

Exhibition booklet edited by Anne Hemkendreis

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EXHIBITION BOOKLET

EDITED BY ANNE HEMKENDREIS

I N F I N I T Y

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PREFACE

Björn Voss

Cosmic infinity and vast expanses of emptiness are unthinkable to us humans. As a consequence, they are, in a way, forced into a scientific or philosophical framework and thereby seemingly structured – an act of intellectual appropriation of these intangible realms. In early cultures, this cognitive appropriation occurred by outer space as a macrocosm ordered into different spheres. Today, a (modern) worldview based on natural sciences has taken on this role: We now know that the current scientific worldview can uniquely claim to faithfully describe the physical universe.

In recent decades, the natural sciences have, for the first time in human history, revealed the extent and tangible dominance of infinity and emptiness within the processes and spaces of the cosmos. Our Milky Way – the »cosmic home« of the Sun and Earth, already comprising more than 100 billion suns and unimaginably vast expanses – was considered synonymous with the entirety of the universe just 100 years ago. Since then, the perceived and mapped vastness of the universe has multiplied by many billions. There is certainty that the true extent of the cosmos – beyond a horizon of the visible and measurable – is indeed infinite. Even more significant is realising the overwhelming emptiness on smaller scales within the universe: to our senses, the cosmos appears strewn with a fascinating diversity of celestial bodies such as stars and planets. However, these occupy only a vanishingly – small space compared to the surrounding vacuum.

Thus, it is not so much the apparent »vitality« of stars and their companions, but rather the elusive, infinitely extended emptiness that emerges as the dominant »leitmotif« of the cosmos. Our focus, however, is drawn to those »islands of order,« those »oases of vitality« in the universe that modern astronomical research reveals to us – stars and planetary systems, cosmic gas nebulae, all those often – vividly – depicted sites of the birth and death of stars, or even the mysterious black holes. Humanity tends – mostly unconsciously – to overlook how much all of this represents mere tiny crests on the vast ocean of infinite cosmic emptiness.

Planetariums around the world convey a mathematically- and physically – informed worldview while also demonstrating the role of planet Earth and humanity within it. In doing so, they invite us to engage with often overlooked aspects: the emptiness and infinity of the cosmos. The exhibition »Infinity, Emptiness, Liveliness« artistically illuminates the interplay of these three facets of our perception of the cosmos, offering a thought-provoking complement to the presentations in the star hall of the planetarium.

FASCINATION COSMOS.
BETWEEN ROMANTICISM AND COMMERCIALISATION

Anne Hemkendreis

A woman stands at the edge of a dark forest, her gaze lifted towards a starry night sky, her bright hair falling in gentle waves down her back. Her red dress, standing out brightly against the night sky, is held up at the hem, as if she is trying to catch the chain of stars that seem to be falling from the sky like a shooting star in a strikingly straight line. The firmament itself is subtly glowing, as if twilight has only just passed, or is about to arrive.

The image presents a certain temporal ambiguity, further enhanced by the fairy-tale quality of the scene. The artist, Swaantje Güntzel, who posed as the figure, barefoot and dressed in a knee-length gown, and photographer Andreas Zierhut, created a modern adaptation of the Grimm Brothers' fairy tale, »The Star Talers«. In this story, a poor and orphaned girl gradually gives away all of her possessions, even her last piece of clothing, to beggars. As she stands alone in the forest, homeless and destitute, stars begin to fall from the sky, transforming into golden coins. The child, now miraculously dressed in fine linen, gathers them up in her new gown. Wonder, wealth and the infinite starry sky are three central motifs in the Grimm Brothers' tale, which inspired Swaantje Güntzel during her Artist-in-Science residency at the European Space Agency (ESA/ESOC), where she researched the science and imagination of space.

At first glance, the »Sterntaler« photograph (2022) depicts a romantic image of a figure standing before an infinite landscape. The woman invites viewers to follow her longing gaze into the vastness of the universe. Upon closer inspection, however, the striking star formation falling towards the figure is revealed to be not a shooting star, but a string of lights from Elon Musk's satellites. Since 2015, Musk's company, Starlink, has been launching between 15 and 56 satellites at a time into Earth's orbit, often visible to the naked eye. By 2024, there were already around 6,000 Starlink satellites in orbit, despite space being considered a »common good«, i.e. a space that belongs to no nation.

Outer Space is generally perceived as an infinite, boundless, and ever-expanding realm. The exploration of the cosmos, which reached its first milestone in 1969 with Neil Armstrong becoming the first person to walk on the moon, is also intertwined with national implications and fantasies of conquest. Today, we are in a second phase of space exploration, increasingly driven by the economic interests of private companies and innovations in space technology, such as space shuttles and the James Webb Telescope. Questions about who owns space and the limits of human control are occupying researchers, politicians and artists alike. Like the »Star Talers« figure in Güntzel and Zierhut's photograph, humanity stands at a threshold where romantic fantasies mix with concrete national and commercial interests.

Recent headlines and reports from ESA suggest that the race into space has already begun. Robots land on Mars, the James Webb Telescope sends back images of Earth-like planets and research into galactic solar panels offer the possibility of capturing solar energy directly in space, potentially alleviating ecological crises on Earth. In 2019, former U.S. President Donald Trump made headlines with plans to establish moon mining operations to extract rare minerals. While crisis-oriented and profit-maximising strategies currently seem to be balanced, the economic sector appears to be embracing the attitude: »First come, first served.«

This development has its roots in the cultural history of space exploration, whose predecessors were heroic polar expeditions, specifically those to the North and South Poles at the beginning of the 20th century. As the last blank spots on the world map disappeared, people's longing gaze turned towards the stars. During the Cold War, astronauts and cosmonauts replaced polar explorers as modern-day heroes. The polar regions, like space, share many similarities. The long polar nights, for instance, make the poles ideal for studying the cosmos, with the world's largest land-based satellite station located on Svalbard. The extreme conditions of the poles also make them a testing ground for astronauts and their equipment. As the Arctic's ice melts due to climate change, revealing untapped resources and new trade routes, interest in the region is growing, much like the commercialisation of space.

Another cultural parallel can be drawn: Both the cosmos and the polar regions carry the promise of an experience of infinity and untouched wilderness. While the Antarctic has received special protection through international treaties to preserve its supposed pristine state, these romanticised notions have had violent consequences for life in the Arctic. The Arctic is the cultural and living space of Indigenous peoples. However, colonial notions of emptiness turned the Arctic into a stage for male acts of conquest, leading to its exploitation and destruction. This raises the question of the direction in which the exploration and commercialisation of space will move: will it lead to the protection of space as a shared good for all humanity, or to its primarily interest-driven exploitation? Already, Indigenous peoples are mourning the loss of cosmologically significant constellations due to Musk's Starlink project.

The artists in this exhibition explore the tensions between emptiness and vitality, as well as between romanticism and commercialisation, from various perspectives and through diverse media. Outer Space no longer appears as an unexplored territory without terrestrial parallels but rather as part of a cultural and intellectual history of humanity, one that has always tended to push boundaries. This is also reflected in the work »Below the Surface« (2024), created on the coast of Svalbard. During a joint residency in the Arctic as part of the Arctic Circle Residency, American photographer Blake Burton and German artist Anne Hemkendreis explored the persistence of heroic aesthetics in depictions of the Arctic. Burton's photograph »Svalbard 164«, featured in this exhibition, shows the Dutch three-masted ship »Antigua« trapped in ice, evoking both the failure of numerous historical

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polar expeditions due to encroaching pack ice and the first settlement of Svalbard by Dutch whalers. However, the ship's mast reflected in the water subtly suggests that beneath these dominant narratives of heroism and commercialisation lies another layer, hidden below the surface. The view of the Arctic as a stage for acts of conquest is replaced by an experience of the world beneath the ice, particularly when accompanied by sounds heard through headphones as part of the exhibition. During her journey aboard the »Antigua«, Anne Hemkendreis recorded sounds of ice and animals to offer another sensory experience of the Arctic's vitality. Visitors can hear the alien, often otherworldly sounds of singing bearded seals, ice floes shifting against one another, and melting glaciers.

At the heart of the exhibition »Infinity, Emptiness, Lifeliness«, supported by the Junge Akademie (the Berlin-Brandenburg Academy of Sciences and Humanities and the National Academy of Sciences – Leopoldina), and the Bodo-von-Borries Foundation, is an awareness of our own perception of regions like the Arctic and the cosmos, which are often imagined as limitless. The way we conceptualise these regions shapes how we engage with them. The artistic and scientific perspectives gathered in this exhibition provide numerous insights for critically examining the cultural and scientific history of space, drawing, among other things, on our relationship with the poles. Hosted at the Planetarium in Hamburg, founded in the first half of the 19th century, the exhibition invites visitors to engage with the imagination of emptiness and boundlessness, offering an experience of humanity's historically evolving and currently shifting relationship with space.



FIG. 1



FIG. 1, DETAIL

INFINITE VASTNESS – UNBOUND WORLDS. THE PLANETARIUM AS SPACE OF EXPERIENCE

Helen Ahner

Long before satellites provided a view of the Earth from space, and decades before the first human set foot on the Moon, the space age dawned in a new type of educational and recreational venue: the planetarium. Since the mid-1920s, numerous visitors enjoyed a spectacular view of the infinity of the universe under its dome. The »theatre of the stars« fuelled hopes that science and technology would soon enable the conquest of space, and inspired speculation about extraterrestrial futures. The moving 360° projection of the night sky simulated the changes of the stars with astonishing realism and conveyed astronomical knowledge. Moreover, the mechanised depiction of the galaxies was emotionally and morally charged, prompting people to reflect on the limits of human agency, the potential of science and the boundlessness of the universe.

In the summer of 1924, the first public planetarium shows took place on the roof of the Zeiss company in Jena.[1] In May 1925, the first permanent institution opened in the Deutsches Museum in Munich. Visitors were enthusiastic, and news of the technological starlit panorama spread quickly. By 1930, 20 planetariums had opened worldwide, 14 of them in Germany.[2] As early as 1925, the Hamburg Senate decided to invest in the costly acquisition of such a »heavenly machine« and to add another attraction to the city. The members were convinced, not least, by the plea of reform educator and school senator Karl Umlauf. In a letter, he described the advantages of the apparatus:

> »Through the planetarium, a source of noble intellectual stimulation, finest aesthetic enjoyment, and pure moral uplift is opened to mankind, one that is inclined to elevate him beyond the hustle and bustle of the day, to provide him with a sacred hour and to nourish his yearning for the great and eternal.«[3]

Umlauf, like many planetarium enthusiasts of his time, emphasised the experience of eternity, which he located in the planetarium, and to which he attributed moral value. In the planetarium, not only could the night sky be encountered in an especially impressive way, but one's own existence could also be probed in the face of cosmic infinity – a purifying experience that was particularly enlightening.

As the opening of the Hamburg Planetarium was repeatedly delayed due to difficulties in finding a suitable location, another impassioned plea appeared in the »Hamburger Nachrichten«, once again focusing on the emotional and spiritual dimensions of the institution:

> »An hour in the planetarium belongs to those truly enjoyable moments; one grasps the wonder of the starry world and feels moved to reverent awe before the majesty of the universe. Such exaltation is needed by us modern people in the hustle and bustle of everyday life. It is like a bath for the soul, and we instinctively think of Kant's words: 'In the realm of nature, worlds and star systems are nothing but cosmic dust when compared to the creation as a whole.'«[4]

The purifying »soul bath« described in this passage is directly linked to the experience of infinity, the re-contextualisation of one's own existence and the resulting realisation of one's own insignificance. Against the backdrop of the post-war era – where the losses of the First World War still shaped everyday life despite a gradual recovery – such a shift in perspective seemed helpful. In the eyes of some contemporaries, this transcendental function of the planetarium even surpassed its educational purpose:

> »Anyone who has ever attended a presentation in a planetarium will be less moved by its scientific aspect and more overwhelmed by the infinity of creation and its eternally incomprehensible mysteries.«[5]

The infinity and incomprehensibility suggested by the projected night sky, framed, measured and explained by the accompanying astronomical lectures, captivated planetarium audiences and, literally, »shivered« down their spines. The immersive presentation and intoxicating visual experience of the projected stars made the vastness of the universe sensibly and physically tangible. The unfathomable depths of space also promised many yet-undiscovered treasures, which, potentially, could be accessible to humans. After all, the development of the planetarium projector itself had seemed almost impossible just a few years earlier. Now that this impressive machine existed and produced a breathtaking sky, it held the prospect of further technological infiltration of the universe. This spirit of discovery extended to the deep sea, the Arctic and the Antarctic – regions that science and technology in the 1920s had made more accessible to humans than ever before, and which allowed room for escapist dreams and colonial fantasies.

For many contemporaries, the night sky, like the poles and the ocean floor, was considered a form of supposed wilderness, a vast nature that, when encountered, also carried a »purifying« effect. The self-perception of being modern and urban went hand in hand with criticism of the associated lifestyles, marked as »unnatural«. To recover from this, many sought refuge in a nature imagined as untouched. The planetarium promised to bring such an experience into the urban centres – a key reason why the decision for the location of the Hamburg Planetarium eventually settled on the water tower in the city park.

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FIG. 2

It was not until five years after the acquisition and much political wrangling that the planetarium opened in April 1930. Besides pragmatic reasons (building a new structure elsewhere posed a financial burden), it was the »proximity to nature« that made the park a fitting place for stargazing. Surrounded by greenery, away from the hullabaloo of the city, the right atmosphere for reflective observation of the heavens could arise, making a visit to the planetarium a well-rounded experience.

Aby Warburg's collection on »Sternglaube und Sternkunde« (celestial beliefs and astronomy) also contributed to this experience, framing and complementing the planetarium programme.[6] The collection was exhibited in the water tower and connected the technical-mechanical approach to the night sky – materialised in the planetarium projector – with the products of millennias of human engagement with the stars. In Warburg's interpretation, astrology and astronomy represented two expressions of humanity's struggle with the cosmos and their place within it. To him, demonically-spiritual narratives and mathematical measurements were two related engagements to address the question of humanity's relationship to the cosmos and their place in the infinity of the universe.
This great question continues and remains a focus under the domes of planetariums to this day. Precisely because these institutions can – through their immersive simulation – unlock infinity and bring it sensibly closer in the form of the projected universe, they function as sites of contemplation about the dimensions, ranges and perspectives of human existence.

1 For more information on the history of the planetarium: Helen Ahner: »Planetarien. Wunder der Technik – Techniken des Wunderns.« Wallstein: 2023; Charlotte Bigg: »The View From Here, There and Nowhere? Situating the Observer in the Planetarium and the Solar System«. Early Popular Visual Culture 15 (2), 2017, pp. 204-226; Hans-Christian von Hermann et al.: »Zum Planetarium – Wissensgeschichtliche Studien.« Leiden: Brill: 2018. Thomas W. Kraupe: »"Denn was innen, das ist außen." Die Geschichte des modernen Planetariums.« Planetarium Hamburg: 2005.
2 Helmut Werner: »Die Sterne dürfet ihr verschwenden«. Gustav Fischer: 1953, p. 153.
3 Letter from Karl Umlauf to Senator Emil Krause, 2.2.1925. »Staatsarchiv Hamburg«: 361-2 V 725, 1 MA. Translated by the author.
4 J. J.: Das Planetarium muss kommen! »Hamburger Nachrichten«, 29.8.1928. Staatsarchiv Hamburg: 361-2 V 725i. Translated by the author.
5 L.: Zur Errichtung des Planetariums. Hamburger Fremdenblatt, 21.8. 1929. Staatsarchiv Hamburg: 361-2 V 725i. Translated by the author.
6 Uwe Fleckner et al.: »Aby M. Warburg, Bildersammlung zur Geschichte von Sternglaube und Sternkunde.« Dölling und Galitz: 1993.

INFINITY IN MATHEMATICS

Timo de Wolff und Oliver Labs

Infinity is a disturbing concept for us humans. It goes beyond what we can imagine – whether it be the idea of an infinitely large universe or of an infinite amount of time. Our mind is unable to get a hold of it, as it requires finiteness for any comparative ordering. Infinity in mathematics appears even more bizarre in its combination of abstraction and incomprehensibility.

Infinity is, however, both ordinary and essential in mathematics. Since the early 20th century, mathematics has not aimed to comprehend what certain objects, structures and concepts are, but, rather, how they behave. Mathematics yields detailed knowledge about the behaviour of infinity. Additionally, the usage of infinity as part of mathematical theory is a fundamental pillar of mathematical methods in its modern form.

Not all appearances of infinity are identical. The most famous and most essential example is comparing countable and uncountable sets. Countable sets are those which allow a bijection, i.e., a one-to-one correspondence to the natural numbers – 0,1,2,3,... and so on. The rational numbers – all numbers represented by fractions – are an example of such a set. And once more, our intuition misleads us, as the natural numbers are strictly contained within the rational numbers: Every natural number is a rational one, but not vice versa. So, how can there be a one-to-one correspondence between the elements in these two sets? Because of the infinite size of the two sets, strict containment of one in the other does not contradict the existence of a one-to-one correspondence. Quite the contrary: The existence of such a bijective correspondence can be proven via Cantor's First Diagonal Theorem. We cannot trust our intuition with regard to infinity. Other infinitely large sets – most notably, the real numbers – do not, however, admit such a bijection to the natural numbers. ↪

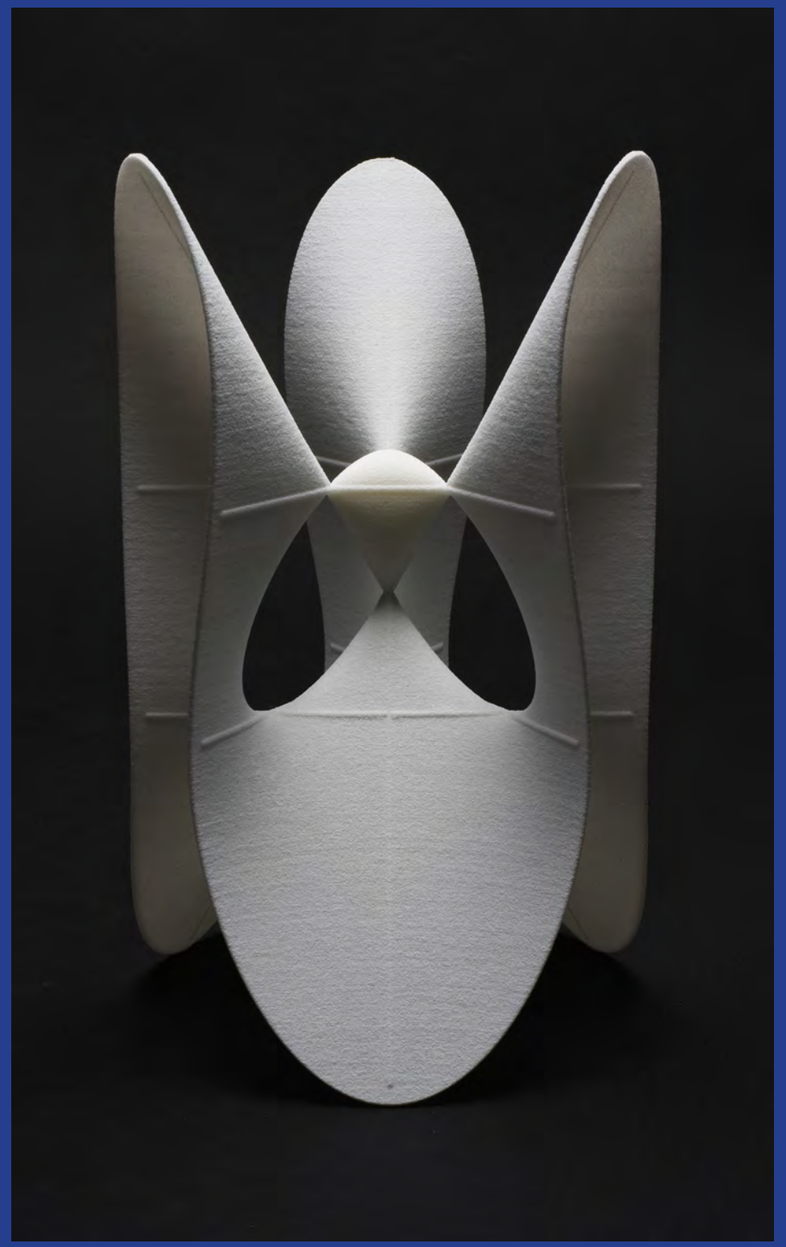


FIG. 3

This distinction certainly appears to be »l'art pour l'art« at first glance – without practical relevance. But this initial impression is not true: For example, differentiation and integration – and thus, the entire modern mathematical area of analysis – are fundamentally built on this distinction. In consequence, so are vast parts of physics and engineering. And this is only one instance of a mathematical subject which uses infinity on a day-to-day basis. Others include, for example, topology – which investigates structural properties of abstract, often infinitely-large spaces – and projective geometry – which we obtain by adding points at infinity to our usual Euclidean Geometry (in a particular way).

By taking a closer look, the description of the behaviour of infinity in the mathematical universe yields an insight about the concept of infinity in the physical universe: It de-mystifies it. We humans intuitively tend to focus on the being of something, instead of aiming to understand its behaviour – and, while striving for transcendence, lose ourselves in a maze of our own human finiteness. In 1930, the mathematician and philosopher Hans Hahn – one of the leading intellectuals of the Vienna Circle – exhorted in his essay »Überflüssige Wesenheiten« (»Superfluous Entities«) to apply Occam's Razor[1]: »Entia non sunt multiplicanda praeter necessitatem – Do not assume more entities than strictly necessary.« And, we might add, whenever we desire entities beyond those strictly necessary to enrich our life and our world, we certainly find them in arts.

The object presented here consists of a group of three mathematically related sculptures, which are mounted on a plate showing a family of mathematical curves. Mathematically, the sculptures represent algebraic surfaces of degree three, also called cubic surfaces. The basic understanding of such abstract objects was developed mainly in Europe during the 19th century. A crucial aspect in this context is the acting in projective space. This space can be understood as a formalisation of representations in perspective using a higher-dimensional space. In particular, it allows calculation with points at inifinity (similar to vanishing points in arts).
The sculptures represent three among the infinitely many possibilities to represent a single one of these higher-dimensional projective surfaces[2] in our three-dimensional space. Intersecting one of these surfaces with a plane (e.g., vertically), yields a plane curve like the ones printed on the plate. This family of curves shows a collection of infinitely many such curves, among which three are created by planar sections of the sculptures.
The group of objects represents a mathematical, algebraic-geometric approach to handle infinity. It obtains lifelines in our modern times; for example via the fact that the printed curves are elliptic curves. These are the basis of a significant part of modern schemes in cryptography. Moreover, the algebra behind the sculptures is the foundation of freeform surfaces used in design and architecture.

1 Dating back to William of Occam, ca. 1287-1347.
2 The defining equation is $1/x+1/y+1/z+1/w=0$, which was already investigated by Arthur Cayley in 1844; see Journal de Mathématiques Pures et Appliquées (Liouville), p. 285.

INFINITY.
SOLAR ENERGY FOR SPACESHIP EARTH AND BEYOND

Michael Saliba und Andreas Pahler

Our contribution to the exhibition project »Infinity, Emptiness, Liveliness« at the Hamburg Planetarium explores the limitless possibilities of solar energy in space – an energy source that helps us view Earth anew and, at the same time, consider the vastness of space. At the centre of our contribution lies the concept of »Spaceship Earth«, which carries humanity on its journey through the universe. Seen from afar, from a bird's-eye perspective, our planet hovers like a lonely, fragile dot in the immeasurable expanse of space. Indeed, many astronauts report experiencing an »overview effect«, a profound feeling of connectedness and responsibility that arises when they see our home planet from a distance and without visible borders.

At the same time, we are at the dawn of a new era in space exploration, where the boundaries between Earth and space are beginning to blur. Companies like SpaceX and other space pioneers have redefined space travel with reusable rockets and extensive satellite constellations, creating potentials that once seemed unimaginable. What was previously deemed impossible, such as the recovery of rocket stages for reuse, is now a reality. This development not only opens doors to new exploration missions but also makes the idea of utilising space as an energy source more tangible than ever.

In our installation, we present a 3D printer and a flexible solar cell film. The printer demonstrates the ability to produce components directly in space – an innovation that could make space missions more independent and adaptable. The flexible solar cell film, on the other hand, embodies future possibilities for harnessing and storing energy in space. This film could be affixed to satellites or space stations, enduring even extreme conditions. Both technologies symbolise the idea that space is not just an uncharted territory but also holds potential for a sustainable energy production.

Our contribution to the imagination of infinity is a look into the future – a future where space serves not only as a realm of discovery but also as a partner in addressing global energy issues. Solar energy offers a perspective that goes beyond mere consumption: It becomes a symbol of our shared responsibility for the planet and an expression of our capacity to explore space with sustainable technologies.

Be inspired and discover how the vision of a sustainable future in space motivates us on Earth and reminds us that we – with all our technologies and possibilities – are on a unique and shared path.

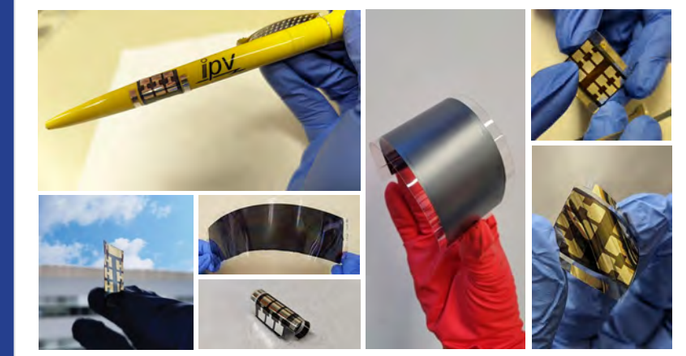


FIG. 4

BETWEEN REPRESSION AND RESPONSIBILITY. THE COSMOS AS A NEGOTIATION OF SPACE FOR ECOLOGICAL DISCOURSES

Catherin Persing

The conceptual and performance artist Swaantje Güntzel uses her art to react to the ecological crises of the present by creating images of the almost-incomprehensible extent of anthropogenic climate change, species extinction and environmental pollution. She also reflects on the ambivalent human relationship to nature as one of the causes of these catastrophes. The cultural auratisation of nature is in tension with its systematic destruction – a paradox that is repeatedly addressed in Güntzel's works. Instead of idyllic depictions of landscapes, viewers are confronted with the cosmic dimension of waste production and its effects, to which individual purchasing decisions contribute as well. Güntzel uses photographs, embroidery, porcelain, plants and AI-generated portraits, and integrates waste into her works not only as an abstract phenomenon, but also as a tangible material. In her art, she further questions the relationship between humans and animals, which have always been used as reference figures and figures of alterity to negotiate the human self-image.[1] Alleged certainties are called into question by her works, in which (above all) the violent consequences of human action for the more-than-human world come to light – for example, through the increasing pollution of the oceans with plastic waste. At the same time, Güntzel creates an awareness of shared vulnerabilities: Microplastics undermine existing hierarchical relationships by entering into connections with human and more-than-human bodies.[2]

The focus on the consequences of anthropogenic changes to global ecosystems and their inhabitants also manifests itself in Güntzel's artistic practice at the interface of art and science. For the artist, who has a background in Anthropology and Liberal Arts, this interdisciplinary exchange is a central element. The projects are preceded by intensive research into scientific data and research results; at the same time, the artist deals with the cultural imaginations that shape our perception of nature or space. This results in recurring collaborations with scientists and institutions such as the Research Institute for Sustainability (RIFS), the German Research Center for Artificial Intelligence (DFKI) and the Alfred Wegener Institute for Polar and Marine Research (AWI).

The photograph entitled »Sterntaler« refers to the fairy tale of the same name from the Brothers Grimm's »Children's and Household Tales«. The portrait by Andreas Zierhut shows the artist herself, Swaantje Güntzel, whose red dress stands out clearly against the stylised starry sky and the nocturnal forest landscape, as she lifts the hem of her skirt to collect the falling stars. The composition of the picture and the figure on the back refer to a romantic tradition of landscape depiction, as expressed in Viktor Paul Mohn's illustration for »Die Sterntaler« (1882). The romantic image of nature – in which man's alienation from it is lamented and nature is elevated to the antithesis of an industrialised world – still influences our ideas today.[3] »Sterntaler« plays with these cultural inscriptions, but at the same time breaks through them by adding a material dimension: the clearly-visible chain of satellites from Elon Musk's Starlink project in the night sky. In this composition, nature and space can no longer be imagined as pristine places of longing. Rather, Güntzel's photography shows the extension of an imperialist and colonial mindset – in which nature is appropriated, commodified and »put to work« as a capitalisable resource – reaching into outer space as a new »terra nullius«.[4]

The work was created during Güntzel's artist-in-science residency at the European Space Agency (ESA/ESOC), as was the project »Golden Record / image No. 117«. In 1977, NASA commissioned a collection of 116 images and graphics for the data disks travelling with the Voyager 1 and 2 space probes (the so-called »Golden Records«). They are intended to provide extraterrestrial beings with information about humanity and life on Earth. However, beyond documenting technical and cultural achievements, these images can also be understood as an expression of anthropological self-positioning. Güntzel is particularly interested in the omissions from this historical self-staging, which are especially remarkable in light of the growing environmental awareness of the 1970s – the biologist Rachel Carson documented the harmful effects of pesticides on the environment as early as 1962 in »Silent Spring«.[5] As a supplement, the artist therefore sent a 1973 image of a landfill site in Jamaica Bay (New York) to the space probes via an ESA antenna on 20 October 2022. Güntzel uses photography to draw attention to the psychopolitical mechanisms of repression that characterise the way waste is dealt with in industrialised nations. Landfills remove what is no longer needed or wanted from visibility and from our consciousness – often enough, to other countries. »Golden Record /image No. 117« addresses these structures and shows waste as an essential part of human life in the 21st century.

Space has long since become an extraterrestrial garbage dump. The installation »Space Debris // ESA« documents this space debris – which ranges from paint chips to disused satellites, and has increased rapidly in recent decades due to the activities of various nations. The installation features a laptop and a printer on a table, from which fanfold paper reaches down to the floor where it collects in a box. The tightly-printed pages list the positions of all objects between one and ten centimetres that were space debris on 20 September 2020 at 12 noon. The work was realised with the support of ESA's Space Debris Office and counters the idea of infinite space, by mapping what has already been left behind in the use of this space. The mass of paper needed to cover all the objects contrasts with the abstract series of figures and makes the extent of the pollution tangible. While the ESA is working on solutions for a more sustainable use of space in the future, Güntzel deals with the traces of past human activities and shows space as an archive that enables an alternative idea of space travel, based on its material legacy.

The work »Lunar Litter« also changes perspective and uses a 19th-century stereoscope, which creates an illusion of depth through two slightly offset images for the left and right eye. However, »Lunar Litter shows two disparate views of the moon: One partial image depicts the celestial body as an unreachable projection surface, while the other features toy objects that Güntzel has placed on it. These objects, documented by the ESA, represent the garbage that has been left behind on the moon since the early days of space travel. These initially cute-looking miniature objects protrude beyond the boundaries of the picture, and make humanity appear to be an invasive species with growing ecological problems. The contrast between the untouched and the littered moon raises deeper questions about the human approach to technology, space travel and their legacies. This creates a cultural depth of field that reveals the connection between the moon as a lunar place of longing and the consequences of these projections.

The idea of boundlessness as a stimulus for technical and scientific developments is closely linked to a practice that seeks to make supposedly-empty space controllable and usable as a resource.[6] In Güntzel's work, the cosmos therefore does not appear as an untouched space, but as a place for negotiation of historical and contemporary environmental discourses, in which human activities have already clearly inscribed themselves. The infinite cosmos meets the practically-infinite lifespan of materials such as plastic. The artistic works develop perspectives on ecological and social challenges that trigger a sense of unease in the viewer and invite reflection on what self-image remains when we think of human culture in terms of its waste production. What does this say about us, and to what extent is waste a central element of human existence in the 21st century?[7] ↪

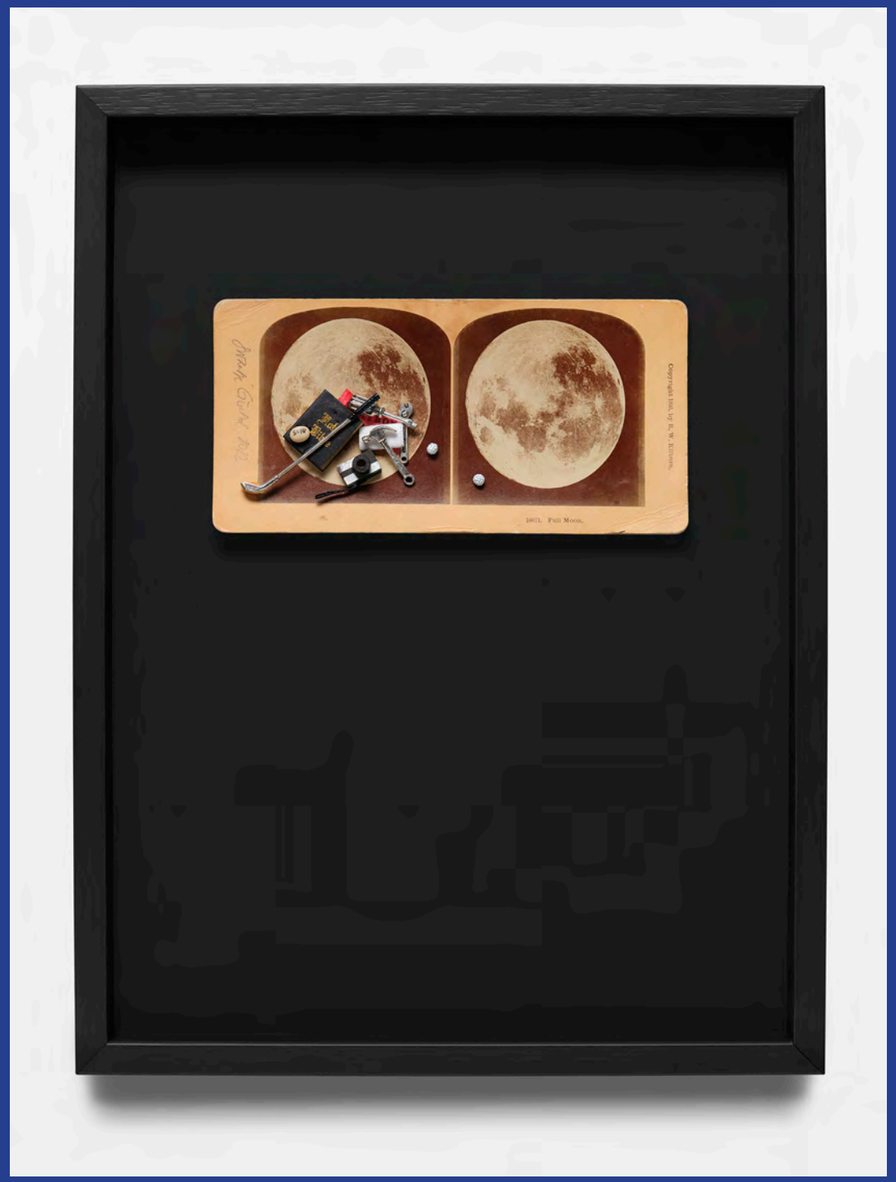


FIG. 5

The dichotomy of visibility and invisibility characterises both the socio-political treatment of waste and Güntzel's artistic approach to the subject. Despite the collection of data by institutions such as the ESA, space debris undermines traditional forms of representation, as the spatially- and temporally-immense consequences of space pollution elude immediate visibility.[8] The reflection on human waste production also raises the question of whether or not the cosmos is still compatible with existing cultural imaginations. Güntzel's art exposes the various layers of meaning and thus enables the cultivation of a different view of outer space and its anthropogenic legacies. She takes the everyday and familiar as her starting point, placing it in an unexpected context and using it as a catalyst for exploring unwanted themes. By bringing together cultural imaginations and scientific research findings, Güntzel also adresses the question of what representations would be needed to make outer space an object of care and responsibility. Waste becomes a material witness to an unsustainable approach to the cosmos.

1 Linda Kalof, Amy Fitzgerald (ed.): »The Animals Reader. The Essential Classic and Contemporary Writings.« Routledge: 2021.
2 Heather Davis: »Plastic Matter«. Duke University Press: 2022, pp. 81–102.
3 Kate Soper: »What is Nature? Culture, Politics and the Non-Human.« Blackwell: 2004, pp. 15–36.
4 On the cultural and discourse-historical connections between Romantic art and colonial structures, cf. Miguel A. Gaete: »Cultural Exchanges and Colonial Legacies in Latin America. German Romanticism in Chile, 1800–1899.« Cambria Press: 2023.
5 Rachel Carson: »Silent Spring. 40th Anniversary Edition.« Mariner Books: 2002.
6 Jason Moore: Über die Ursprünge unserer ökologischen Krise. »PROKLA. Zeitschrift für kritische Sozialwissenschaft 185«, 2016, pp. 599–619.
7 Michael Marder, with artworks by Anaïs Tondeur: »Dump Philosophy. A Phenomenology of Devastation.« Bloomsbury Academic: 2021.
8 Rob Nixon: »Slow Violence and the Environmentalism of the Poor.« Harvard University Press: 2013.

THE ART OF EARTH GAZING. AN INTERVIEW WITH RICHELLE ELLIS

Amelie Wedel

Richelle Ellis' artistic practice brings distant and abstract places – above all, the universe – closer to the senses and the tangible. As an expeditionary artist, she not only travels the globe but also moves through different media, from paintings, drawings and sculptures to papermaking, digital animations and collages. Many of her pieces convey a softness, tactility, and patience that offer a different perspective on the predominantly technological, commercial and militarised realm of space. While sometimes an interest in the vastness of the universe can be seen as a form of escapism, Ellis turns to outer space and remote places to focus on living systems, habitability and appreciation for planet Earth. To explore this, she travels to places that resemble other planets, like the North Pole and the volcanic deserts of Hawaii, to better understand the systems of interaction between humans and nature. Ellis has also entered the context of the space industry, an ambivalent arena determined by scientific and commercial interests, to introduce an artist's perspective to the conversation. It is also a way to pursue her ultimate goal: to see the Earth from afar. She has completed various analog astronaut training programs that have prepared her for this journey, and she is ready to go. In this conversation, we discuss why the view from space is compelling for earthlings, her thoughts on the role of art, and some of the charged issues surrounding space travel.

A: When did your interest in space as a connective thread first emerge in your artistic practice? Do you remember a particular moment?

R: The idea that has always captured my interest from very early on is understanding where I am in relationship to everything else. Growing up in a very small town in California with just 3000 residents, I was immersed in nature and the night sky, feeling an intimate connection to the cosmos. I assumed that everyone had that experience until I moved to Los Angeles for school. The dormitory alone housed as many people as my entire hometown, creating an immediate shift in perspective of scale within a sprawling urban landscape. This transition led my art to evolve, shifting from intimate depictions of natural scenes to portrayals of bustling cityscapes and vast crowds. It felt as though my work was zooming out, revealing complex networks – social, environmental and technological. I began to see a much larger picture, both personally and artistically, recognising my role within interconnected systems, as an individual and as part of a collective whole. When you see the bigger picture, you can start to have a better understanding of how you affect things.

A: How would you describe your fascination with the universe? And in turn, how does viewing Earth from space allow us to see the planet and its systems in a new light?

R: Many people are drawn to space because of sci-fi and space exploration narratives or because they love star gazing. For me, however, I love earth gazing. Whether I am on a plane or hiking to the top of the mountain, it is in these moments – when I am able to see things from a greater distance and a greater perspective – that I feel connected and a sense of purpose. After college, I began participating in artist residencies in different parts of the world, including to the North Pole. Art became my passport, allowing me to go to these new places and to reflect on the specific environmental and social communities and the ways they interact. I asked myself: what threads connect these places, and what makes each distinctly unique? This exploration became a process of transcending boundaries and realising we are on one connected planet. It was then that I discovered the concept of »The Overview Effect«, the awe-inspiring shift in perspective astronauts experience when they see Earth from space. Meeting a few astronauts and listening to their stories, I realised that seeing Earth from above offers a profound sense of both perspective and belonging. You can understand yourself, your origins and where you come from so much clearer than when you're just like an ant in the ant farm. It is when you step back that you realise how incredibly fragile the Earth system is. ↪

A: This shift in perspective you describe – seeing Earth from afar – sounds to me like a form of recalibration. The experience of suddenly viewing the world in a new light reminds me of aesthetic experiences and the transformative potential of art.

R: From very early on, I have always used art as a way to understand the world and I have always been driven by ideas and concepts and always exploring various media. What excites me is the question of how can we create those »aha« moments, those incredible experiential shifts in your mind and in your heart when you can travel the distance? And I think that art can bring you there. There is this philosopher I admire, Jason Silva, who said, »Our paintings, our songs, our stories – they are maps of where we went.« I just love this idea that art can take people to realms beyond their immediate reach. Space is one of those realms.

A: When you talk about art bringing people to places otherwise inaccessible to them, I'm reminded of early photography in the 19th century. At that time, there was a desire to document remote landscapes seen as threatened by industrial progress. Photographers traveled to these areas via newly built railways, hoping to capture and preserve these landscapes through their images. Yet paradoxically, the very technologies that granted them access to these places also contributed to their degradation. I think about this ambivalence of traveling to a place in order to protect it, only to further its destruction.

R: Yes, I definitely grapple with the same questions. Why do you want your fingerprints in space? To touch it, to say you were there? I think it's a fine line. The commercial space industry is definitely shifting. The dominant questions are: Who has access? What are the goals of inhabiting other planets than the Earth? Many of these discussions are really charged and have the potential to replicate narratives of conquest, colonisation and resource extraction. Is it exploration or exploitation?
I guess what convinces me is to ask: If we exclude artists from the conversation on space travel, what are the cultural implications? Going to the moon is inevitable in the future, driven by the technological innovations and the opportunities they create. What I can say is, let me join this conversation as an artist to get more people engaged in the topic. Let's bring more perspectives to this. Because if space exploration is going to be an inherent part of our future, then we need to collectively understand its beauty, confront its challenges, explore its possibilities and consider its impacts, both positive and negative. This is the journey I'm on.

A: Through your training in analog astronaut programs, you have become part of these controversial discussions. How does such a training program operate, and what role have you taken on there as an artist?

R: This journey is one I'm carving out on my own. Around the world there are many different space analog programs. I've chosen to partner with »NASA Goddard« as well as commercial space ventures like »Space Perspectives, Planet Labs, Relativity Space« and »Blue Origin«. I'm exploring how each of these different space communities interact with space. I have one foot in the traditional NASA astronaut training – from underwater certifications to wilderness training and conducting research alongside scientists. And then I have this other foot in the more commercial space tourism where I'm helping to build some of those programs around venturing into space through my research at »Hi-Seas«, »Astroland« and »Lunares Research Station«. I'm often surrounded by scientists researching how to grow food in low gravity, how medical practices adapt to space and the effects on the human body. However, my focus lies in the cultural dimension: How can creativity foster flow states to enhance psychological well-being on extended missions? This aspect is often overlooked, yet nearly every astronaut has some creative outlet during their journey – whether it's playing music, quilting or even watercolour painting in space.

A: You are part of an all-female artist collective, participated in an all-female crew for the Astronaut Analog Mission and were one of the first women to send art to the moon. What is the connection between gender, art and the history of the space?

R: The story of space exploration has long been shaped by a male perspective and a Western lens. Historically, even art that has ventured into space reflects this. Take the »Moon Museum«, a tiny microchip featuring artworks by six male artists, including Andy Warhol and Robert Rauschenberg. Their illustrations included symbols like a penis, Mickey Mouse, a single line, and a black square: just some of the symbols that represent man. This has been the story of how human accessed outer space. In contrast, I have loved connecting with women around the world and seeing how we can celebrate the Earth from a feminine lens. My arts collective »Beyond Earth« created the sculpture »Living Light«, which evokes feminine forms with its curving shapes. When it traveled to space, it did so in a way that feels distinct from the upright rockets that pierce the sky. It's a step toward reimagining space access with delicate designs soaring to space and back without leaving a trace of destruction in its path. ↪



FIG. 6

WORKS PRESENTED IN THE EXHIBITION BY RICHELLE ELLIS

Richelle Ellis creates her artworks in various locations and often under extraordinary conditions. As such, her pieces document the diverse and sometimes extreme circumstances in which they were produced. A particular focus of her work is the uniqueness of each place, its physical characteristics and the different sensations it evokes. In the following, Richelle Ellis describes the exhibited works, paying special attention to the contexts and production conditions that have influenced her artistic process

LIVING LIGHT, 2020

»Living Light« is a project I developed with »Beyond Earth«, an arts collective I co-founded with two other artists to explore the intersections of biology, space and art. When »Space Perspectives«, a company offering stratospheric flights to give people the »overview effect«, invited us to design a capsule for their test flight, we created our sculpture at the Kennedy Space Center, surrounded by supersonic jets and aircrafts. This juxtaposition of art-making and space travel was surreal and inspiring.

The project aimed to advocate for a more ecological future. Our design concept bridged deep space and the deep sea, realms that share mystery, alien life forms, and a dark abyss. Inspired by aquatic ecosystems, we studied comb jellies and other deep-sea creatures, using AI to combine over a thousand aquatic species into a single, otherworldly life form that became the internal structure of our »sea-space jelly«. We used iridescent materials to allow the sculpture to interact with light, shifting colours as the sun moved. Launched to celebrate World Ocean Day, the capsule ascended into the stratosphere for a six-hour flight, eventually landing in the ocean, where it was retrieved. ↪

MOON GALLERY, 2022

»Moon Gallery« includes 64 artworks made from artists from around the world. They're tiny objects, each one is one centimetre by one centimetre. This collaborative project was about bringing artistic perspectives from different places and people around the world to space. My artist collective and I also contributed a piece: a sealed steel capsule containing DNA encoded with an artistic message representing culture in space. We chose DNA as the medium since it is a building block to life on our unique and habitable planet. Each of us created an individual artwork, which we then sequenced into synthetic DNA housed within the capsule.
DNA remains stable for billions of years and can withstand the elements of space – in that sense it's an archival material. In the distant future, this DNA can be sequenced to extract the binary data and recreate the artwork digitally. In essence, our steel capsule is like a hard drive of encoded artworks, where the art itself is preserved in the DNA. The »Moon Gallery« has flown to the International Space Station and it still floats in zero gravity today.

MARTIAN ROCKS, 2022

»Martian Rocks« emerged from a Mars Analog Mission with an all-female crew on a Hawaiian volcano, a landscape that mirrors Mars with its lava tubes and red regolith. I thought a lot about how, as someone coming to this new environment, there's an impulse to collect rocks as souvenirs to bring home and show people. But that's a form of extraction and exploitation. Instead, I wondered: how could I capture the beauty of the environment – with the Martian red regolith in all these different shades of colours – without exploitation? That's when I started to collect some of the sand, mix it with my own saliva, conserving our limited water supply, to paint rocks that could then be viewed under a lens.
Our month-long mission required intense resource management – from daily reports and bio-sampling to crew meetings and extravehicular activities (EVAs) in full spacesuits. During EVAs, I 3D-scanned rocks to build a digital archive, preserving the landscape without taking from it, and providing visual references for my paintings. Art-making in these conditions demanded adaptability, turning limited resources into tools for expression and documentation upon return home.

INPLORATION: LOOKING WITHIN, 2022

The inspiration for »Inploration: Looking Within« emerged from a conversation with my collaborator, Lawrence Azerrad, about creating perspective shifts by moving between micro and macro scales. We were inspired by early stereoscopes – an early form of VR that merges two images into a perceived 3D view. This led us to consider how such a device could help people shift their perspective on the world, from the tiniest details to sweeping views. We created mixed-media artworks ranging from close-ups of insects to aerial shots of crowds and expansive landscapes. One set of stereoscope image cards remained earthbound, while another set was launched on a rocket into space. This required us to design a device that was lightweight, durable enough to withstand the journey, compact and easily shareable upon its return.

ARCTIC VOYAGE, 2023

»Arctic Voyage« was created during the »Arctic Circle Residency«, a sailing expedition around the island of Spitsbergen. The piece combines cyanotypes, drawings and plastics. To create the cyanotypes, I used iceberg fragments from the ocean, having them melt under the sun and imprint directly onto paper. I liked this idea of showing the temperature shifts in the Arctic and having that translate directly onto paper. The process creates these memories of this environment: It is a documentation of a place. Instead of taking a photograph, I wanted to give different impressions of a place, to reflect the temperature and the colours, to capture what the shape of melting ice looks like, how it feels to physically touch materials that came from the North Pole.
The artwork is like a field journal. Equipped with a minimal kit, I created in a small space, with my bunk bed doubling as a studio, all while adjusting to the ship's constant motion.
I was struck by the amount of plastic pollution there was, and by the air bubbles in the ice – which indicates that it is melting, leading to the release of methane gas into the air. In Svalbard's waters, something you can't anticipate is the sounds of melting ice – the bubbling, fizzing sound as if surrounded by an ocean of sparkling water. Witnessing these effects firsthand deepened my awareness of our warming planet. My aim as an artist was to capture these sensory experiences and emotional nuances. Through this work, I hope to evoke a personal connection to these vulnerable places.

SEEING INFINITY FROM FINITE GROUNDS. PLANETARY VISIONS IN JESSICA MAC MILLAN'S »TIME LINE« AND »EVERYDAY MOONS«

Lana Uzarashvili und Philipp Hohmann

Many might have learnt it at school: the Earth orbits the Sun – each circle amounting to a time frame we call a year (at least in a Gregorian calendar). The history of astronomy bears witnesses to the grave difficulties and the hundreds of years it took for this insight to travel from the observatory, through courts and prisons and into schoolbooks; challenging established frames of knowledge and reference can have shattering effects. One of the barriers that would have impeded this insight from gaining traction was a general mistrust of observational methods, which were seen as capturing only fleeting and insubstantial features; these were specifically rejected for the study of the »heavenly celestial world« as patterns of movement in space were deemed inscrutable to the human eye. It was only through the gradual rehabilitation of observation and visualisation in science since the 16th century – the Enlightenment is a decisive turning point here – that it became possible to justify postulates about earthly movement and, thus, the heliocentric model. One of the most common anxieties conjured by this vision was the relativity between every element in the universe and their contingency on one another. This attribute of instability was encapsulated by the English poet John Donne in 1611 in his »The Anatomy of the World« and cited by Alexandre Koyré:

> »[…] When in the Planets, and the Firmament
> They seeke so many new; then see that this
> Is crumbled out againe to his Atomies.
> 'Tis all in peeces, all cohaerence gone;
> All just supply, and all Relation.«[1]

In contrast to heliocentrism, the movement of the Earth on its own axis – that Jessica MacMillan's »Time Line« (2021) focuses on – was smoothly integrated into astronomy's body of knowledge, but it also did not travel quite as far. So, for some viewers, »Time Line« uses an impressive visualisation that, firstly, teaches us about a movement that is impossible to perceive from the vantage point of our earthly perspective. This showed that not only are we, as residents of the earth, circling the sun, but our whole solar system is itself in motion around the (approximately calculated) gravitational centre of our Galaxy (which also moves within the universe). The green laser that MacMillan shoots into the dark sky over Svalbard makes this movement perceivable, enabling an aesthetic understanding of movement on a hardly-comprehensible scale.

MacMillan's work unveils the relational character of this dynamic: The orbit of the Sun depends on the Local Standard of Rest, on all significant masses in the galaxy – which are, themselves, in motion and serve as a neutral reference frame for calculating movement of objects in the galaxy. »Time Line« plays not only with incomprehensible scales but also with movement and stasis – or the impossibility of the latter. If we try to understand our position in the cosmos, we are faced with an infinitely complex reciprocity. This leads us to examine the meaning of Albert Einstein's theory of relativity, which introduces gravity as the product of massive objects interacting with the space-time continuum, and thus reveals the nature of many forms of movement in our galaxy. Due to its enormous mass, the Sun curves the so-called space-time, forming the paths, or orbits, for other planets. In a similar vein, this applies to our solar system's circling through the galaxy, only the pattern of masses that shape this movement is a lot more complex.

MacMillan has experimented artistically with this force before. »Everyday Moons« (2021) is a series of 3D animated videos that speculate about fantastic and (at the same time) very ordinary celestial bodies. Together with Charles H. Lineweaver, a professor at the Australian National University's Planetary Science Institute (PSI), MacMillan came up with speculative artificial »moon sculptures« that consist of everyday commodities like porcelain cups, socks or strawberries. MacMillan's videos allow us to hover through alien landscapes of these very earthly goods; they create a tension between the mysteriousness, or at least unintuitive, nature of the gravitational force – that pulls matter together to a spherical form once a certain mass is reached – and the profane form this matter could take. The videos meditate on the physical parameters that would make such a moon (im)possible. They can be read as a poetic visualisation of a thought experiment. However, they also allow for reflection on the perspective that grounds this thought experiment. The incomprehensible landscapes of innumerous small objects, their identical motifs, their form and which elements were chosen to come up with these »Everyday Moons« tell us something about whose everyday life is the starting point for this (extra)ordinary imaginary.

Fresh red strawberries like we might know from advertisements, simple Ikea-like cups that can be bought for about two Euros in Germany and one-size wool-socks also point towards processes of industrialisation – especially in the aesthetic frame of a high-definition animation.

↪



FIG. 7

Clearly, we are engaging in a thought experiment: No one is planning on building artificial moons or worrying about the resources and supply chain this project would require, as these are beside the point. However, industrial and mass production are embedded in the iconography of this work, which provokes the question of its intellectual foundations. To think: »What if…?«, is a central operation of philosophical (or, actually, most forms of) knowledge production. How, through what means, and with what narratives and metaphors are we imagining the incomprehensible scale of space, and how will it change with our situatedness? Such a change in the figurations and metaphors of knowledge production is necessary with very material, epistemic and political implications – as the philosopher Donna Haraway (amongst many others) has been tirelessly teaching us in the last decades.

How would »Everyday Moons« be imagined from a different perspective, or from someone whose everyday life does not contain the objects that amount to planetary sculptures here? A change of elements would change the size and form of the moons, but it would also change their aesthetics and iconography. What else would be altered? Maybe a change in perspective would provoke totally different thought experiments on gravity, framing it as but one of the many forces that structure life, space and time.

In »Time Line«, this relation between space and time through mass and movement points back towards questions of contingency and instability that accompanied the birth of heliocentrism in the Renaissance. They come to the fore as a starting point for contemplating our planetary future. For MacMillan, the intangibility of time and the impossibility of predicting what lies ahead can be mitigated, at least partially, by illuminating the path we move through. This frame of thought reminds us that we live in an era where our own, or at least human activities and their effects – while being individual and predictable on a small scale – lead to uncertain, yet destructive, repercussions when accumulated.[2] Hence, when we think about planetary existence, we should train our eyes to see across scales. Surprisingly or not, Einstein's general relativity can be construed as one of the scientific theories for the Anthropocene – the time in which humans became the driving geological force – for it offers a means to envision »space-time« not merely as an absolute and abstract constant force independent of the events unfolding within it, but, rather, as an active participant. It is one deeply affected and transformed by these processes, facilitating other phenomena of life to happen.[3]

If we think about our planetary future with and through MacMillan's work, our gaze does not only have to stay fixed on the sky the laser is fired at, instead, it is free to wander to the ground where it emerges from. »Time Line« allows us to think of Earth in its cosmic dimensions, but it can also point us to other, equally-complex relationalities and scales that it is entangled with. The Svalbard (i.e. Spitzbergen) space so prominently featured in MacMillan's video, and the implications of installing the laser in this territory, is another entry point to examine our ways of cosmic thinking through a situated perspective. The vastness and darkness associated with Svalbard in the video make it appear as a sort of »empty place«, falling under the umbrella of the established conception of the Arctic. The absence of life – that is, a certain way of human life that heavily relies on artificial light – seems to be a prerequisite for MacMillan's experiment, or at least for its effectiveness. The complex history and crisis-shaped presence of the land the laser is standing on causes the viewer to step back and imagine the Earth like a spaceship from this place of darkness and vastness. However, if we not only understand the laser as a beacon going up into the sky but also as pointing down into the Earth, it allows us to think in both a cosmic and a planetary scale. MacMillan alludes to the peculiarity of the perception of time in this place, which imbues it with a distinct character.

↪

It also enables beholding of that which is typically unseen from other vantages, thereby creating an all-encompassing vision for those who stand upon this island. Known as a Norwegian territory, Svalbard is a historically-dense place, having long served as a mining ground where nations have exercised their extractivist interests since the 17th century – a legacy continued by the present-day coal mining activities of Russia and Norway across the archipelago. Svalbard now experiences some of the most intense warming conditions, with temperatures rising six times faster than the worldwide average, leading to detrimental effects on the local ecosystem. This context – interwoven with the laser, in this astronomic-artistic project into the complex materiality of the archipelago – reminds us that the uncertainty of our future is deeply rooted in the past and present, where colonial and extractivist forces have critically shaped the planet as a mere backdrop, material or resource, devoid of any relational nature, thereby enabling its very destruction.

What is the future scenario that we attempt to grasp by rendering the movement of the planet we inhabit visible? How should we, as humanity, act based on understanding our situatedness on Earth as but one element of the galaxy? And how ought we envision our interconnectedness as a collective existence upon a planet in crisis? While it is even harder to imagine the possible effects a different position of our Sun within the Galaxy might have on the movement of our planet, MacMillan's work allows us to wonder which cultural frameworks are forming our fundamental categories like time and space, in and through aesthetical inquiry. Therefore, we find it of interest to ask for the perspectives this work itself is shaped by – and how its meaning shifts if we change the context of reference.

1 Alexandre Koyré: »From the Closed World to the Infinite Universe.« The John Hopkins Press: 1957, p. 29.

2 Talking about »human activities« as a cause for and of humanity in its totality as affected by climate change can obscure important distinctions and power relations embedded in the term »Anthropocene«. The ones responsible for the geologic and atmospheric changes that are foundational to the concept of the Anthropocene should not be subsumed under an anonymous humanity but named. Western, industrialised countries and their extractive industries relying on fossil fuels are and must be held responsible for their historic and ongoing contribution to coming and present destructions. Furthermore, the way how and the degree to which climate change affects and will affect people, differs greatly depending on their geographical location and positionality, e. g. race, gender, class, and relation to land (i.e., Indigeneity). Hence, while we don't want to dismiss the notion of shared or even united humanity if it serves comradeship or solidarity, we suggest caution when thinking about 'the Anthropos' as a universalised notion of geological actor defining the era of the Anthropocene. For alternative formulations of our geo-ecological present – for example Capitalocene or Chthulucene – see Donna Haraway: Tentacular Thinking: Anthropocene, Capitalocene, Chthulucene. »e-flux Journal. Nr.75«, 2016 (https://www.e-flux.com/journal/75/67125/tentacular-thinking-anthropocene-capitalocene-chthulucene/). For decolonial perspectives on the Anthropocene see Kathryn Yusoff: »A Billion Black Anthropocenes or None.« University of Minnesota Press: 2018; critical examination of visual politics in the Anthropocene is offered by T. J. Demos: »Against the Anthropocene: Visual Culture and Environment Today.« Sternberg Press, 2017.

3 Einstein's theory is, however, not a testimony of the ability of the Anthropos to affect our planet on a scale that has to be grasped in geological (time) frames. It could even be argued that it suggests a certain humbleness: thinking of the incomprehensible mass of a black hole that bends space-time to such a degree that not even light can escape its gravitational pull, might put fantasies of human (omni)potence into perspective, even though the operationalisation of Einstein's fundamental research suggests the contrary.

RESEARCHING THE STARS.
INDIGENOUS COSMOLOGIES IN ERIN GENIAS »FALLING STAR WOMAN«

Anne Hemkendreis



FIG. 8

Erin Genia's piece is a tiny sculpture – smaller than a fingernail – placed within Sojourner 2020 that illustrates »Falling Star Woman«, a Dakota legend that describes the journey of a star-gazing young woman. She travels to space, marries another being from the universe, and gives birth to a star child. Over time, however, the woman misses her family, friends and her work as a plant medicine healer within her community, which is why she eventually decides to leave her home in the cosmos and return to her people on Earth to offer wisdom and support. Using the thread of her woven dress as a rope, she climbs down from the stars. Unfortunately, the thread is not long enough, so at a certain point she bravely has to let go and tumbles down to Earth as a falling star.

Genia carved the sculpture from the traditional material of canupa iŋyan (also known as pipestone or catlinite). It shows the moment when the woman is transformed into a falling star and becomes Wicahnpi Hinhpayawin, i.e. the »Falling Star Woman«. Her face appears on one side of the cylinder while her hair flows into the shape of an eight-pointed star on the other end. On her body, Genia carved a Dakota floral pattern to show the strong pull the woman felt to resume her duties to her people as a plant medicine healer, and the relevance of the stars to planting seasons. Thus, a cyclical worldview and the importance of caring communities – central to many Indigenous cultures – are conveyed.

As a Dakota artist, Genia was inspired by the possibility of recreating this poetic tale from an Indigenous cosmology, which was also an opportunity to bring an often overseen and even oppressed cultural context to the world of high-tech space travel and space flight. The goal of her project has been twofold: The first was to send the work into a microgravity environment to study changes in the piece when it returns back to earth. The second was more inspirational, that is to bring a part of endangered Dakota culture into space and in doing so inspiring the Dakota youth that struggles with the consequences of (ongoing) colonial violence.

»Falling Star Woman« is a sculpture created for the »Earthlings: Open Call for Artworks in Low Earth Orbit« project of the MIT Media Lab Space Exploration Initiative. The tiny artwork went on board the Sojourner 2020 that circled the earth on the International Space Station for one year. It was launched on March 6, 2020, from the Kennedy Space Center at Cape Canaveral, Florida on the Space X Falcon 9 CRS-20. The piece is an extension of Genia's ongoing project: »Canupa Iŋyan: carvings of my ancestor«, in which the artist works with pipestone to study its history and cultural meaning. This stone comes from the quarry located on Dakota homelands where people of many tribes historically came together to dig stone for their pipes. Today, due to colonization, the quarry is under the jurisdiction of the United States, known as Pipestone National Monument in Minnesota. Canupa iŋyan is still a sacred material to Dakota people for many reasons, which Genia plays upon: Transferred into a cosmological symbol that travels to Outer Space, it becomes an artistic expression and highly evocative prayer for peace and for the strengthening of Indigenous peoples all over the globe. As an object travelling in time and space it also signifies the need for a resurgence of Indigenous knowledges in times of global crisis, where people seem to have lost their entanglement with the world.

When the sculpture returned to the earth after an extensive time in the orbit, Genia observed and documented certain changes in the work, and then honored its journey through traditional ceremonies. Similar to the legend, the artwork of the »Falling Star Woman« travelled into the cosmos and returned in a different manner when it came home. Through its journey, it gained the potency to alter the manner in which we perceive our connection to the cosmos. Outer Space, as it becomes clear, is not an ounbound region to be explored and exploited; instead, it is a rich cultural space with an ongoing history and a source of knowledges that might help to change or even to heal the way we relate to the world.

LENA VON GOEDEKE'S »MOUCHES VOLANTES«. FINITE EXPANSES AND NETWORKED INFINITY

Anna Grelik

»Space: the final frontier.« – Or is it? It is the year 2024, and we gaze at the sky above the Adventdalen in Spitsbergen through the camera lens of Lena von Goedeke, who addresses the relationship between humans and nature, as well as our position within the Critical Zone and the cosmos in her work.[1]

The conceptual artist von Goedeke, born in Duisburg in 1983, lives and works in Berlin, Dresden and Longyearbyen (part of the Arctic Archipelago of Svalbard).[2] Her artistic practice emerges from close collaboration with scientists from various disciplines, who are accompanied and observed by von Goedeke during their research expeditions to one of the northernmost points on Earth. Recently, Lena von Goedeke has artistically engaged with the remote sensing of planet Earth. The »view from above«, or satellite remote sensing, is utilised to gather information and new data about the Earth and its surface. In Arctic regions, the focus is on, among other things, developments in the cryosphere, i.e. the entirety of solid water on Earth. This data is used to record and analyse the ongoing climate processes in the polar region. Satellite images are sensory images that have to be processed using various techniques and are only created after algorithmic processing steps (using artificial neural networks) in the ground stations. The scanner systems of the satellites therefore do not collect photographs, but numerical values, which are then technologically constructed as vertical images in post-production to generate climate forecasts. It is precisely these digital satellite images that shape our ideas of the Arctic Ocean and the ecosystem, and which Lena von Goedeke scrutinises in her artistic practice. The artist experiences the vanishing landscape of Svalbard first-hand, as the habitat is threatened by severe climate-induced coastal erosion. In her work, she highlights the discrepancy between the ever-growing data quantities concerning the Arctic and the simultaneous disappearance of the landscape. To achieve this, Lena von Goedeke had to learn how to navigate both

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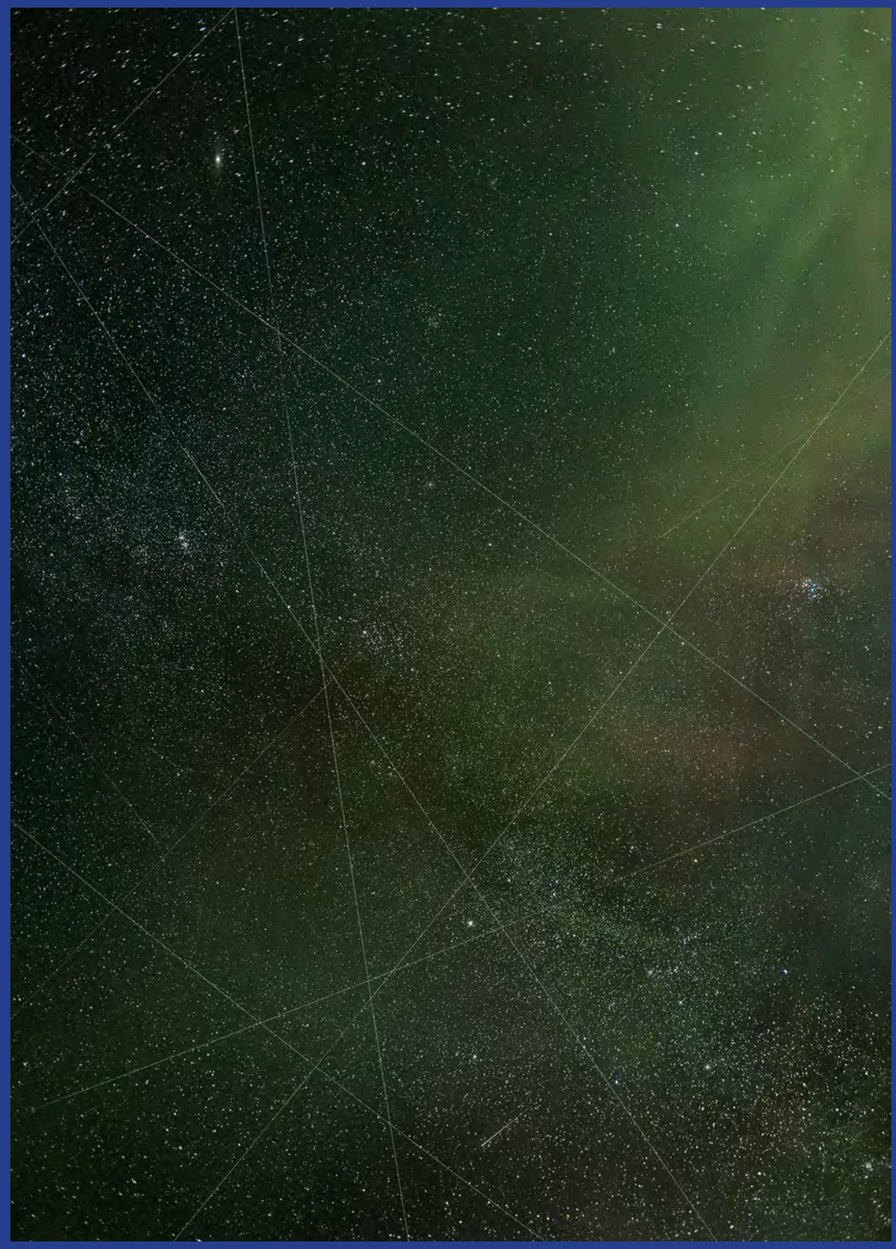


FIG. 9

Norway, specifically Longyearbyen, and the Arctic region. The climate is characterised by long, extremely cold winters. Without technical assistance, humans would not be able to survive in this part of the Earth – in this Critical Zone. Sub-zero temperatures, rapidly changing winds and the polar night mean that von Goedeke can only operate her camera without gloves for a short time, and even the equipment does not withstand the cold for long. Moreover, Svalbard's fauna is diverse and not without danger. Outside the settlements, there is a constant threat of polar bear attacks, which the artist must also consider when assembling her gear for photographic work. As a result, she ventures into the landscape armed.

Monitoring of the cryosphere is still considered inadequate, yet whether the protection of this endangered landscape (and the planet) truly relies on collecting more data is questionable. Svalbard plays a crucial role in the collection of satellite data: In the internationally-utilised (NASA, ESA, Iridium, among others) satellite receiving station, the northern hemisphere satellites are recalibrated and the collected data is downloaded. To transmit data to ground stations, the satellites must be within the visibility range of the ground station. Polar reception stations have the advantage of being able to provide satellite data particularly quickly; up to 800 satellites orbit the poles daily.

So, let's start again: »Space: the final frontier.« – Or is it? It is the year 2024, and we look through the camera lens of Lena von Goedeke. In her series »Mouches Volantes«, we observe the universe »from below« and become aware of the sensory gaze of the satellites on planet Earth. The artist uses ground-based astro-photography not only to capture the infinitely-deep starry sky above the Adventdalen – which remains bright for half the year and is immersed in darkness for the other, due to the midnight sun and the polar night – but also to highlight the satellites. Lena von Goedeke's photographs reveal something we rarely pay attention to, even though we are aware of its presence. On the one hand, she shows us the starry sky above, the nocturnal firmament with all its optical phenomena and, on the other, the artificial spacecraft – satellites – on their way around the earth. They are used to fulfil scientific, commercial or military purposes. However, the artist draws attention to a graphic phenomenon that takes place above our heads and occurs daily in a wide variety of forms. Through her photography, the satellites become visible as drawing actors.

Numerous larger Earth satellites, which orbit us at altitudes over 200 km, can be observed with the naked eye as points of light traversing the night sky. Often, we only become aware of them peripherally, as they are visible only when sunlight reflects off them. Lena von Goedeke captures the satellites, which we perceive as small points racing across the sky, as fine lines cutting through the heavens, documenting them in the photograph so that we can recognise how densely woven the net of these sensory »observers« is. And it is becoming increasingly dense! Over the decades, Earth's orbit has accumulated such a vast number of satellites, sensors, technical devices and debris – much of it consisting of defunct satellites – that it now poses a threat to new satellites and space missions.[3]

For her »Mouches Volantes« series, Lena von Goedeke shoots hundreds of photos with long exposure times so that the satellites become visible as dots in the image. Using a tracker, the camera tripod moves with the Earth's rotation, ensuring that the section of the sky remains the same. Later, the artist overlays the many images (»stacking«), allowing the individual satellite points to connect into fine lines, which then merge into networks due to their quantity. The title of the work, »Mouches Volantes« (literally »flying flies« in French), refers to the thread-like, transparent structures in the human field of vision, which shift in a fleeting manner along with the direction of gaze. Everyone experiences »Mouches Volantes«, also known as floaters in the vitreous body, at certain lighting conditions throughout their life. This phenomenon is usually harmless, yet in rare cases the vitreous opacities in the eye can become fixed and lead to impairment of the visual system.

Von Goedeke refers to this when the sublime of the starry sky is abruptly cut by the fine lines of the satellites and our view is trapped and obscured, as if by a net. The endless expanses of space no longer appear boundless. Instead, the Earth is enveloped in a dense, omnipresent web of technology, satellites and data. By drawing our attention to the traces of technology in the cosmos, Lena von Goedeke challenges us to perceive infinity not only as cosmic sublimity but also as a human-made reality – a net that densifies our conceptions of the world and its place in the universe, as humans also intervene in this seemingly-infinite space.

1 In scientific research, the »Critical Zone« is the thin, living layer of the Earth's surface where all ecological processes interact. Bruno Latour and Peter Weibel conceptualise the »Critical Zone« in the Anthropocene as both a physical and symbolic space that visualises the extensive influence of humans on the environment and condenses ecological and social conflicts. Latour and Weibel regard the Critical Zone as a laboratory for exploring the interconnectedness and vulnerability of our habitat, where humans play a central, formative role. Cf. https://www.ozcar-ri.org/the-critical-zone/ (Last checked: 01.12.2024) and: Latour, Bruno & Weibel, Peter: »Critical Zones. The Science and Politics of Landing on Earth.« ZKM Karlsruhe (Centre for Art and Media), 2021.

2 The Norwegian name means »cool coast« in English and is used for the largest island in the archipelago. The older name of the archipelago is »Spitsbergen« and was also used for the treaty of the same name in 1920, which gave Norway sovereignty over the archipelago.

3 In 2019, space expert Christophe Bonnet warned: »Today, there are already over 20,000 objects in our catalogs, of which less than ten percent are truly active. Not all of them can avoid a collision.« Bösche, Jan: »Too Many Satellites. Traffic Chaos in Space.« ARD Washington/tagesschau Online: https://www.tagesschau.de/ausland/satelliten-weltraum-101.html, as of 25 October 2019, 14:34 CET. (Last checked: 01 December 2024)

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