground of this image raises chilling question about the exact vantage point from which it might become possible to regard humanity as a species rather than as a collection of different people. Could it be that the only logic that really unites us is the logic of mutually assured destruction?«

their own waste by moving away from it.[17] The emphasis on waste with regards to the spaceship suggests an environmentalist interpretation critical of technology, but it would be misleading to regard this example only as an allegory of human wastefulness. In this case, waste must be understood as a ›natural‹ byproduct essential to the world we live in and even more so to the way we are able to view the planet. Hence, Blumenberg attributes the beauty of Earth as seen from space »to the effect of the turbidity and opacity of its atmosphere«.[18] His concept asserts that the appeal of the Blue Marble is due to its atmosphere which, in turn, is in large part the metabolic product of the organisms (*Lebewesen*) populating its surface. The spaceship, thus, becomes a miniature Earth[19], surrounding itself with an atmosphere formed by the inevitable byproducts of life. Even more than the deserted moonscape, the effort and energy necessary to sustain the astronauts on their journey connect a sense of homesickness to the image of the Whole Earth, which appears splendid and vivid in comparison to the poor environment of the miniature system. Nevertheless, Blumenberg contests the idea that the new perspective on planet Earth made it palpable as humanity's finite home-world (*Weltheimat*); instead, he claims that this interpretation came as exaltation after the fact.[20] To the contrary, since no trace of human beings, their artifacts, waste, or desertification is visible at all, the image of the precious whole Earth was in no way a warning but a reassurance.[21] The very same perspective that lets »the entire planet seem suspended within the same horizon, suggesting an experiential fusion of all members of the human race, regardless of ethnicity, creed, nationality, or socio-economic status«[22], hides the transformations of

17 | Cf. Blumenberg 1997, 434.

18 | »Wirkung der Trübung und Undurchsichtigkeit ihrer Atmosphäre« (Ibid., 433).

19 | Cf. Ibid., 434.

20 | Cf. Ibid., 440: »Nur ist eines unzutreffend, was neuerdings auch gesagt worden ist: Der neue Blick auf die Erde habe sie als endliche Weltheimat des Menschen sehen lassen. Das ist einfach eine rückprojizierende Überdeutung. Im Gegenteil: Die Erde sah aus, als gäbe es den Menschen, seine Werke und seinen Unrat, seine Desertifikationen nicht! Keine Spur vom Menschen.«

21 | Ibid., 440.

22 | Boes 2014, 157.

the planetary environment due to human civilization and thus fatally appears as pristine ground for human expansion.[23]

Blumenberg's critique of Whole Earth-images and their optimistic interpretation has been picked up today by a wide range of scholars who focus on the medial conditions of the images.[24] While many contemporary depictions of the planet attempt to include human traces both in order to navigate the planet and make visible changes, »Whole Earth images fail to do justice to the force-like nature of the human species in the Anthropocene, because force, by its very definition, is a measure of change over time (in Newtonian physics, $F = m \Delta v \Delta t''$). The iconographic nature of Whole Earth photography, however, places it outside the temporal flow entirely«.[25] By stepping back far enough to make any trace of human activity invisible, while at the same time the position of the photographer is only possible because of the same attitude that enables technological progress[26] causes the bemoaned destruction of natural environments, the appeal of the Whole Earth-image depends, as mentioned above, on a startling paradox, more specifically on its concealment. Its ongoing success relies as much on what it shows as on what it hides. The Whole Earth, in effect, can be regarded in terms of Roland Barthes' *Mythologies*: it naturalizes a certain notion by veiling its artificial character thus potentially becoming a vessel for ideology.[27] The ›universal appeal‹ of the images, their »undeniable thusness«[28] is thus the result of the effectiveness of modern myth-making.

23 | Ibid: »Eine Reinheit des Kostbaren, als sei es lupenrein. Und damit auch ein noch unberührter und ungenutzter Boden für das fatal dazugedachte Wachstum. Es war eine Versicherung, was man sah, keine Warnung.«

24 | Cf. Heise 2008.

25 | Boes 2014, 162f.

26 | Blumenberg coins it »Verbrennungsbetriebsamkeit« which translates to »a frenzy of combustion« but also can be read as a, here slightly derogative, synonym for the diligence or industriousness to burn things.

27 | Cf. Barthes 1993 [1957].

28 | Boes 2014, 159.

Consequently, the »abolition of human horizons«[29] goes along with an obliteration of narrative[30] which becomes inevitable when the temporal dimension is abolished. In other words, Whole Earth-images have always already achieved the preservation of the depicted state by freezing it in the present moment and eradicating past and future. Instead, they become projection surfaces for all too different ideologies[31] and thus serve to obscure the very sense of urgency and need of protection that the images are meant to procure.

Earth-Making

The Whole Earth-images' mythical quality depends on their apparent independence from previous narratives. Set against the backdrop of utter blackness, the glowing blue planet, indeed, seems to be life's stronghold against nothingness. Yet while Earth might appear to be ›just there,‹ the Whole Earth-images never are. Their ubiquity masks the fact that they never come unmediated: be it when they were first published or in one of the countless contexts they come in, they are never free of a ›message‹. Hence, research on Whole Earth-images – as does this paper – often tries to answer what it is the images actually portray. While Benjamin Lazier studies Earth as an artifact[32] and Tobias Boes looks at Earth as a medium for human inscription[33], my suggestion to understand Earth as a myth in Barthes' terminology aims at once at emphasizing that the earth that is looked at is the Whole Earth as an already mediated object

29 | Ibid., 156.

30 | This is where I argue in opposition to Boes who claims: »And therein, of course, lies the universal appeal of the Whole Earth photographs. They do not depend on previously existing narratives, which are always tainted by cultural specificity, no matter how seemingly universal. They appeal to us instead by what the Medieval Scholastics would have called their quiddity, their undeniable thusness« (Boes 2014, 159). In fact, the images do depend on narratives but analogous to their technological character (Lazier 2011, 614) they also hide their narrative roots, thus appearing to be independent of traditions.

31 | Cf. Cosgrove 2001.

32 | Lazier 2011, 606.

33 | Boes 2014, 160f.

as well as that it refers to a narrative core at the center of a network of myths. Blumenberg's account of the photograph's beauty as an effect of the turbidity of Earth's atmosphere and the inevitable creation of miniature Earths out of everything a human being ›inhabits or traverses‹[34] can be extended to a (new) materialist approach. Denying the Cartesian distinction between nature and culture, Blumenberg's image acknowledges instead that both realms are interwoven. Earth consists of the layers of remnants human beings and other living beings produce, often as (unwanted) byproducts of their metabolisms. That is, Whole Earth's *Totalgegenwart* (absolute presence) (Blumenberg) or »total thusness« (Boes) are an effect of the visibility and invisibility of matter within the images.

Since the original photographs do not allow for ›zooming in‹,[35] the suggested totality of the perspective wipes out individual differences – much like one cannot focus on a beach and a single grain of sand at once. Aside from differing interpretations – united humanity as *one* species living on *one* planet that is to be protected in a communal effort[36] in contrast to Blumenberg's claim that Whole Earth-images might function as a quasi land-use plan – what the images seem to depict is a world of matter free of (inherent or traditional) meaning. Again, what can be read optimistically as a reunification of humankind and nature can also be understood as a reduction of »life to a set of mechanical, causal relationships.«[37] This reduction, Lazier argues (following Heidegger), goes along with the reduction of a second human horizon, the

> displacement of earth by the ›merely astronomical idea of a planet,‹ of *Erde* by *Erdball*. […] The view of Earth from space threatened both of these horizons for human being. If the view transformed earth into Earth, existential ground into planetary body, it did away with world by erasing evidence of artifice altogether.[38]

34 | Blumenberg 1997, 435.

35 | Cf. Heise 2008.

36 | Lazier 2011, 623: »The sight of an incomparably lonely living Earth, however, did produce a felt experience of a planet so eccentric, so exceptional, that it became the only thing worth attending to in the first place.«

37 | Ibid., 612.

38 | Ibid.

Heidegger's concern is based, Lazier argues, on Edmund Husserl's claim that »[n]otwithstanding our post-Copernican knowledge that the Earth revolves around the sun, […] our everyday experience is pre-Copernican through and through«.[39] Husserl's assumption and Heidegger's corresponding arguments adhere to and affirm a thoroughly anthropocentric world. Insisting on the distinction of earth/planet, world/globe, and globe/earth[40] is also insisting on the human as the center of everything. Hence, the abolishment of human horizons[41] does not coincide with an actual abolishment of meaning; rather, it enables the narratives generated from this perspective to gain a fundamental quality unknown to former imaginations of a global or planetary perspective.

In his writings, Blumenberg introduces a perspective[42] that allows for an opposing view without throwing out the philosophical tradition of planetary mediation. By continuing a tradition of thought experiments, here in reference to anthropologist André Leroi-Gourhan, he assumes the view-point of an extraterrestrial visitor with the perk that »space tourists« (*Weltalltouristen*)[43], apprehend the planet and its inhabitants not only at one given point in time, but at several. Following Leroi-Gourhan, Blumenberg claims that a being uninfluenced by the causal explanations that we are accustomed to would distinguish eighteenth-century humans from nineteenth-century humans much the same as he or she might a lion from a tiger or a wolf from a dog.[44] As Blumenberg himself claims, this is a profound (*tiefsinnig*) perspective since it assumes the process of evolution as the only common trait of all living beings and thus sees ›our‹ history as an exception, an abnormality (*Abnormität*) even, that is only relevant to our own species and thus not accessible to another, more advanced species.[45] »While everything in the

39 | Ibid, 611.

40 | Cf. Lazier 2011.

41 | Cf. also Boes 2014, 156.

42 | Cf. Lazier 2011.

43 | Blumenberg 1997, 340.

44 | Cf. Ibid, 341.

45 | »Er [der außerirdische Beobachter] würde die kulturellen Veränderungen am Menschen nur als biologische Evolutionsdifferenzen des Menschen selbst auffassen können. Das ist deshalb so tiefsinnig, weil es als Normalbefund aller Lebenserscheinungen den einzigen homogenen Vorgang der Entwicklung unterstellt,

universe, if at all, only evolves and differentiates, human beings have surrounded themselves with a world of culture with which they disguise themselves treacherously from any spectator«.[46] This second instant of *Verhüllung*, i.e. a veiling or disguising, is especially interesting since it connects to the layers of metabolic remnants that are, according to Blumenberg, responsible for the beautiful appearance of Earth seen from space. Just as the astronauts cannot escape the material byproducts of their existence, Earth keeps, he claims, every (by)product of metabolisms just as it has kept the fossils of every geological age.[47] Continuing this line of reasoning, culture as a ›substrate of the species‹ (*Gattungssubstrat*) adds to the material layers surrounding the planet and provides it with its exceptional appearance in the first place.

In this sense, the world-making capacity of human beings is, although it might seem exceptional from an anthropocentric perspective, emphatically equal to that of other human beings. Distinguishing between world and planet, globe and earth, nature and culture is no longer an operation that can be imagined as – if only theoretically – outside of natural and evolutionary processes. The modern myth of Whole Earth, thus, hides the fact, to borrow Bruno Latour's phrase, that we have never been modern, i.e. we have never ›left‹ the planet and have never been fully differentiated from the material foundations of our existence. At the same time Blumenberg's connection of the cultural and the natural puts human beings in a position that is far from being an object, or even a victim, of, evolution. The creation of miniature Earths, exemplified by the spaceship, not only refers to the inability to leave behind the conditions of the home-planet, but also the ability to influence and determine the face and very nature of the world human beings live in both epistemologically and materially.

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unsere ›Geschichte‹ hingegen als eine am Gattungssubstrat sich abspielende Abnormität vom Begreifen einer überlegenen Vernunft ausschließt.« (Ibid., 341).

46 | »Wo alles im Universum, sofern überhaupt, nur sich entwickelt und differenziert, hat der Mensch eine Kulturwelt um sich herum entwickelt, mit der er sich vor jedem Zuschauer trügerisch verhüllt.« (Ibid., 341, my translation, SN).

47 | Cf. Ibid., 344.

The Final Whole Earth

Dietmar Dath's novel *The Abolition of Species* offers many accounts of a world (almost) without humans. Beginning in a future circa five hundred years after the end of the ›Monotony,‹ the age of human dominance over the planet, the novel extends over three millennia and features at least three post-human lifeforms. By performing dimensional shifts in space, time, and the idea of species, and what constitutes a lifeform, *The Abolition of Species* comments on many aspects of current discourses on the relationship of humans and nature.

The novel's most prominent dimensional shift is to make non-human, in this case post-human, agents the center of attention. The ›Gente,‹ creatures who bear animal names and humanoid features, have assumed humanity's role as the dominant species on Earth. The territory that once has been known as Europe has developed into a fluctuating space of three cities which, although they resemble ›our‹ urban environments in certain aspects, fit the needs of this new era of dynamic and seemingly limitless transformation. The Gente – not quite animal, not quite human – exceed the Darwinian terms of species in that they have overcome the boundaries which determined biological life prior to their emergence. Some Gente even possess the wisdom to regard their civilization as occupying a transitional stage rather than, as is suggested, their predecessors who thought *homo sapiens* to be the climax of evolution (Dath 9). Nevertheless, the emergence of a non-biological or at least radically different life-form puts the Gente on the spot. The long postponed question of what to do with the remaining specimen of the human race has now been answered by the ›Ceramicans‹ who mate – or rather, merge – with the human race and gain enough power to force the Gente into exodus.

In the same manner the Gente transform themselves, they are able to actively and consciously transform their surroundings. In the novel's fictive world, climate change on Earth had been brought to a halt by planting vast grass lands.[48] The Gente's exodus first to the Moon and then to Mars and Venus respectively relies on their ability to terraform their environments, i.e. to produce miniature Earths, thus lending credence to Blumenberg's claim that we – in this case, every species that

48 | Cf. Dath 2013, 34.

originates on Earth – are not able to ever fully leave the planet behind. Hence, for centuries the descendants of the Gente invest all available energy to find a way back. However, the way back leads to a completely transformed Earth, a monument to the ›home‹ they left and, as I will argue, to the very idea of a »Whole Earth.«

Two representatives, chosen and trained for the task, go back to Earth in order to assess whether a return would be safe. Expecting everything but the paradise they encounter, they find that »the terror that had shattered the Gente, now itself [had] given up the ghost.«[49] Instead of devouring Earth's biomass in its entirety, as the Gente had predicted, the planet appears to be the lush and fertile garden of environmentalist fantasies. However, the children quickly realize that what they see is not at all ›natural‹ but the product of intentional and thorough curation. What they encounter is not nature but »a planetary ecotecture never before seen since the Monotony began – a present moment with no speaking creatures, no one that needs language. Plants, beasts that hunt and beasts that graze – your garden, if you like.«[50] This rendering of the planet characterizes it as the literal product of conscious, if automated, creation. Holding the planet in a singular present moment changes its nature in a profound way.[51]

Although living things – plants and beasts – still exist, life itself takes on an entirely different quality. Instead of a system that evolves as a whole and thus, despite constant change, forms a unity[52], the wholeness of this ultimately artificial nature is caused by the intervention of an albeit collective consciousness. Still, Dath's creation emphatically resists the introduction of a deity. The ›administers‹ of the estate – a program that is all that is left from the being who devoured the ›old Earth‹ – rath-

49 | Ibid., 370.

50 | Ibid., 374.

51 | »›…you've brought history to an end? The way we might seal an arc? Earth's reality has become…a curve in time that leads back to itself, the higher-dimensional equivalent of a Klein bottle in three dimensions or a Möbius strip in two?‹ ›The construction, the monument, is held together by Ceramican work. They're diffused…‹ ›…through all phases of development right up to the Singularity. In the Age of Gente, in the Monotony…and we're two Gente partials, so that means we're visitors for you. Guests, from outside, for your museum.‹« (Ibid., 372).

52 | See Bruce Clarke's article »Mediating Gaia« in this volume.

er act as an afterthought of the already extinct creature which last gave the planet its shape.

The Abolition of Species does not fully realize its title until this strange and still somehow familiar vision of planet Earth appears. While both Gente and Ceramicans might have achieved freedom from taxonomy, from genetic, phenotypic, and even biological boundaries, the earth that forms the scene of this monumental novel becomes itself a monument to the ideas staged throughout the text and, more importantly, to the history of planetary imagination. From biblical Eden to Google Earth, this Earth literally contains its entire history in a single moment, a single image. It can thus be read as the fictional realization of Blumenberg's Earth, which consists of layers of metabolic products of which human and, Dath's novel adds, non-human culture are a part. Earth's curators have turned the planet into an actual artifact that can no longer be altered by evolution, since there is no room for spontaneity or randomness. And still it contains everything that ever lived and breathed on the planet, every building ever built and every organism that ever existed. Nothing is left to chance and still its structure is so complex that it will take alien visitors almost an eternity to explore. It is a perfect arc, a narrative encyclopedia of life, albeit with no purpose. The cybernetic reincarnation of the biblical paradise resembles a *tableau vivant* in that it is fixed without being fixated.

According to Stefan Willer, Dath's »encyclopedic science fiction« should be read as a »speculative extension« of an emphatically realist and materialist way of thinking towards the future.[53] The scenarios provided in *The Abolition of Species* are thus the result of thought experiments that have subsequently been carried out – one of which is the realization of the Whole Earth-image. Just as the novel refuses to lend itself to a mere affirmative illustration of animal studies[54], it does not exhaust itself in a vision of Earth as a warning from the (imagined) future. Rather, like Blumenberg's writings suggest, it toys around with the idea of history as a biological characteristic of our species on the one hand and biological facts as cultural artifacts. Nonetheless as Dath has claimed in many other texts[55], he is not interested in literature that

53 | Willer 2013, 393.

54 | Cf. Ibid., 398.

55 | Cf. Ibid., 404-405.

has no claim on reality. With this in mind, Blumenberg's idea of Earth appearing beautiful to the human eye because of its (human) nature, i.e. because it consists of the byproducts of life, and Boes' idea of Earth as a medium for human inscription meet in this vision of Earth as a monument to Earth. And at the same time the Earth as a total artifact, the ultimate work of art, makes visions and the very notion of life impossible as it eliminates the future in favor of the past. In spite of this, the ending of Dath's novel continues its decidedly non-apocalyptic approach to endings (of species, civilizations, history, etc.) and, at the same time, refuses to deliver a straightforward message – environmentalist or otherwise. Thus, the novel's macroscopic perspective provides a way that is able to connect the dimensional characteristics of virtual Earths with original Whole Earth-images. In its claim to assemble a sense of time on an evolutionary scale and an absolute ›sense of planet‹,[56] *The Abolition of Species* acknowledges at once the mythical quality of the Whole Earth and brings forth narration as a qualified discipline to explore its nature both figuratively and literally. Utopian science fiction lays claim to a mode of thinking that is in no way the opposite of science fact. Dath embraces this notion without risking the freedom and artistic sense of pleasure that literature offers compared with non-fictional manners of representation. The happiness and freedom the novel's last protagonists experience while roaming the Earth-monument is matched by the sense of playfulness that the text retains despite the gravity and complexity of the concepts it plays through. At last, the refusal to attach a message to the Whole Earth, to defy the claims to total preservation as much as to total possession of natural environments, opens up space for the imagination of its guests and maybe its inhabitants, too.

In the distant future of *The Abolition of Species*, thinking about whether or not life on Earth as it is lived by human civilizations is the only desirable form loses its sting, mostly because there really is »no point in missing this life once it's dead and gone«.[57] It allows for a very intriguing thought experiment: to think of humanity not as »a plague of people« (Lovelock) that could destroy the planet but as too boring or monotonous to live up to its possibilities. While Dath in his other novels *Pulsarnacht* and *Feldeváye* plays out the fate of humans without Earth,

56 | Cf. Heise 2008.

57 | Dath 2013, 214.

in this scenario Earth obviously does not need the human species, or in fact any species, to survive. Instead, it opens the stage to exciting and creative ways of life that make way for new imaginations of Earth as well as re-imagining Earth as long as we can. At the end of the novel, the paradise that Earth becomes allows for something radically new: to not be part of something and still be part of everything because progress and history have been stopped and are nevertheless eternally inscribed into the planet's surface. Here, the planet has indeed become a myth – containing the physical and cultural inscription of its subjects and at the same time being the product of their lives and ideas. Despite his refusal of utopianism as a refuge, Dath ends his novel with a utopian vision – that freedom comes at the expense of progress and, ultimately, of evolution. Still, the expulsion of a future is not a dismissal of life but rather of growth and dominion as the (badly) hidden telos of modernity. *The Abolition of Species* offers its narrative vision of the final Whole Earth as an alternative to the ›total thusness‹ of all subsequent demands: »So it was done, and then lives began such as never had been lived before. *Shanti shanti shanti*.«[58]

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58 | Ibid., 382.

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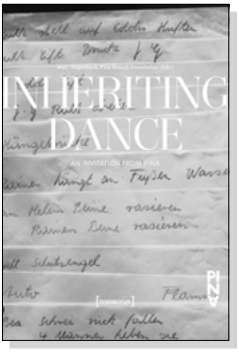

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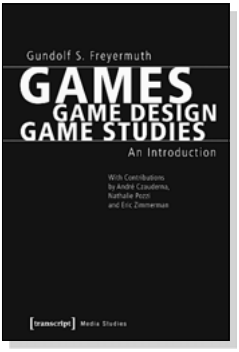

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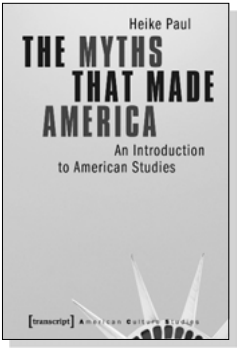

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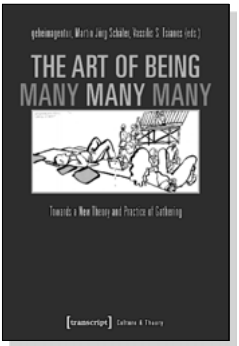

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