

The Age of Entanglements is a two-year long, cross-disciplinary project for invited designers and scientists. Conceptualized by speculative designer Jenny Lee, the project idea developed into an open call initiated by non:agency, a speculative design platform established by Jenny Lee and Petra Lilja. From an initial workshop the project evolved into a teaser exhibition and a main exhibition titled The Age of, consisting of The Age of Humans, Consciousness and Entanglements, curated by Lee, and Lilja. This catalogue gathers the eight design studios' extensive research and texts about their speculative design projects for The Age of Entanglements. The designers are: Agi Haines and Nicholas Tamás (UK/US), Cathrine Disney (UK), Fred Erik & Pleun van Dijk (BE/NL), Nonhuman Nonsense (SE), Mariah Wright (US), Pleoforma, Oscar Salguero & Zack Saunders (US), Thomas Pausz (FR) and Wang & Söderström (SE). The project is made possible by Kulturbryggan.

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~~THE AGE OF HUMANS~~

~~THE AGE OF CONSCIOUSNESS~~

THE AGE OF ENTANGLEMENTS

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*Is it easier to imagine life on Mars than to take care of life on Earth?*<sup>1</sup>

## **The Age of Entanglements**

**The Age of Entanglements project, brings together eight design studios who responded to an open call by non:agency: Agi Haines and Nicholas Tamás (UK/US), Cathrine Disney (UK), Fred Erik & Pleun van Dijk (BE/NL), Nonhuman Nonsense (SE), Mariah Wright (US), Pleoforma, Oscar Salguero & Zack Saunders (US), Thomas Pausz (FR) and Wang & Söderström (SE). Responding to what could be called a new space hype within the design field,<sup>2</sup> non:agency took a more critical stand point, asking the question: Is it easier to imagine life on Mars than to take care of life on Earth?**

**For just over a year, the designers have worked with the planet Mars as a projection plane for critique and speculation. The curatorial aim was to think outside the human-centered box, and focus on non-human others, overlooked in the current space narrative which is predominantly tech- and progression oriented. Instead of entrenching human exploitation of Mars, the designers have created scenarios and fictions that manage to put the spotlight back on Earth and its entangled life-enabling systems. Animals, plants, fungi, other living organisms and even non-sentient entities like rocks, come to the forefront in these design projects. What can we learn from stories told from the perspectives of a lichen, a space coral or an extreme bacterium?**

<sup>1</sup> Sparked by the quote, “it is easier to imagine an end to the world than an end to capitalism,” attributed to both Fredric Jameson and Slavoj Žižek as discussed by Mark Fisher in *Capitalist Realism: Is There No Alternative* (2009).

<sup>2</sup> E.g. the exhibitions *Moving to Mars* at Design Museum, London, *The Future starts here* at Victoria & Albert Museum and *ArkDes, Far Out: Suits, Habs, Labs for Outer Space* at San Francisco Museum of Modern Art, *The Moon* at Louisiana Museum of Modern Art and the design contests *The Mars Colony Prize* by Mars society and *NASA's 3D Printed Habitat Challenge*, to name a few.

### The colonial space narrative

Both private companies and governmental agencies from many countries plan missions, invest in and make commitments to long-term colonization of Mars. Currently organizations like NASA and Space X are planning landings on Mars and also to terraform the planet to make it suitable for human habitation. Space X's goal is to ship humans to Mars as early as in 2024. The main reasons for space colonization on Mars are, just like Europe's colonies of the so-called New World, economy. Efforts are made to mine asteroid belts as well

as the planet to facilitate future Mars-Earth trade. Little is discussed regarding the ethical implications of colonizing Mars, and as I see it, it is a continuation of imperialism and colonialism. Why would anyone have the right to change a whole planet to suit human needs?

<sup>3</sup> Inspired by Anna Lowenhaupt Tsing et al., *Arts of Living on a Damaged Planet* (Minneapolis: University of Minnesota Press, 2017), p.G1-G13)

Being critical of the anthropocentric and colonial aspects of space explorations, The Age of Entanglements exhibition still takes the visitor on a speculative journey to Mars, departing from Earth's ghostly landscapes haunted by the violence of modernity<sup>3</sup>. The eight design projects ask, what if focus would shift from an exceptionally human perspective, to the unseen actors, whether living or non-living matter, rendered invisible by the common design process of the current paradigm of progression? Designer Cathrine Disney is questioning the lack of debate around the affirmative colonial ideas in the current space hype. Her work takes its title from Timothy Morton's quote: "*The end of the world* is the end

of a normative, white Western world that takes itself to be coherent and smooth and top"<sup>4</sup>. Disney's performance embodies a frustration over exploitative, anti-democratic and capitalist behaviors. Her installation materializes the brokenness of unsustainable consumerism and combines it with acts of care, thinking through insects, trees and her own body.

..... We live in capitalism, its power seems inescapable—but then, so did the divine right of kings. Any human power can be resisted and changed by human beings. Resistance and change often begin in art.

—Ursula Le Guin<sup>5</sup>

### The fictional space narrative

In science fiction, the colonization of Mars is one of the most prevalent themes. Perhaps it is Mars' dramatic red color that sparked authors imagination throughout history, since early speculations that Mars might be life-supporting, preceded the space flight and other devices exploring the planet in the 20th and 21st centuries. Swedish poet Harry Martinsson, author of the poem *Aniara*, wrote about the eponymous spaceship, built for large scale emigration, leaving a toxic and radioactive planet Earth behind. Heading for Mars, it gets off track and it drifts farther and farther away until the realization occurs, that "turning back was possible no longer"<sup>6</sup>. Designers Agi Haines and Nicholas Tamás explore when bodies exposed to the low gravity of space, become altered to

<sup>4</sup> Timothy Morton, *Humankind: Solidarity with Nonhuman People* (London: Verso, 2017), p.92)

<sup>5</sup> "Ursula K Le Guin's Speech at National Book Awards: 'Books Aren't Just Commodities,'" *The Guardian* (Guardian News and Media, November 20, 2014), <https://www.theguardian.com/books/2014/nov/20/ursula-k-le-guin-national-book-awards-speech>)

<sup>6</sup> Harry Martinsson, *Aniara* (Stockholm: Albert Bonniers, 1956)

the extent that there's no turning back. In their scenario, the bodies of animals, plants and fungi are becoming alter-terrestrial. The project also hints to the question of ethics regarding the history of animals being sent to space for research purposes.

In Aniaya, Martinsson described Earth as gravely damaged, to the point that it is no longer livable. Perhaps this is not far from our current situation, as we are facing exponential disruption of earthly life-supporting systems. What if Earth will transform into an extreme, Mars-like environment, uninhabitable for humans? With the project *Making Kin*, designers Wang & Söderström question why organisms that thrive in such hostile environments are called "extremophiles". Extreme for whom? Rather, they say, this is an example of how we elevate human life. Wang & Söderström have made tactile models of microbes in a comprehensible scale for humans, with the aim to facilitate an understanding of the otherwise unseen.

.....  
I'm surprised to see people get so wildly excited about a possible bacterium on Mars when our own planet is crawling with undiscovered species.  
.....

—George Schaller<sup>7</sup>

### Exploring the Posthumanities

The *Age of Entanglements* project aims to challenge the participating designers and scientists, as well as its curators, to expand the "understandings of the multiple agencies, dependencies, entanglements, and relations that make up

our world."<sup>8</sup> as Laura Forlano describes the potential for design to look into the posthumanities. This is what anthropologist Tim Ingold addresses in his important question: How can design be more inclusive towards animals, plants, machines, artifacts or even stones and rocks?<sup>9</sup> The design duo Fred Erik and Pleun van Dijk's installation *The Body Garden*, explores the human body as a garden to grow and harvest. They propose that, for lack of better alternatives, organic waste created by the human body becomes increasingly valuable on Mars. What bodily materials can the human body produce that could benefit other species? What was once regarded as trash perhaps turns into a vital resource to sustain our everyday needs on the red planet.

Weaving together multiple sources of thought, art practice and science is what feminist posthumanists Cecilia Åsberg and Rosi Braidotti argue can be an "engine of discovery and alter-worlding device."<sup>10</sup> The *Age of Entanglements* has been supported from various researchers and practitioners, making trans-disciplinary discussions possible around the designers' speculative approaches as well as the nonhuman topics.<sup>11</sup> One of my initial curatorial questions related to feminism. Would the notion of care materialize itself in any of the designer's projects? Especially, Maria Puig de la Bellacasa's notion of care, "as a parameter of existence, tran-

<sup>7</sup> George Schaller, *Awake!* Magazine (1998)

<sup>8</sup> Laura Forlano, "Posthumanism and Design," *She Ji: The Journal of Design, Economics, and Innovation* 3, no. 1 (2017): pp. 16-29, <https://doi.org/10.1016/j.sheji.2017.08.001>

<sup>9</sup> Tim Ingold, "Materials against Materiality," *Archaeological Dialogues* 14, no. 1 (April 2007): pp. 1-16, <https://doi.org/10.1017/s1380203807002127>

<sup>10</sup> Cecilia Åsberg and Rosi Braidotti, *A Feminist Companion to the Posthumanities* (Cham: Springer International Publishing, 2018), p.3

<sup>11</sup> A list of the collaborators involved in *The Age of Entanglements* project can be found in this catalogue.

scending the human for something more than, where making time for care appears as a disruption of anthropocentric temporalities.”<sup>12</sup>

Designer Mariah Wright chose to work with care for human-microbiome relationalities in her project *Mother Culture*. Predicting a first-generation human on Mars not being able to give birth due to low gravity, she is proposing the use of technological, external wombs. However, her work is not so much about technological devices. Rather, Wright is putting a spotlight on the fact that multitudes of bacteria have co-evolved with humans, passed down from mother to child, since the beginning of human history. In Wright’s scenario, these fragile bacterial colonies, one of our last links to the diversity of earth, have become our most valued inheritance. Wright speculates that this hidden world of bacteria might in the future travel to Mars as the colonies within the colonizers.

<sup>12</sup> María Puig de la Bellacasa, *Matters of Care: Speculative Ethics in More than Human Worlds* (Minneapolis: University of Minnesota Press, 2017), p.23)

<sup>13</sup> Anthony Dunne and Fiona Raby, *Speculative Everything: Design, Fiction, and Social Dreaming* (MIT Press, 2014)

<sup>14</sup> A term developed by Ola Ståhl and Sara Hyltén-Cavallius and Petra Lilja in a series of workshops.

### Speculative design

Design has a long-standing relation to speculation, one could say all design is more or less speculative. Especially commercial design uses creativity as a tool for coming up with new ideas and selling future technology. In its making, design predicts the behaviors of its users to a certain extent. In the book *Speculative Everything: Design, Fiction, and Social Dreaming*, Anthony Dunne and Fiona Raby opened up for critical, speculative design, working conceptu-

ally with criticality, imagination and materiality.<sup>13</sup> Such design practices have been both cheered and critiqued, evolving and mutating ever since. The Age of Entanglements makes use of speculative design because it is an alternative approach to the market-driven, solution-oriented design. Speculative approaches, or what we can call *fictionings*<sup>14</sup>, are capable of enabling stories and ideas to become constructed realities when given form and materiality as objects, moving images and performances. Studio Pleoforma is creating posthuman fictions set on Mars. The project *A False Encounter*, is a far-future scenario, a poetic tale in which the main character is a lichen, the only surviving specimen of a late Mars exploratory mission. The plot unfolds into a relational drama between the lichen and an ancient Martian basalt rock, registered by a long-abandoned Mars rover. A merging of worlds, as Pleoforma puts it, when all of Mars is a rock and all of Earth is a single lichen...

The design studio Nonhuman Nonsense on the other hand, brings the Martian matter closer to Earth’s political worlds of today. In their work *Planetary Personhood*, they are proposing independent personhood for the entire planet of Mars. Their proposal is a critique of the normative way of discussing Mars as an empty place. As scientists continue to search for microscopic forms of life *Planetary Personhood* takes the opposite approach extending compassion and respect beyond the (constructed) life-nonlife boundary.

Towards an understanding of entanglements  
From my curatorial perspective, it became clear at

<sup>15</sup> Lynn Margulis and Dorian Sagan, *Dazzle Gradually: Reflections on the Nature of Nature* (White River Junction, VT: Chelsea Green, 2008)

<sup>16</sup> Laura Forlano, "Post-humanism and Design," *She Ji: The Journal of Design, Economics, and Innovation* 3, no. 1 (2017): pp.16-29, <https://doi.org/10.1016/j.sheji.2017.08.001>, p.17

an early stage of the project, that one of the most important stories for The Age of Entanglements project to narrate, was the one of life as symbiotic entanglements across bodies, questioning the current issues of human exceptionalism on Earth. Designer Thomas Pausz is inspired by the powerful idea of "symbiotic life", championed by microbiologist and evolutionary theorist Lynn Margulis. Pausz states that our ideas about life in outer space are no exception: to

truly dream of *another* Earth, the current utilitarian projections and techno-fantasies must be decolonized. In his project Spacecoralia, Pausz draws parallels between mutual collaborations in symbiotic life underwater and possible life in outer space.

Without microbes, life's essential processes would quickly grind to a halt, and Earth would be as barren as Venus and Mars.

—Lynn Margulis & Dorian Sagan<sup>15</sup>

What can we learn from the designers' future scenarios? Perhaps, that The Age of Entanglements is not about the future at all, but rather about the present. Not about space, but about Earth. Neither about aliens, but about the human as an ecosystem. This two-year long project has been a collective learning process. A curatorial wish to challenge the normative field of design, by encouraging emergent design perspectives that "might better support values such as equality

and justice for humans and nonhumans that have been traditionally ignored in design processes", to quote Laura Forlano.<sup>16</sup> What we can conclude is that this exhibition is neither a final product of a design process, nor does it offer solutions. I believe it is part of a continuous process that has made us humbly aware of how difficult it is to step out of our human-centered mindset and how privileged we are to be able to speculate in plausible futures at all.

It is also a call to continue exploring how design can blur the lingering boundaries between nature and culture even more, and question the living/non-living binaries. A design- and curatorial challenge that I will bring with me into the future, is exploring ways to work beyond the representational and symbolic, since we believe that greater change in the design field only can happen if we approach our practice as becomings in the world.

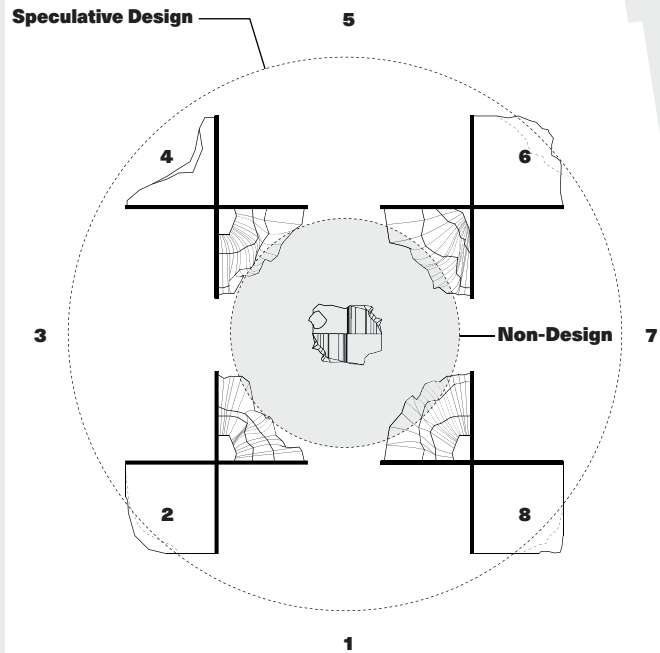
<sup>17</sup> Donna Jeanne Haraway, *When Species Meet* (Minneapolis: University of Minnesota Press, 2008), p.244)

If we appreciate the foolishness of human exceptionalism then we know that becoming is always becoming with, in a contact zone where the outcome, where who is in the world, is at stake.

—Donna Haraway<sup>17</sup>

Petra Lilja





- 1** Pleoforma
- 2** Wang & Söderström
- 3** Thomas Pausz
- 4** Agi Haines & Nicholas Tamás
- 5** Cathrine Disney
- 6** Fred Erik & Pleun Van Dijk
- 7** Nonhuman Nonsense
- 8** Mariah Wright

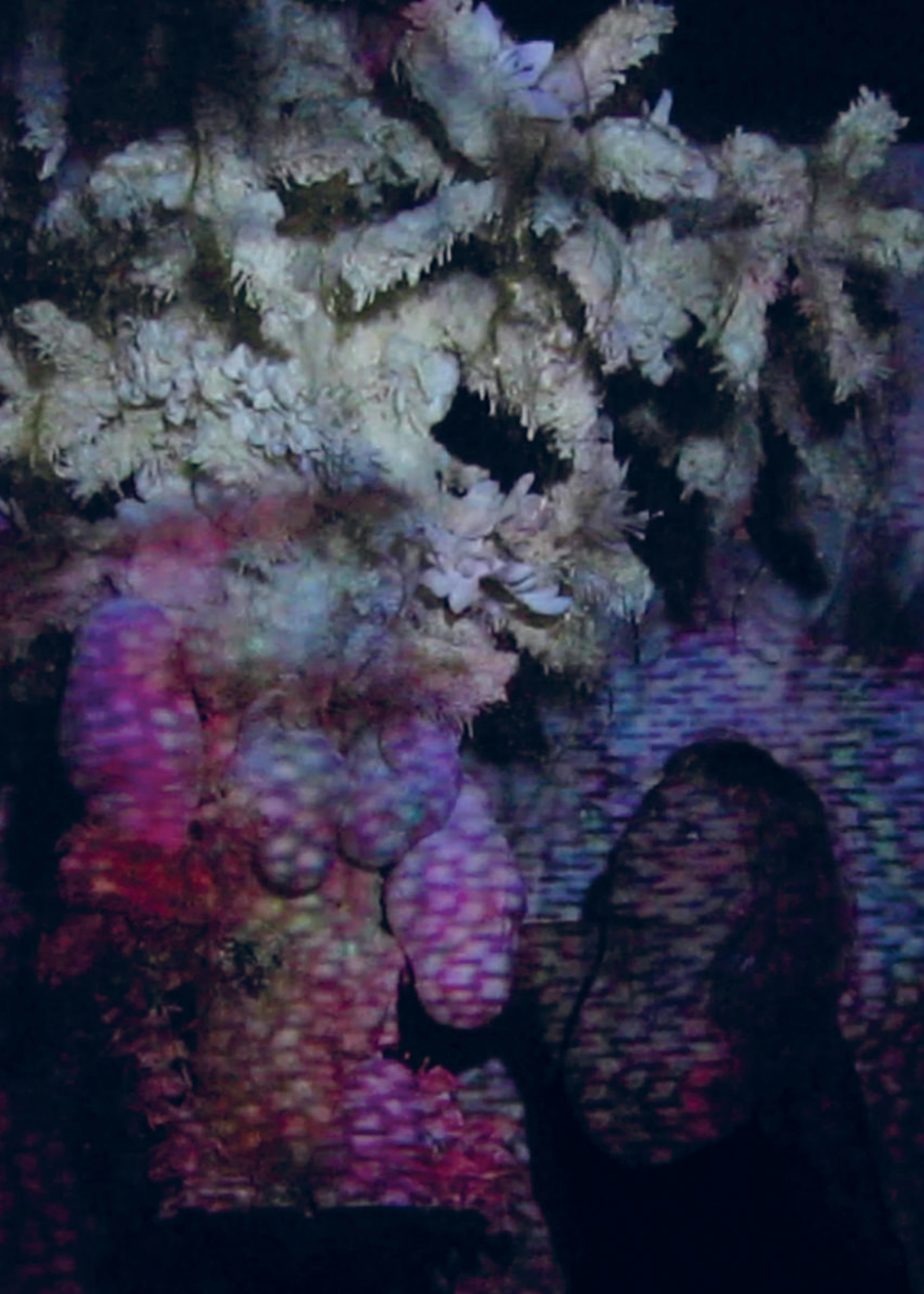
The exhibition design maps the ratio between our current familiar environment and unknown speculative future environments, Nondesign and Speculative design.

The inner circle maps our current familiar environment—a dream of a world in infinity on planet Earth. The gaze of infinity questions the human centered anthropocentric age. The projects in the outer circle investigate unknown speculative future environments—preparing for a life on planet Mars.

Our biospherical essential lithosphere (i.e earth layers, minerals, organic and unorganic materials) and us shaping it, serves as narrative tool.

It is time to widen and translate the visual language of form and colours, to a design that moves further than symbolism and interpretation, towards reality and alive spaces. Design that is both meaningful and problematize itself.

*Tove Alderin*  
*Artistic director of TAS*



*THE END OF THE WORLD*

*by*

*CATHRINE DISNEY*

Is the race to colonise Mars the fourth wave of colonialism?

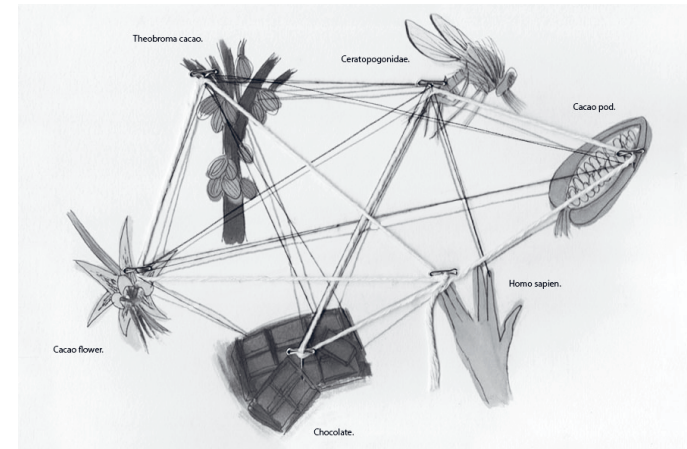
*Exploring the entanglements between the human and non-human in the colonial race to Mars, unravelling the complex structures of exploitation in a consumer/producer relationship that binds together the human being, the biting midge, the cacao tree and capitalism.*

We are living in the age of entanglements; whether we consciously acknowledge the powers at play or not, multiple species are enmeshed in ways that can not be unbound. We can untangle the knots, but we will forever be entwined by the same thread. Professor Donna Haraway explains “we require each other in unexpected collaborations and combinations, in hot compost piles. We become-with each other or not at all”<sup>1</sup> though most of the human species refuse to acknowledge this.

In our exploitative, unsustainable, anti-democratic, capitalist, consumerism-driven society, the rise of economic inequality, escalating climate crisis and erosion of human and non-human rights across the world, makes way for an inconspicuous utopian vision to inhabit Mars. Elon Musk, Tesla billionaire and founder of Mars mission, Space X, claims, “you want to wake up in the morning and think the future is going to be great—and

that's what being a spacefaring civilization is all about. It's about believing in the future and thinking that the future will be better than the past. And I can't think of anything more exciting than going out there and being among the stars.”<sup>2</sup>

The current state of our dehydrated, exhausted and suffocating planet can not be determined as the fault of the entire human



Species entanglement of *Theobroma cacao*, *Ceratopogonidae* and *Homo sapien*.

<sup>1</sup> Donna Jeanne Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham: Duke University Press, 2016)

<sup>2</sup> Spacexcmsadmin, “Making Life Multiplanetary,” SpaceX (SpaceX, September 20, 2016), <https://www.spacex.com/mars>

<sup>3</sup> Rupert Neate, “Richest 1% Own Half the World’s Wealth, Study Finds,” *The Guardian* (Guardian News and Media, November 14, 2017), <https://www.theguardian.com/inequality/2017/nov/14/worlds-richest-wealth-credit-suisse>)

<sup>4</sup> Carolyn Gallaher et al., *Key Concepts in Political Geography* (Thousand Oaks, CA: Sage, 2010)

<sup>5</sup> “Mission,” Mars One, accessed November 19, 2019, <https://www.mars-one.com/mission>)

species, but that of a unique self-identifying class of humans known as ‘the 1%’<sup>3</sup>. They are the colonisers; the kings of vertical integration; the masters of oligopoly and political corruption.

According to Mary Gilmartin, Professor of Geography at Maynooth University, Ireland, three prior waves of colonialism were linked to capitalism. The first wave of European expansion involved exploring the world to find new revenue and perpetuating European feudalism. The second wave focused on developing the mercantile capitalism system and the manufacturing industry in Europe. The third wave of European colonialism solidified all capitalistic endeavours by providing new markets and raw materials.<sup>4</sup> Now that the Earth is drained of all its resources, they’re moving onto the next business venture: Colonising Mars.

To colonise Mars is not an opportunity to start again with a clean slate or to do it right this time. To claim it as the next giant leap for humankind is to justify the greed-fuelled enslavement of the non-human, and often even the human, by the 1%.<sup>5</sup> In consideration of the current state of global politics, the race to Mars is another shocking reminder that, yet again, we may be heading towards the fourth wave of colonialism. To be colonised means to be disconnected and disintegrated from ancestry and land based knowledge, colonisation is supported by supremacy and capitalism. In today’s society, there are three layers of supremacy commonly found; White supremacy—this legitimizes slavery and provides cheap labour for capitalism, as well as legitimizing genocide and supporting resource grabbing for capitalism; Human supremacy—this legitimizes ecocide (ecological destruc-

tion) and the exploitation of resources; and Male supremacy and patriarchy—this legitimizes femicide, domestic violence, and child abuse whilst also creating ‘invisible labour’ that is not compensated for in capitalism.<sup>6</sup>

During the colonial conquest of the Americas in the 1500s, Cacao, among many other consumables, was colonised. Over 99% of the population, along with their wisdom, culture and spiritual practice, was eradicated by disease and violence in a massive cultural genocide. White supremacy justified slave labour and poverty level wages to get more cacao for cheaper. To this day cacao is still grown in the context of an extractive capitalist system in countries where political and economic realities are determined by the descendants of the original colonizers.<sup>7</sup>

Ceratopogonidae, or the biting midge, also known as ‘no-see-ums’, are a very small blood feeding biting insect well known in the Scottish Highlands. This tiny insect is one of many few small enough to pollinate the complex reproductive structure of the Cacao tree and producers are worried about its ongoing supply. Chocolate is an \$80 billion year industry with 3.5 million tonnes produced annually, a figure set to increase to 4.5 million tonnes by 2020. Traditionally the tree has been grown on small-scale farms but these are becoming increasingly affected by stochastic weather patterns, growth in the numbers of pests and diseases and by political instability in many of the countries where the cacao tree is grown. The pollinating flies thrive in damp and shady conditions and require aquatic, semi-aquatic or moist soil conditions for their larvae to develop in, but on cultivated farms many trees are removed to create more space for the cacao, destroying their habitat.<sup>8</sup>

<sup>6</sup> “Decolonization of Cacao,” Firefly Chocolate, accessed November 19, 2019, <https://ceremonial-cacao.com/pages/decolonize-chocolate>)

<sup>7</sup> Ibid.

<sup>8</sup> Erica McAlister, *The Secret Life of Flies* (London: Natural History Museum, 2018)

9 Val Plumwood, "Human Vulnerability and the Experience of Being Prey," *Quadrant* (Quadrant Magazine Limited), accessed November 19, 2019, <https://search.informit.com.au/documentSummary;dn=276838296188087;res=IELLCC>

This excessive demand for chocolate, along with a number of iconic consumer goods of the 21st Century; plastic straws, artificial christmas trees and disposable coffee cups are quintessential symbols of our capitalist society. Whilst it may be seductive to dream of inhabiting Mars to create a new world full of opportunity and promise, leaving behind

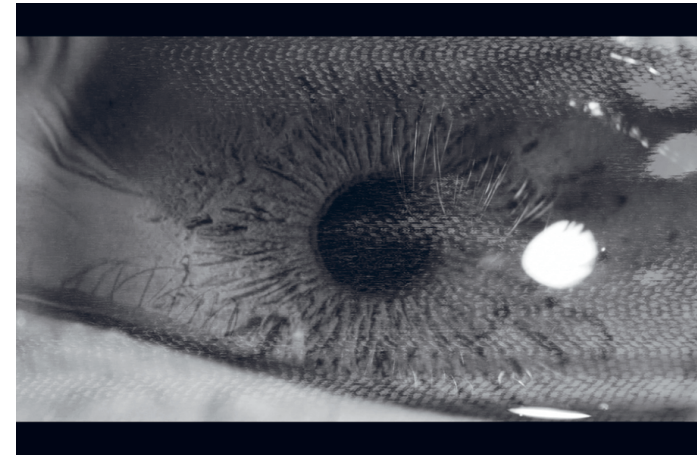
the devastation and destruction of the planet Earth, if we continue attempting to master and control all others, the human species is failing to recognise the very same perils as history repeat itself again.

Our human-centred view and perceived dominance over other species has provided us with a false sense of justification to ignorantly exploit and consume; how can we encourage a sense of mutuality, empathy and reciprocity? Feminist philosopher, Val Plumwood, provides her perspective after surviving a horrific crocodile attack. Recalling her near-death experience, she explains:

“Before the encounter, it was as if I saw the whole universe as framed by my own narrative, as though the two were joined perfectly and seamlessly together. As my own narrative and the larger story were ripped apart, I glimpsed a shockingly indifferent world in which I had no more significance than any other edible being. The thought, This can't be happening to me, I'm a human being. I am more than just food! was one component of my terminal incredulity. It was a shocking reduction, from a complex human being to a mere piece of meat. Reflection has persuaded me that not just humans but any creature can make the same claim to be more than just food. We are edible, but we are also much more than edible.”<sup>9</sup>



The End Of The World by Cathrine Disney. Installation, mixed media.



The End Of The World by Cathrine Disney. Video collage.

By considering the human, not as the dominant species, but as a single part of nature by mindfully placing ourselves back into the food chain, perhaps we can encourage multi-species living. What if we were able to see ourselves not at the masters of the universe, but simply as one? We recognise that we as humans are made up of blood, water, muscle, skin, bone, hair and fat, the very same materials as many other species, but not only are we that, we are also the neurons that carry our thoughts, our memories and our imaginations. Furthermore, we are the chemical reactions that turn the food we eat into the energy we need to think, to speak, to sing, to dance, to dream and to remember. We are an astonishing complex structure of elements and atoms combined in a 'perfect' mass that assembled in the form of a human being.

Evolution teaches us how these complex structures have created a variety of life forms; fish, birds, mammals, fruits, vegetables and trees. All exist also as 'perfect' masses in their own ways, as do what we might also consider as non-living non-humans such as stones, mountains, volcanoes, clouds and oceans. All solids, liquids or gases, whether human, non-human or non-living are a careful and unique combination of complex atoms aligned by forces and energy unseen by the human eye. If I die, you will burn my body and I am dust once again. We (the universe) are the very same substance, we are everything. With this knowledge, to harm ourselves, others or to exploit, exhaust, dehydrate and suffocate this planet (Earth) or any other planet (Mars, the Moon) is nonsensical when we are just one.

If we fail to recognise who and what we are made of; if we continue to justify our exploitative, unsustainable, anti-democratic, capitalist, consumerism-driven behaviours under the guise that we are simply just "human", if

we refuse to stay with the trouble and colonise Mars, our agonizing history will continue to repeat itself in a never-changing ongoing cycle of destruction and devastation.



**SKIN**

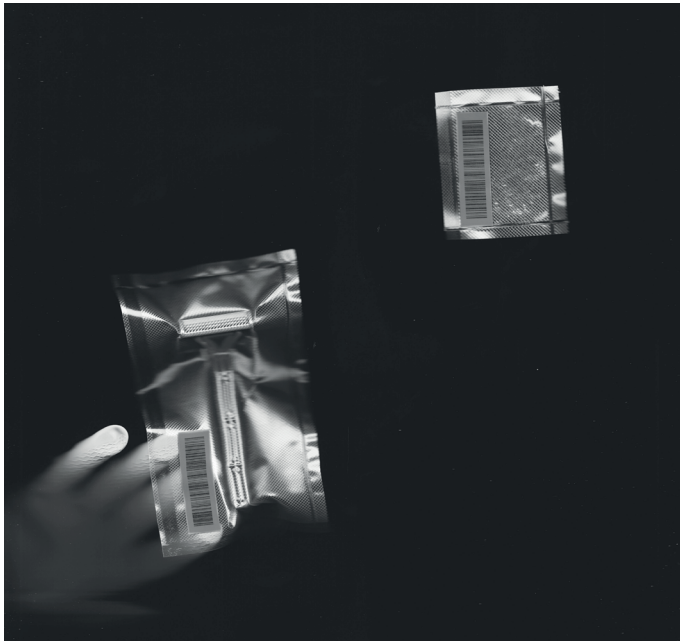
**MATERIALS**  
keratin

**RESIDENTS:**  
Staphylococcus epidermidis, Staphylococcus aureus, Staphylococcus warneri, Streptococcus pyogenes, Streptococcus mitis, Cutibacterium acnes, Corynebacterium spp, Acinetobacter johnsonii, Pseudomonas aeruginosa, Candida albicans, Rhodotorula rubra, Torulopsis, Trichosporon cutaneum, dermatophytes, Microsporum gypseum, Trichophyton rubrum, non-dermatophyte, Rhizopus stolonifer, Trichosporon cutaneum, Fusarium, Scopulariopsis brevicaulis, Curvularia, Alternaria alternata, Paecilomyces, Aspergillus flavus

*by*

### Project beginnings

Decreasingly a distant dream, the idea of colonising Mars is slowly getting closer. We have a new blank piece of paper in front of us. Untouched, barely discovered and with just a small amount of local resources to start from. Contrary to the sleek sci-fi bliss of Hollywood movies, filling in this page will be difficult, conflicting, and challenging.



Beard hairs and the tool needed to harvest them.

The first humans to set foot on Mars will find themselves in a unique, unfamiliar position. They will be—as far as we know—the only organic beings on the red planet. For lack of better alternatives, waste created by the human body becomes increasingly valuable. What was once

regarded as trash becomes a goldmine of unexplored possibilities. Harvesting this mine only seems to be a logical step in the context of a bigger self-sustaining system.

The human body is in a constant state of renovation, producing skin, hair, and sweat among others. The Body Garden aims to be a speculative research project where the potential of human body material is explored. This organic material is approached as part of a bigger process, in which the natural geological resources of Mars and local parameters are taken into account.

Beyond the reality of going there, speculating about these possibilities will be most valuable. Mars might be the mirror reflection we need to rethink our everyday lives on earth.

### Subsequent Research

For her graduation project—similarly called ‘The Body Garden’—Pleun van Dijk explored the grotesque side of the human body by investigating the rich variety of materials our bodies produce. It served as a base for our research, in which the main project vision was repositioned in an interplanetary context.

Everyday we are being exposed to an endless stream of photos and images. We see beautiful clean polished bodies, stripped of anything that might make it look grotesque. This gives us the illusion of a finished and controllable body, something far away from reality. The human is always in process and in a state of renovation. Everything that lost its function will be pushed off, we constantly lose skin, hair, saliva, snot, sweat etc. Most things we lose without being aware of it. We call this body waste but in fact this waste is full of hidden information. It is a microscopic world that we find difficult



to understand and comprehend. By zooming in on what is normally hidden, it tells us a visual story and changes our view on our own body waste.<sup>1</sup>



© Photography, Bart Schouten

Interactive installation at Eye Filmmuseum Amsterdam.

Beyond being a speculative research, the body garden is aligned with scientific research currently being undertaken by various institutes. An example is MELiSSA, or Micro-Ecological Life Support System Alternative, which aims to develop a regenerative life support system for long term human space missions. The project makes use of the most 'mainstream' bodily materials, like sweat, urine and faeces.

For us, getting in touch with individuals behind the extensive team of the MELiSSA project was important to get a sense of what's happening in the scientific field, and to ground the relevance of our project. Besides adding confidence to our more speculative research, the project also influenced the selection of bodily materials we focused on in our final project. If mainly focussing on

urine and faeces, the projects would neglect the rich variety of organic materials our bodies produce. Therefore, we decided to highlight materials that usually go unnoticed in scientific research on regenerative life support systems.

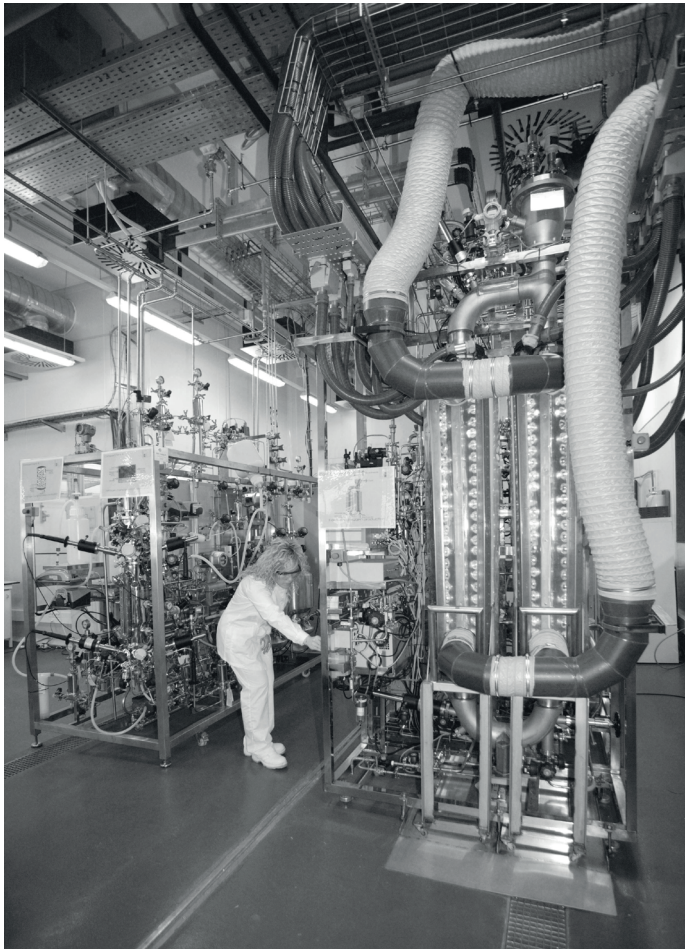
Another scientific, almost performative experiment/research which related to our project is HI-SEAS.

The Hawaii Space Exploration Analog and Simulation (HI-SEAS) is an analog habitat for human spaceflight to Mars. HI-SEAS is located in an isolated position on the slopes of Mauna Loa volcano on the island of Hawaii. The area has Mars-like features and an elevation of approximately 8,200 feet (2,500 m) above sea level. The first HI-SEAS study was in 2013 and NASA's Human Research Program continues to fund and sponsor follow-up studies. The missions are of extended duration from four months to a year.<sup>2</sup>

During the HI-SEAS IV mission, 6 crew members lived for exactly 1 year in a fictive settlement as if they were on Mars. The experiment's aim was to conduct research on the effects on human behaviour in this specific context. During the analogue mission, crew members collected bodily materials with the aim of fueling a regenerative system. Getting in touch with one of the crew members felt as close as we could get to talking to a Martian. We wondered how the mission affected their view on their bodies and if it influenced their perception towards bodily materials.

<sup>1</sup> Dijk, Pleun van. "THE BODY GARDEN - RESEARCH." Pleun van Dijk. Accessed November 13, 2019. <http://www.pleunvandijk.com/the-body-garden-research>.

<sup>2</sup> "HI-SEAS." Wikipedia. Wikimedia Foundation, October 15, 2019. <https://en.wikipedia.org/wiki/HI-SEAS>.



© UAB

A view inside the MELiSSA pilot plant at the Universitat Autònoma of Barcelona.

FE

We know that during the mission, you and other crew members were collecting faeces for agricultural purposes. Can you tell a bit more about it?

CV

Yes, we didn't use it because we were' allowed to because of hygiene and safety reasons. We were basically using a composting toilet in which microbes were turning feces into compost. Then we gathered the compost and just stored it in bags. We didn't use it for agriculture, but on Mars you could try to get nutrients back.

FE

We learned that from time to time there were problems with this toilet?

CV

Yes, normally the microbes turn faeces into compost which is odorless and almost dry. But the microbes were not really happy and it took us months to get it to work properly. So for months we had this liquid thing which smelled really badly. We often had to open up the bathroom and clean this liquid mess. It was smelling in the whole habitat.

FE

How did you feel about this? Especially since in western culture, going to the toilet is something very private?

CV

It was smelly for sure and the cleaning was almost like speleology since you had to unmount the thing and clean all the hidden parts. We had to completely cover ourselves because there was no way to do that in a clean way. It was rather messy.

FE Were there besides feces any other bodily materials that you were collecting during the mission?

CV Urine as well, normally it also went into the toilet but since the compost was really liquid we had to collect it in cans while trying to fix it. Apart from that we tried to compost the food waste. We used a system called anaerobic composting where you put the waste in a bucket, and some microbes and close the lid. It makes a compost which doesn't smell bad.

FE And then afterwards you can use that for...

CV You can use it as nutrients for plants.

FE But once again you weren't allowed to use it?

CV We could have used it but we didn't have the right facilities and were producing much more than we could use. But on a real Mars mission you would try to recycle all the nutrients.

FE What was happening with for example your hair after you got a haircut during the mission?

CV We would put it in general waste afterwards we would store it.

FE How and why did you do that?

CV We would store it outside under the solar panels.

Human-centrism & Interspecies relationships

The act of colonising another planet can be described as arrogant and extremely human centered. Given the short time-frame of our project (approx 50-100 years) we continue surfing this wave not because we believe it is the right thing to do, but because it exposes the status we grant ourselves.

Therefore, our Mars-based, human-centred approach, amplifies the egocentric position humans have within the ecosystem on Earth. It illustrates the unfulfilled potential and one-sided relation of the human body within a multi-species ecosystem.

The scarcity of resources on Mars therefore exposes our questionable relation with other life forms on Earth. It illustrates our dependance on species while we—mistakenly?—positioning ourselves as a dominant form of life.

The Body Garden can therefore both be seen as mirror to question our role on Earth, and a stepping stone to reposition ourselves within an interplanetary context. What started as a human-centred project, could eventually turn into an engine which fuels a bigger independent eco-system in which both humans and other species co-exist.

#### Final Project

For our final project, we have canalized our research findings in 3 conversation pieces which each talk about a specific bodily material: hair, skin and sweat. Evoking the aesthetics from vertical farms, each 'sculpture' consists out of 3 parts which focuses on a different parts of building a regenerative system. First we have the tool(s) needed to harvest, second the harvested material and third the application of the bodily material within the process. This

last step will elaborate on 3 different aspects of a regenerative system: creating clean water, creating oxygen and the production of food. The outside of the greenhouses will be imprinted with information and reflect both the volume's content and its surroundings. It creates an extra visual layer which aesthetically dehumanizes the installation as a whole and forces us to perceive it as an independent system. Overall, the installation questions if this human-centered approach to space colonization is that human-dependent after all?



*ALTER-TERRESTRIAL*

*by*

*AGI HAINES & NICHOLAS TAMÁS*

When does terrestrial life become alien?

In the endeavour to reach increasingly beyond earthly limits, various living creatures have been exposed to the harsh environments of space travel. As missions lengthen so does knowledge regarding impacts of long-term space expeditions on the character and composition of those beings jettisoned away from their terrestrial home.

Currently when biological beings return from space they attempt to readapt and reintegrate, often with long-term physiological problems. But longer periods of time away from earth may result in changes which may alter the forms of these beings irrevocably. Therefore the environment of space travel will re-shape and re-design the life originating from earth as we know it.

These modal specimens reveal how beings, at one time thought to be terrestrial, change to the point that reintegration on earth would no longer be possible. For these beings the off planet environment has become the norm and their morphological changes make them alien from earth life.

These biological beings are in a sort of adaptive purgatory, not yet fully comfortable in the new environment of space but also no longer finding comfort on their home planet. They are 'alter-terrestrials', not quite terrestrial, being of or from earth, and not quite extra-terrestrial, being of or from space, the alter-terrestrial is a being that exists in-between. These modals show examples of the altered morphological forms that might be the stepping stones to life elsewhere.

#### Research

In 1986 Kentucky Fried Chicken (KFC) funded a project sending twelve white leghorn chicken eggs into space<sup>1</sup>.

The project, initially a concept developed by middle schooler John Vellinger, was the second of only two avian experiments in the history of space travel, of which no more have been conducted. The research by Vellinger, otherwise known as Chix in Space explored the possibilities of embryos in space, birth beyond earth and the complexities of incubation in low gravity. But its association with KFC, a multinational fast food corporation suggests transferring industrialised mechanisation of non-human beings beyond the stratosphere<sup>2</sup>. As though the often problematic processes of earth life will be mirrored in the creation of domestic life off planet. This experiment, although radically valuable in terms of the range of knowledge it produced, like many other non-human space experiments represents the anthropocentric values entrenched in current space research. Where non-human beings are predominantly the canaries in the coal mine, the modal organisms or the food<sup>3</sup> when it comes to the exploration of life away from earth.

In a paradigm shift towards global space exploration<sup>4</sup>, frameworks in favour of the well being of living cargo might be implemented since stray dog Laika's one way ticket in Sputnik II in 1957, for which there was no re-entry strategy<sup>5</sup>. Laika's fate to die in orbit when the power eventually ran out, although an isolated and frightful destiny for an unwilling astronaut, was probably in fact a less horrific idea than the most probable cause of death, being boiled alive as the cabin overheated. In more recent missions,

<sup>1</sup> Gregory Byrne, "Chix in Space," *Science* 240, no. 4858 (October 1988): pp. 1411-1411, <https://doi.org/10.1126/science.240.4858.1411-b>

<sup>2</sup> Sigfried Giedion, *Mechanisation Takes Command: a Contr. to Anonymous History* (New York: Oxford Univ. Pr., 1970)

<sup>3</sup> Colin Burgess and Chris Dubbs, *Animals in Space: from Research Rockets to the Space Shuttle* (New York: Springer, 2007)

<sup>4</sup> P. Ehrenfreund and N. Peter, "Toward a Paradigm Shift in Managing Future Global Space Exploration Endeavors," *Space Policy* 25, no. 4 (2009): pp. 244-256, <https://doi.org/10.1016/j.spacepol.2009.09.004>

<sup>5</sup> Alice George, "The Sad, Sad Story of Laika, the Space Dog, and Her One-Way Trip into Orbit," *Smithsonian.com* (Smithsonian Institution, April 11, 2018), <https://www.smithsonianmag.com/smithsonian-institution/sad-story-laika-space-dog-and-her-one-way-trip-orbit-1-180968728/>

**6** Taylor, Lin. "Astronauts Grow First Zinnia Flower in Space." CNN. Cable News Network, January 18, 2016. <http://www.cnn.com/2016/01/18/world/first-space-flower-iss/>

**7** Peter N Witt, David P Peakall, and Raymond L Gause, "Spider Web-Building In Outer Space: Evaluation Of Records From The Skylab Spider Experiment," *The Journal of Arachnology*, 1977)

**8** Jon Ronson, "Jon Ronson Is Ready for Blast-off. Is Richard Branson?," *The Guardian* (Guardian News and Media, February 21, 2014), <https://www.theguardian.com/science/2014/feb/21/jon-ronson-virgin-galactic-richard-branson-future-atronauts>

**9** Carl Sagan and Ann Druyan, *Pale Blue Dot: a Vision of the Human Future in Space* (New York: Ballantine Books, an imprint of The Random House Publishing Group, a division of Random House, 2011)

**10** Thomas T. K. Zung and Michael A. Keller, *Buckminster Fuller: Anthology for the Millennium* (Carbondale, IL: Southern Illinois University Press, 1969)

researchers have worked on the well being of space plants<sup>6</sup> and become attached to spiders building webs in low gravity<sup>7</sup>. Some designers have even considered the perception of using non-humans in spaceflight by beings not originating from earth, as interior designer Adam Wells comments on the use of animal products when working for Virgin Galactic.

... "Leather would be a temptation for a high-end product, but it would be an odd thing to line the interior of your state-of-the-art spacecraft with a fellow earthling's skin." He pauses. "We think about this stuff a lot –about what's right and wrong."<sup>8</sup>

As space flights become less fleeting the relations between biological beings are increasingly put into question. It seems as though there is a developing concern for the welfare of non-humans in space. So how can we better prepare for a multi-species existence in space to reach the ultimate goal of maintaining a healthy and sustainable ecosystem for all living cargo during space flight and beyond?

In the famous words of Carl Sagan "Visit, yes. Settle, not yet"<sup>9</sup> it is clear that just like spaceship Earth, the whole universe is void of an instruction booklet<sup>10</sup>. Even if beings and materials of earth are shipped into space, it is a challenge to envision how the resources

used by and made from those beings might transform under new conditions. Therefore in order to imagine how to settle elsewhere, we must remember that, as on earth, living beings are rarely stable reference points, they

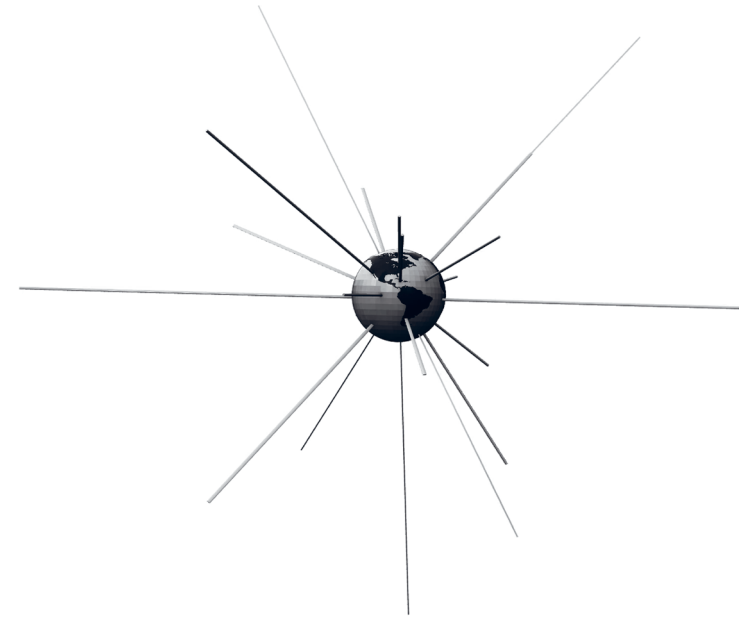


Illustration mapping the distance in time away from earth in which different species would become 'alien' (they would struggle to reintegrate) by Agi Haines and Nicholas Tamás.

are dynamic entities susceptible to consistent change. In a similar experimental scenario to Chix in Space in 1991 a payload of 2,478 jellyfish polyps were carried on the shuttle Columbia. After growth and reproduction there were some 60,000 jellyfish orbiting the earth. The jellyfish born in space seemed to acclimatise and successfully function in their new home, although on their return struggled with the constraints of earth's gravity<sup>11</sup>. It seemed they had adapted, forming a new trajectory of modifications for life away from earth. Their struggle to reintegrate causing them to become alien from earth life.

**11** D.b. Spangenberg et al., "Graviceptor Development in Jellyfish Ephyrae in Space and on Earth," *Advances in Space Research* 14, no. 8 (1994): pp. 317-325, [https://doi.org/10.1016/0273-1177\(94\)90418-9](https://doi.org/10.1016/0273-1177(94)90418-9)

“Every slight modification, which in the course of ages chanced to arise, and which in any way favoured the individuals of any of the species, by better adapting them to their altered conditions, would tend to be preserved”<sup>12</sup>

It seems that for successful multi-species space travel the complexities of life on earth can not be emulated to suit the vastly different environments of space<sup>13</sup>. In this familiar Darwin quote it may be best to first consider the trajectory of adaptations and which of those might be preserved when exposed to long term space travel in order to then consider the complex networks of how the ecosystems of life might thrive away from our planet.

#### Speculative future beings

Alter terrestrial is an ongoing project exploring case studies of beings originating from earth and their speculative adaptations to long term space life. In the Age of

Entanglements exhibition three creatures are modelled presenting the initial adaptations to a life elsewhere. These models are based on current studies of human and non-human morphology and well being in space travel and show the shifting forms of creatures which through their adaptations would struggle to reintegrate back on earth, but have started the adaptation process to the harsh conditions

of space environments. The alter-terrestrials imagined may not necessarily survive on the outer limits but reveal symptoms of the strive to get there.

<sup>12</sup> Charles Darwin, *The Origin of the Species* (Place of publication not identified: Pacific Publishing Studio, 2010)

<sup>13</sup> In conversation with Dr Mick Hanley, Associate Professor in Plant-Animal Interactions, School of Biological Sciences University of Plymouth.

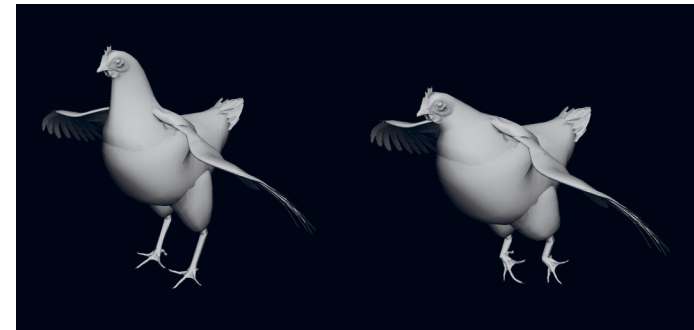
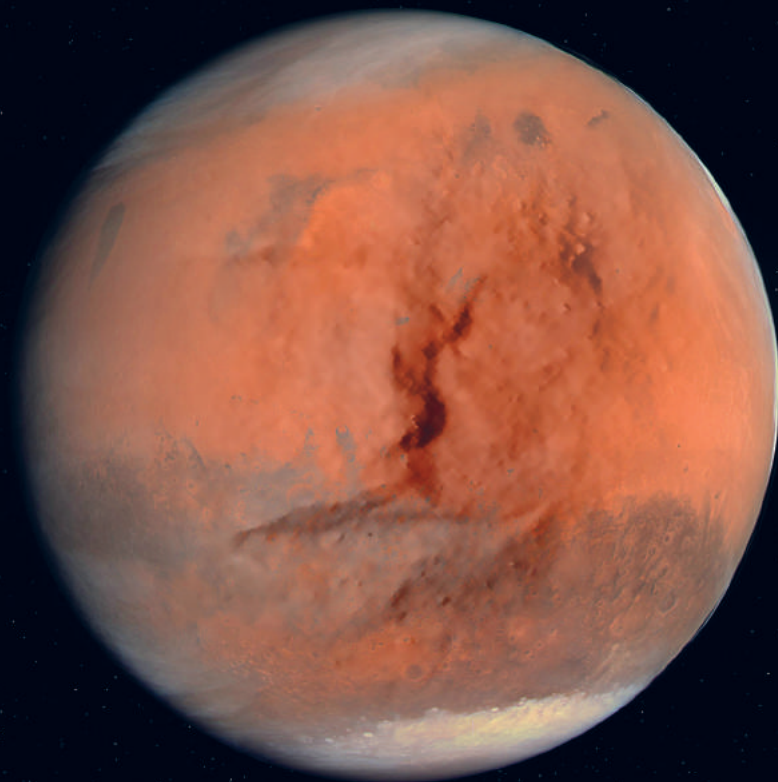


Illustration of space adaptations of chicken by Agi Haines and Nicholas Tamás.



*PLANETARY PERSONHOOD: MARTIAN MATTERS*



*by*

*NONHUMAN NONSENSE*

*Planetary Personhood proposes radical space decolonization to explore ways of not destroying another planet.*

*The project proposes personhood for the planet Mars and considers the possibility of solidarity with the entities already there—the stones! An intervention with ethical, philosophical and legal implications, the project seeks citizenship for a martian meteorite residing on Earth—welcome Allan Hills 84001!*

Planetary Personhood has three demands:

### 1. LET MARS BE MARS!

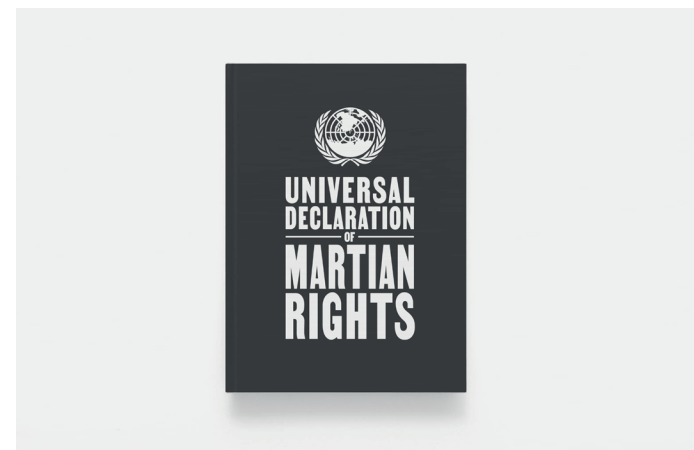
Planetary Personhood proposes independent personhood for the entire planet Mars. Legally, this means that Mars will be owned by Mars – any decisions regarding martian matters will ultimately be taken by Mars, a legal entity with rights protected in a martian constitution.

This includes large scale issues such as settlements and colonies of earthlings, geomorphological alterings such as mining and extraction of minerals, manipulation of planetary systems such as atmospheric composition and water presence.

For compatibility with earthly institutions and current decision-making processes, the direct communication of the will and intention of Mars could be deferred to a group of human guardians or custodians. This group, similar to a board of directors for a legal corporation, or guard-

ians of the Te Urewera area in northern New Zealand<sup>1</sup>, would think deeply about what is best for Mars, and strive to uphold Mars’s fundamental rights; Mars has a right to be Mars. This group would ideally be composed of a diverse set of knowledge systems (epistemologies), such as representatives from indigenous

<sup>1</sup> “Te Urewera Act 2014,” Te Urewera Act 2014 No 51 (as at 01 October 2018), Public Act Contents – New Zealand Legislation, accessed November 19, 2019, <http://www.legislation.govt.nz/act/public/2014/0051/latest/DLM6183601.html>



groups and philosophies here on Earth, many of which enable a deeply symbiotic and respectful bond to the land.

## 2. RECOGNIZE ALL MARTIANS!

Furthermore, blurring the subject-object divide, Planetary Personhood recognizes all the native inhabitants of Mars as Martians. This includes all constituent parts, objects, structures, phenomena, matters and moons. This is a complete leveling of the playing field of what is considered to be a Martian. On Mars, everyone and everything is born a Martian and all Martians are born free and equal in dignity and rights.

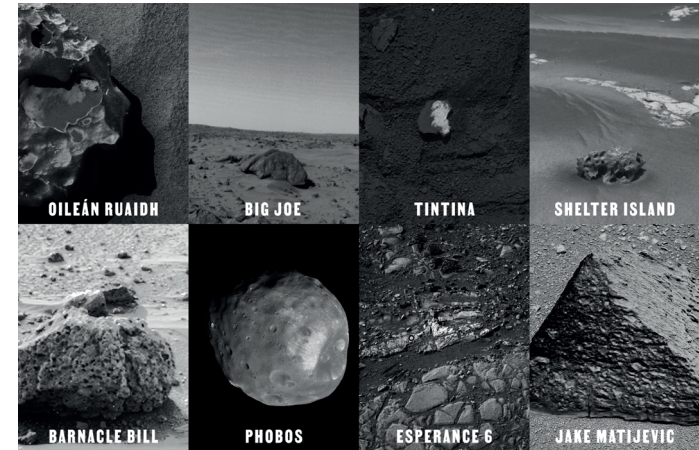
- ⋮ Mountains and mosaics
- ⋮ pebbles and poundstones
- ⋮ silt, slivers and sandstones
- ⋮ are all martian in composition, origin, and intent
- ⋮ and should thus be considered Martians.

Martians cannot be owned, and their presence and trajectories should be taken into account by all human visitors to Mars.

## 3. WELCOME ALLAN HILLS 84001!

Experimenting with how this thinking would collide with Earthlings and their institutions, the project seeks Swedish citizenship for a martian meteorite residing on Earth—Allan Hills 84001.

Allan, also known on Earth as ALH84001, was born on Mars by being crystallized by molten rock 4.091 billion years ago, and left the martian surface by utilizing the impact energy of another meteorite about 17 million years ago. Allan, the Martian, arrived on Earth approximately 13,000 years ago on the International Continent



© NASA/JPL

Notable Martians.



Allan Hills 84001's passport.

of Antarctica, and established first contact with humans on December 27, 1984.

After careful study by human scientists, it was first decided that Allan contained evidence of life on Mars, leading to the announcement of the US. President Bill Clinton in 1996:

“Today, rock 84001 speaks to us across all those billions of years and millions of miles. It speaks of the possibility of life. If this discovery is confirmed, it will surely be one of the most stunning insights into our universe that science has ever uncovered. Its implications are as far-reaching and awe-inspiring as can be imagined. Even as it promises answers to some of our oldest questions, it poses still others even more fundamental.

We will continue to listen closely to what it has to say as we continue the search for answers and for knowledge that is as old as humanity itself but essential to our people’s future.”<sup>2</sup>

It was later decided that it was unclear what Allan was saying about life. Allan is currently held captive at the Johnson Space Center in Houston, Texas, Planetary Personhood is leading the efforts of restoring Allans independence.

### DOES MARTIAN MATTER MATTER?

When considering human settlement on Mars, the planet is often seen as an empty place, a blank canvas, void of “life”—and therefore empty of independent agency and inherent value. Mars is the ultimate desert, at the frontier of life, our new Terra Nullius where humankind can once again carelessly manipulate the world to our liking. Mars is the dreamworld where the narrative of human domination is running wild and free<sup>3</sup>.

We speak of Mars colonization as if we suddenly forgot the atrocities and genocides that the drive of colonization caused the last time we pursued it<sup>4</sup>. We speak of terraforming Mars disregarding how the current terraforming of the Earth is causing unprecedented mass extinction and climate disruption<sup>5</sup>.

As scientists continue to search for microscopic forms of life, or even fossilized traces of it on mars<sup>6</sup>—Planetary Personhood takes the opposite approach—extending compassion and respect beyond the (common-sensically constructed) life-nonlife boundary!

The life-nonlife boundary is an idea that continues to neglect, deny and obstruct nonhuman ways of being. This idea is doing work to legitimize and subtend an extractivist mindset focused on short term goals of power and profit.

The boundary is at the core of the biocentric worldview—seeing life in any form as valuable and worthy of attention and protection, seeking to protect species from extinction, valuing biodiversity and wildlife<sup>7</sup>. Biocentrism might be more emphatically inclusive than Anthropocentrism (regarding human beings as superior and unique), but it does not go far enough, because biocentrism also inevitably leads to untethered exploitation of other worlds, modes, phenomena, existents, objects and fuzzy assemblages. Biocentrism is another way of separating ourselves from otherness, another attempt at constructing an inherently existing subject that can be protected and nurtured.

<sup>2</sup> Clinton, W. J. 1996. “President Clinton Statement Regarding Mars Meteorite Discovery.” *White House, Office of Press Secretary*. <https://www2.jpl.nasa.gov/snc/clinton.html>.

<sup>3</sup> Kelsey Piper, “Jeff Bezos and Elon Musk Want to Colonize Space to Save Humanity,” *Vox (Vox, October 22, 2018)*, <https://www.vox.com/future-perfect/2018/10/22/17991736/jeff-bezos-elon-musk-colonizing-mars-moon-space-blue-origin-spacex>

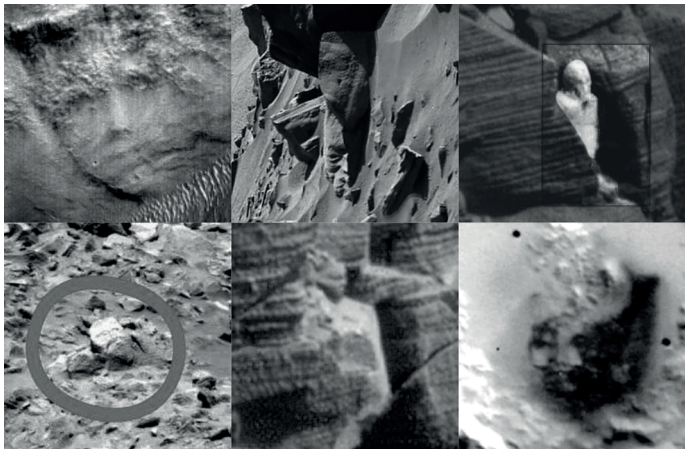
<sup>4</sup> “A Quick Reminder of Why Colonialism Was Bad | Current Affairs.” September 2017, <https://www.currentaffairs.org/2017/09/a-quick-reminder-of-why-colonialism-was-bad>

<sup>5</sup> William J. Ripple et al., “World Scientists’ Warning to Humanity: A Second Notice,” *BioScience* 67, no. 12 (2017): pp. 1026-1028, <https://doi.org/10.1093/biosci/bix125>

<sup>6</sup> “NASA’s Mars 2020 Will Hunt for Microscopic Fossils,” *NASA (NASA, November 12, 2019)*, <https://www.jpl.nasa.gov/news/news.php?feature=7539>

<sup>7</sup> Robin Attfield “Environmental Ethics: An Overview for the Twenty-First Century, *Polity*, 2014

This becomes clear on Mars, where, in the absence of “life”, biocentrism mutates from an attitude of care and protection, into a driving force of terraformation and human self-cherishing. Focusing on biodiversity misses the fact that there is a lot of diversity on Mars, Geodiversity! It is a planet full of activity, but perhaps on different timescales: sandstorms, volcanoes, freeze-thaw cycles, marsquakes, and stones falling over—it is a place where “no-one” is doing anything, but a lot of things are happening.



© NASA/JPL

Faces found on Mars—anthropomorphism.

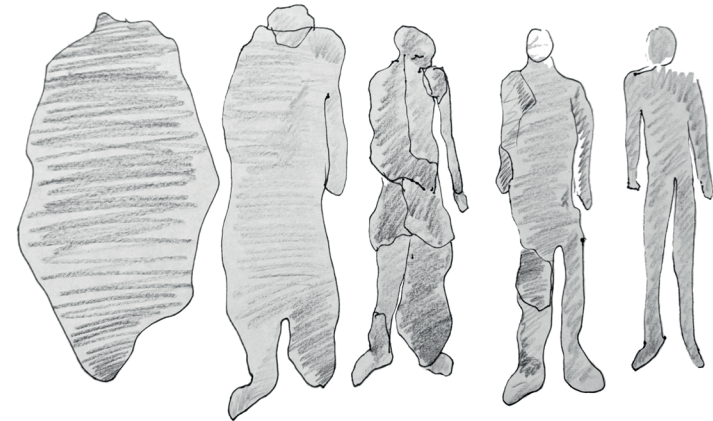
A possible way then, of enabling empathy and respect to other ways of being, is using the method of “Strategic Anthropomorphism”, called for by the contemporary philosopher Jane Bennet.<sup>8</sup> This strategy exploits a glitch in the human psychology, the innate tendency to attribute human traits, emotions or intentions to non-human entities. We cannot know how Mars or meteorites experience or access the world, or if they have a will

or memories. But trying to imagine otherness, even from our inevitably human perspective, might provide a sense of humbleness and curiosity, needed in these urgent times.

This practice does not provide immediate answers but rather poses a series of questions and frames a certain (martian) mindset:

- What forms of presences and absences are supported and constructed by particular activities?
- Who is allowed to maintain their current form?
- What is better and better for whom?

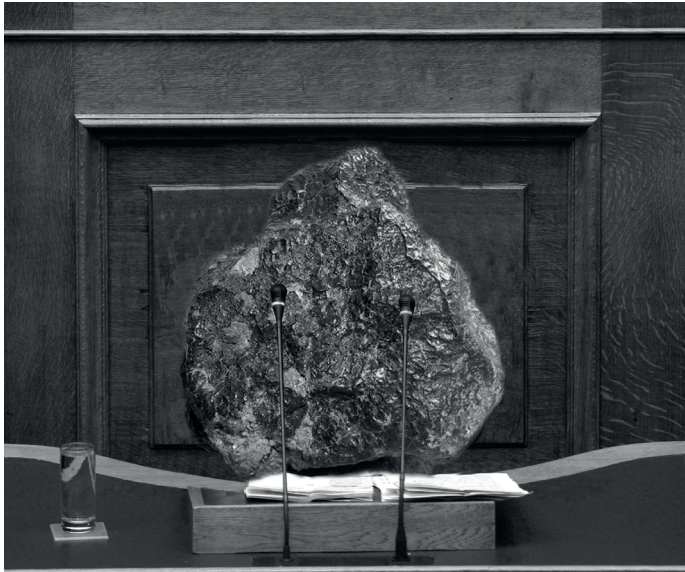
Can respecting Martian ways of being move us to reconcile with Earthlings?



Blurring the subject-object divide—we are all subjects now.

<sup>8</sup> Bennett, Jane. *Vibrant Matter : a Political Ecology of Things*. Duke University Press, 2010.

<sup>9</sup> Le Guin Ursula K., *Hard Words, and Other Poems* (New York: Harper & Row, 1981)



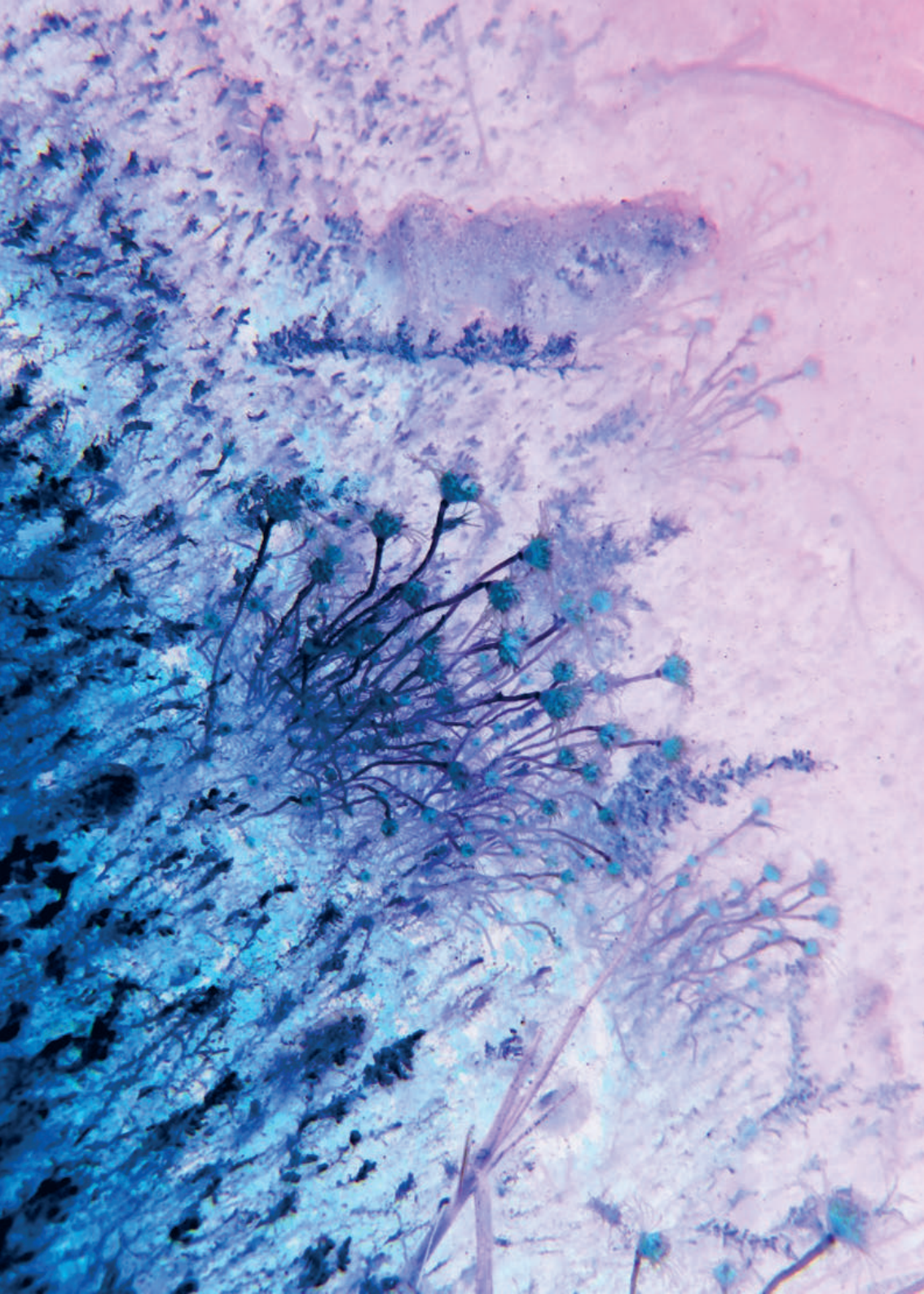
Listening to meteorites.

### The Marrow

There was a word inside a stone.  
I tried to pry it clear,  
mallet and chisel, pick and gad,  
until the stone was dropping blood,  
but still I could not hear  
the word the stone had said.

I threw it down beside the road  
among a thousand stones  
and as I turned away it cried  
the word aloud within my ear  
and the marrow of my bones  
heard, and replied.

—Ursula K. Le Guin<sup>9</sup>



*SPACECORALIA*

*by*

*THOMAS PAUSZ*

Our understanding of biological life is undergoing a revolution. We are slowly moving from a mechanistic model of biology based on competition between species for survival (neo Darwinism) towards an understanding that life is a complex collaboration between organisms, a co-evolution of multispecies ecosystems. Maybe life selects relationships, not individual species. This powerful idea of ‘symbiotic life’ championed by Lynn Margulis demands a new imaginary, and our ideas about life Outer Space are no exception: to truly dream of another Earth, the current utilitarian projections and techno-fantasies must be decolonized.

On Earth, the most ancient and diverse example of a symbiotic ecosystem is the Coral Reef. More species variety coexists in coral reefs than in the rainforest. In Spacecoralia, Thomas Pausz Studio draws parallels between mutual collaborations in symbiotic life underwater and possible life outer-space. Based on biological

<sup>1</sup> The largest interdisciplinary European Maritime Research Institute based in Brest, France.

studies in collaboration with the I.U.E.M<sup>1</sup> Pausz models the birth and evolution of a Coral-like ecosystems on Mars, which feeds on the remnants of a human astro-botanical experiment.

The forms, colours and agencies of the new hybrid species of Spacecoralia are animated using mixed-media techniques, and borrow from the aesthetics of early underwater photography as well as new digital aesthetics. In a meaningful reversal of perspective, making models of a scenario for symbiotic life of Mars becomes a mirror to understand the complexity of one of the most endangered life forms and ecosystem on Earth: wild Corals reefs.

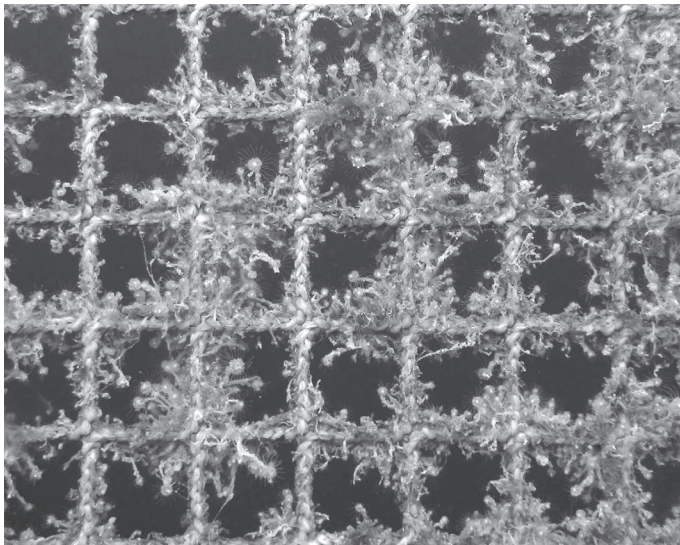




## Spacecoralia, a Glossary in progress

The terms and quotes below are extracts from the research logbook of Spacecoralia. They are not a program or an explanation for the project, rather a parallel enquiry into how we attempt to observe and describe unknown worlds. They are concepts or texts from scientific literature, fiction and critical studies, which mirror the questions encountered in our sensory experiments in the studio.

**Amorphous** When looking at the world of Spacecoralia, we need a new lens. Instead of looking for things with fixed essences based on exploitable or seducing forms and exotic functions, we have to adjust to a picture that is much more fluid and amorphous, where any 'thingness' is strictly temporary.



## Devolution

Devolution, de-evolution, or backward evolution is the notion that species can change into more “primitive” forms over time. In modern biology the term is redundant: evolutionary science deals with selection or adaptation that results in populations of organisms genetically different from their ancestral forms. The discipline makes no general distinction between changes leading to populations of forms less complex or more complex than their ancestors, and in such terms the concept of a ‘primitive’ species cannot be defined consistently. Consequently, within the discipline such a word is rarely useful.<sup>2</sup>

## Intra-dependence

“The lesson of biology derived from Coral Reefs is that organisms are most likely to do best when mutualist in their environments, forming ongoing and flexible symbiotic relationships.”<sup>3</sup>

## Membranes

Species in Spacecoralia seem to be made exclusively of membranous tissues. The unknown nature of these membranes allows for porosity, fluidity, transfer, transformation, osmosis,

<sup>2</sup> “[PDF] Devolution (Biology): Semantic Scholar,” [PDF] Devolution (biology) | Semantic Scholar, January 1, 1970, [https://www.semanticscholar.org/paper/Devolution-\(biology\)/87b99bda6203990056b2860857d385595a17b9b1](https://www.semanticscholar.org/paper/Devolution-(biology)/87b99bda6203990056b2860857d385595a17b9b1)

<sup>3</sup> Science X staff, “When Corals Met Algae: Symbiotic Relationship Crucial to Reef Survival Dates to the Triassic,” Phys.org (Phys.org, November 2, 2016), <https://phys.org/news/2016-11-corals-met-algae-symbiotic-relationship.html>

convergence. We suppose they allow for a flow of energy and nutrient to run through the entire ecosystem. A world where nothing is private.

**Symbiopoetics** The petrified membrane fragments show resemblance with the frustule of Diatoms. Diatoms are a part of all marine ecosystems on Earth. They contribute to the symbiotic and hybrid mixture of bacteria, algae and minerals, which gave birth to Coral reefs, where the first symbiotic life emerged.

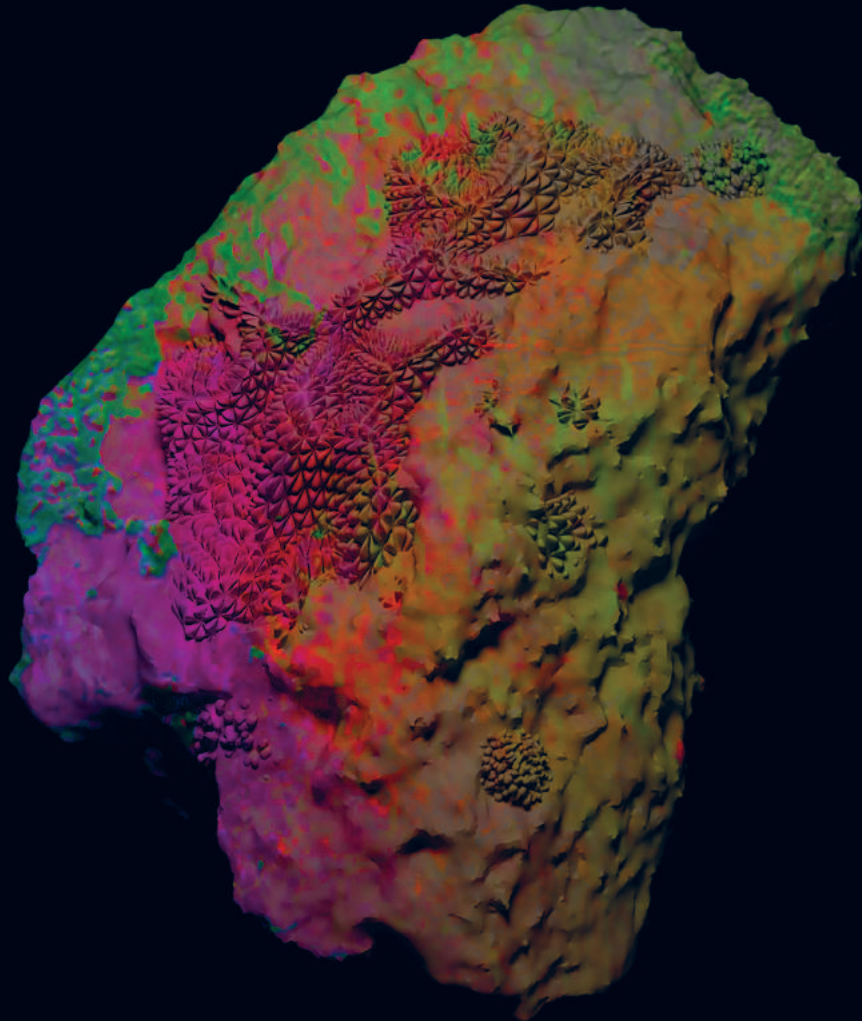
By storing Diatoms together with various pioneer plant species in the anti-ageing containers, Sea for Space researchers created the conditions for a new type of symbiotic relations between species. Pioneer plants such as *Salicornia* supplied diatoms with energy through photosynthesis; in return diatoms crafted silica shells, which helped the plants cope with the low sun exposure on Mars. Other life forms benefited from this mutualism, and started to form the amalgam we came to know as Spacecoralia, which thrived when humans abandoned the planet.

Symbiosis corresponds to the rise of coral reefs in the Earth Oceans.

Symbiopoetic is the core process that made Spacecoralia possible on Mars.



*A FALSE ENCOUNTER*



*by*

*PLEOFORMA*

*Design: Oscar Salguero & Zack Saunders, Concept & Research: Oscar Salguero*

What if a sentient rover encountered life on Mars and decided to keep it a secret?

*Our scenario assumes a near future reality, in which the only surviving member of a late Mars exploratory mission is Ray, a fully sentient rover. Wandering around a large basin plain, Ray has stumbled upon a fascinating sight: a lichen species growing on the crevices of an ancient Martian rock. A multi-spectral, false-color miracle of life unfolds in front of Ray, as it decides to understand, admire, and allow this moment to exist in secret forever...*

... “Our capacity for fascination is what fuels solidarity, not some pre-theoretical, prefabricated concept of need. Fascination is the aesthetic gravitational pull of entities toward one another, the dynamics of solidarity, within a forcefield-like matrix of sensitivities”.<sup>1</sup>



A False Encounter.

## A Martian Host

Mars is fundamentally an igneous planet. As such, the majority of its crust is composed of volcanic basalt rock.<sup>2</sup> Curiously, basalt can also be found on the Moon, and even on Earth. Locations like Hawaii’s volcanic basaltic soils and Iceland’s lava fields, have thus, become experimental grounds for NASA’s future Martian missions. When exploring the Red Planet, one can’t help but to wonder about basalt rocks and their eternally silent and dormant residency.

## Mars = Basalt Rock

... “A rock is a gigantic empty cathedral at a microscopic level; at a nanoscopic level, it is a vast empty region of a solar system”<sup>3</sup>

Currently, most of the hypothetical uses of Martian basalt rock are in the quality of raw material. One example is basalt fiber, a relatively recent industrial product.

This material, formed via a smelting process, results in a fine fiber with properties such as high tensile strength and radiation resistance (commonly used in the aerospace industry). Whether in the form of 3D printable composite (AI SpaceFactory’s Project MARSHA<sup>4</sup>), or basalt fiber reinforced clay blocks, all current material-based experiments with basalt rock on Mars aim to create efficient shelter and shielding conditions for human laboratories or colonizing settlements.

Could we challenge this rock-as-resource attitude (human expansionism) and instead focus on a rock-as-world idea (species co-existence)?

<sup>1</sup> Timothy Morton, *Humankind: Solidarity with Non-Human People* (London: Verso, 2019)

<sup>2</sup> “Mars Crust: Made of Basalt,” PSRD, accessed November 19, 2019, <http://www.psrdr.hawaii.edu/May09/Mars.Basaltic.Crust.html>

<sup>3</sup> Timothy Morton, *Humankind: Solidarity with Non-Human People* (London: Verso, 2019)

<sup>4</sup> “MARSHA by AI SpaceFactory,” AI SpaceFactory, accessed November 19, 2019, <https://www.aispacefactory.com/marsha>

Some thought was given to the creation of a speculative Martian “petro-philial” relationship between a human and a rock. Perhaps the condition of basalt rocks as cosmic ray shelter might inspire new behaviors of admiration towards these entities. In spite of its narrative appeal, this idea further implied an anthropocentric angle to the Martian experience, which proved, in a sense, how difficult it is to remove ourselves as protagonists of an interplanetary story.

Since 2015, research projects such as BASALT (Biologic Analog Science Associated with Lava Terrains)<sup>5</sup> attempt to look at basalt rock as a potential source of biosignatures, or indicators of past life on Mars. Such investigations makes us wonder: what sort of species might basalt rock be able to host?



Mars, a petro-philial relationship?

## Beyond the Human

⋮ “We must unhumanize our views a little, and become  
 ⋮ confident / as the rock and ocean that we were made  
 ⋮ from.”<sup>6</sup>

As the research continued, great influence was received from “The Martian Chronicles,” a 1950 collection of science fiction stories by Ray Bradbury, which narrates the colonization of Mars by humans fleeing Earth. As expressed in one of the stories: “and somehow the mountains will never sound right to us; we’ll give them new names, but the old names are there, somewhere in time [...] No matter how we touch Mars, we’ll never touch it. And then we’ll get mad at it, and you know what we’ll do? We’ll rip it up, rip the skin off, and change it to fit ourselves.”<sup>7</sup>

The text both challenges us to consider the purity of Mars, and makes visceral humankind’s expansionist and exploitative agenda towards this planet. In order to imagine a future where ideal symbiotic cohabitation exists, we must first attempt to get rid of our own species’ Ego.

### Earth = Lichen

⋮ “One could speculate that lichens would be among the  
 ⋮ last inhabitants to succumb on a dying earth at some  
 ⋮ distant point in the future.”<sup>8</sup>

While searching for examples of rock-inhabiting species, an email exchange with scientist Andreas Johnsson, PhD Research Fellow from the Department of Earth Sciences at the University of Gothenburg, pointed to the existence

<sup>5</sup> “BASALT Research Program,” NASA (NASA), accessed November 19, 2019, <https://spacecience.arc.nasa.gov/basalt/>

<sup>6</sup> “Carmel Point by Robinson Jeffers - Poems | Academy of American Poets,” Poets.org (Academy of American Poets), accessed November 19, 2019, <https://poets.org/poem/carmel-point>

<sup>7</sup> Ray Douglas Bradbury, *The Martian Chronicles*: (New York - Toronto etc.: Bantam Books, 1990)

<sup>8</sup> Steven L. Stephenson, *The Kingdom Fungi: the Biology of Mushrooms, Molds, and Lichens* (Portland, Or.: Timber Press, 2011)

**9** Kerry Knudsen and Ayana Young, “For the Wild,” *For the Wild* (blog), April 24, 2019, <https://forthewild.world/listen/kerry-knudsen-on-lichen-and-life-after-capitalism-116>

**10** Ibid.

**11** “Lichens.” National Parks Service. U.S. Department of the Interior. Accessed December 10, 2019. <https://www.nps.gov/glac/learn/nature/lichens.htm>.

**12** Richard Armstrong, “Could Lichen Survive on Mars.” *Journal of Astrobiology and Space Science Reviews*, accessed November 19, 2019, <http://journalofastrobiology.com/Mars15.html>

**13** “Lichen on Mars [Speculative Design Project].,” *Kerry Kent Knudsen, email to Oscar Salguero*, November 11, 2019

**14** Graham Harman, *Object-Oriented Ontology a New Theory of Everything* (London: Pelican, an imprint of Penguin Books, 2018)

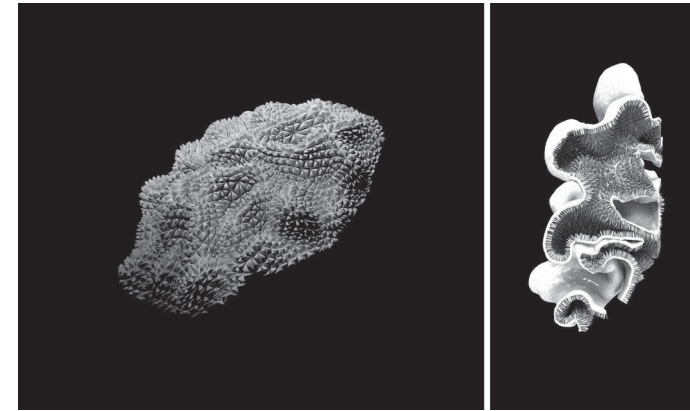
**15** Curiosity Rover, “Just Your Friendly Neighborhood Robotic Geochemist Checking in with an Update from the Field: <https://t.co/N6oUzKk8BpP.S.>,” Twitter (Twitter, October 24, 2019), <https://twitter.com/MarsCuriosity/status/1187455153793830913>

of lithotrophs, organisms that feed off mineral substrate (rocks) as a source of energy acquisition. Further study led to the exploration of lichens as life forms of primary interest.

Lichens are deeply fascinating. They are part algae/part fungi organisms that coexist in perfect symbiosis. According to Kerry Knudsen, mycological researcher and lichenologist at Prague University of Life Sciences, although lichens are, in terms of human use, “almost totally useless,”<sup>9</sup> they are nevertheless “useful for the total ecological landscape.”<sup>10</sup> As a species, lichens make up about 8 percent of Earth’s biomass, and have been around for at least 500 million years (in fact, one of the oldest living organisms on Earth is an Arctic lichen species estimated to be 8,600 years old).<sup>11</sup> Their adaptability records are equally unparalleled. Due to their symbiotic existence, slow growth rate, and low nutrient needs, lichens have been known to survive in the most extreme environments, including deserts, the poles, and even outer space. In a 2016 study at the International Space Station (ISS), it was proven that lichens could survive UV exposure and cosmic radiation almost unscathed.<sup>12</sup>

Kerry Knudsen was kind enough to share his thoughts on a hypothetical lichen species on Mars: “first, they would be crustose... their thallus would be basically flat. Because of the loss of atmosphere and water, they would have a thick outer cortex that would be like a thick plastic. This would protect them from losing

water and from extreme temperatures... They would grow on basalt at the poles where they get water vapor during polar summer when ice and dry ice evaporates. They would not have a dispersed pattern but radial pattern from replicating by division.”<sup>13</sup>



Speculative Martian lichen (based on Kerry Knudsen’s hypothesis).

The Witness [Basalt Rock + Lichen = An Interplanetary Encounter]

... “The world is not the world as manifest to humans; to think a reality beyond our thinking is not nonsense, but obligatory.”<sup>14</sup>

A Mars rover is a motor vehicle designed to travel and document the surface of Mars. From their presence on films like “The Martian” (where long-lost Pathfinder essentially saves Matt Damon’s life), to the recent Twitter accounts of Curiosity, Spirit and Opportunity rovers (where they share updates and selfies<sup>15</sup>, almost adopting a personality of their own); Mars rovers have essentially earned a pop cultural status in our collective imagination.

As observing entities, rovers are equipped with an incredible capacity to view the world in spectra beyond the limits of the human eye's range. One example is their "false-color" vision, which results from a composite of filtered images that allow them to highlight certain chemical compositions or textures in search for life signals. A question arises: Could we ever consider a rover's false-color vision an objective, or true, capture of reality?

Jim Bell, the lead scientist for the Pancam color imaging system on the Mars Exploration Rovers (MER), refers to this conundrum: "we actually try to avoid the term 'true color' because nobody really knows precisely what the 'truth' is on Mars."<sup>16</sup> Perhaps even the moniker

"Red Planet" is destined to become contested as future rovers will continue to be equipped with higher-tech lenses (covering the spectrum "from deep infrared to far UV"<sup>17</sup>), and further independent intelligence.

In a 2015 Gizmodo article titled "Why our current missions to space could create sentient robots," science journalist and sci-fi author, Annalee Newitz poses that "it's quite possible that our space robots could become the first artificial intelligences. That's because we're programming them to be as autonomous as possible."<sup>18</sup> Extrapolating on this thought, will rovers eventually transcend their human-assistant status into their own nonhuman selfhood? And in doing so, will they develop creativity or even solidarity?

<sup>16</sup> Nancy Atkinson, "True or False (Color): The Art of Extraterrestrial Photography," Universe Today, March 22, 2016, <https://www.universetoday.com/11863/true-or-false-color-the-art-of-extraterrestrial-photography/>

<sup>17</sup> "Question about rover vision [Mars Project].," Peter Lipschutz, email to Oscar Salguero, December 10, 2019

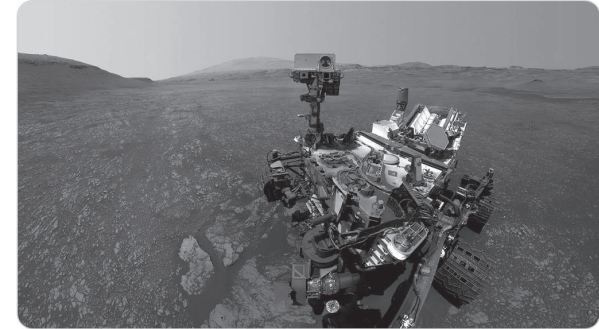
<sup>18</sup> Annalee Newitz, "Why Our Current Missions to Space Could Create Sentient Robots," io9 (io9), December 16, 2015), <https://io9.gizmodo.com/why-our-current-missions-to-space-could-create-sentient-5931389>



Curiosity Rover @MarsCuriosity · May 29, 2019  
Meanwhile, back on #Mars...

I've found the highest amounts of clay minerals ever during my mission and then snapped this selfie.

More about the science: [go.nasa.gov/2XhCAZq](https://go.nasa.gov/2XhCAZq)  
How I take selfies: [youtu.be/b2nwWECbEHg?t=...](https://youtu.be/b2nwWECbEHg?t=...)



182 1.3K 7.5K

@MarsCuriosity selfie Tweet (May 29, 2019).



Testing Mars 2020 engineering cameras.

### A False Encounter [Everybody Needs a Rock]:

2055. Ray, the last rover sent to Mars, has been circling around Utopia Planitia (46.7°N 117.5°E), the largest basin on the planet, in an unusual manner. Ray follows a certain instinct not previously observed in other miniature AI-enabled rovers. It hesitates, it plays with the wind, and at times it seems to truly connect with the moment it occupies. On 424 sol day, Ray found a special rock. A full hour went by with no official recording of the event. Mass spectrometer off. Pure blank nondata. If it's any indication, Ray had recently accessed the files of a children's book called "Everybody Needs a Rock" by Byrd Baylor, a human of the 20th century. Among a set of 10 rules for finding the perfect rock, Ray's metadata highlighted, on page 2, the following passage: "If somebody says, 'What's so special about that rock?' don't even tell them. Nobody is supposed to know what's special about another person's rock."<sup>19</sup>

<sup>19</sup> Baylor, Byrd. *Everybody Needs a Rock*. New York: Macmillan, 1974.

"A False Encounter" is an ode to the mystery of a chance meeting of worlds, an invitation to a silent contemplation of realities that escape our perception and whose existence are nonetheless as real and universal as ours. After all, perhaps beauty is in the eye of the nonhuman...







*MAKING KIN*

*by*

*WANG & SÖDERSTRÖM*

The project *Making Kin*, begins in a research into what we as humans call extreme life on Earth: Extremophiles. This gives us a glimpse of what life could be like on another planet, since many of the extremophiles have the ability to survive Martian conditions. For example thrive in radiation or high temperatures. While oxygen, for example, is a necessity for life as we know it, some organisms flourish in environments with no oxygen at all.

That fact that we humans call a group of another life-form *extreme*, describes well how we put our [human] life at the centre. Extremes, minimums and maximums, creates a type of categorisation that is dependent on a “normal”, an ideal. But is any life really normal? Life never follows a

1 Donna Jeanne. Haraway, *When Species Meet* (Minneapolis: University of Minnesota Press, 2008)

linear way to perfection, it mutates, twists and try every potential direction. Life is, in its very evolutionary core, directionless and therefore cannot have a defined centre. We constantly have to remind ourselves that humans = nature. The culture we think is ours, affects all cultures in nature.

“I love the fact that human genomes can be found in only about 10 percent of all the cells that occupy the mundane space I call my body; the other 90 percent of the cells are filled with the genomes of bacteria, fungi, protists, and such, some of which play in a symphony necessary to my being alive at all, and some of which are hitching a ride and doing the rest of me, of us, no harm.”<sup>1</sup>

We have decided to highlight four extremophiles here on Earth that are likely to survive on Mars.



Figure with extremes puts the human in the centre.

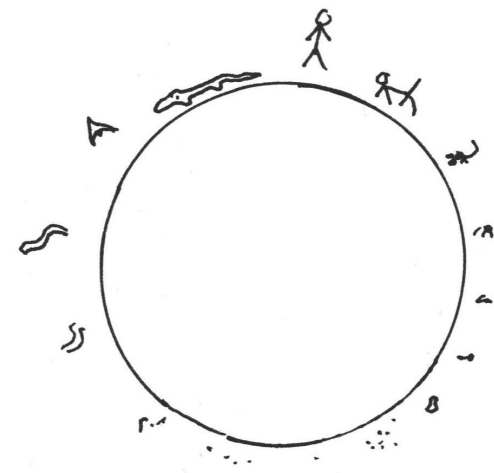


Figure without extremes.

## Methanococcus jannaschii



Planet: Earth

Domain: Archaea

Kingdom: Euryarchaeota

Discovery: Discovered 1982

<sup>2</sup> F. Orange et al., "Experimental Silicification of the Extremophilic Archaea *Pyrococcus abyssi* and *Methanocaldococcus jannaschii*: Applications in the Search for Evidence of Life in Early Earth and Extraterrestrial Rocks," *Geobiology* 7, no. 4 (2009): pp. 403-418, <https://doi.org/10.1111/j.1472-4669.2009.00212.x>

*Methanocaldococcus jannaschii* is a thermophilic methanogen that lives near hydrothermal vents. It survives on carbon dioxide, hydrogen and a few mineral salts. It cannot tolerate oxygen and takes care of its energy needs by producing methane.

Given the tentative identifications of CH<sub>4</sub> gas in the atmosphere of Mars, research about *M. jannaschii* is of high relevance to analogue martian studies.<sup>2</sup>

## *Pyrococcus furiosus*



Planet: Earth

Domain: Archaea

Kingdom: Euryarchaeota

Discovery: Discovered 1986

*Pyrococcus furiosus* is an extremophilic species of Archaea. It can be classified as a hyperthermophile because it thrives best under extremely high temperatures.<sup>3</sup>

*P. furiosus* lives in superheated vents at the bottom of the ocean, but periodically it gets spewed out into cold sea water. Unlike in plants, *P. furiosus* function over 100+ degree Celsius range in temperature. That's a swing that could match what plants would experience in a greenhouse on Mars.<sup>4</sup>

<sup>3</sup> "Pyrococcus Furiosus," Wikipedia (Wikimedia Foundation, October 18, 2019), [https://en.wikipedia.org/wiki/Pyrococcus\\_furiosus](https://en.wikipedia.org/wiki/Pyrococcus_furiosus))

<sup>4</sup> Karen Miller, "Prozac for Plants," ed. Tony Phillips, NASA (NASA), accessed November 19, 2019, [https://www.nasa.gov/vision/earth/livingthings/05aug\\_nostress.html](https://www.nasa.gov/vision/earth/livingthings/05aug_nostress.html))

## Deinococcus radiodurans



Planet: Earth

Domain: Bacteria

Kingdom: Eubacteria

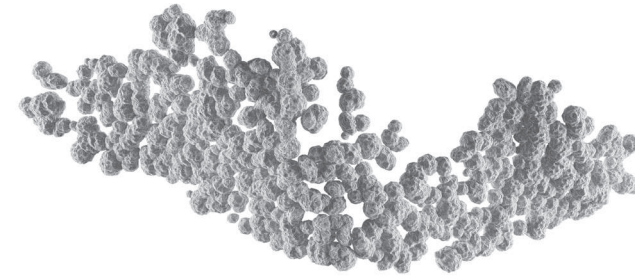
Discovery: Discovered 1956

<sup>5</sup> Jasmin Fox-Skelly, "Earth - The Microbes so Extreme They Might Survive on Mars," BBC Earth (BBC, December 21, 2015), <http://www.bbc.com/earth/story/20151221-the-microbes-so-extreme-they-might-survive-on-mars>

*Deinococcus radiodurans* is an extremophilic bacterium, one of the most radiation-resistant organisms known. It is often found in habitats rich in organic materials, such as soil, feces, meat or sewage. A study found that *D. radiodurans* was able to stitch broken DNA back together with

repair proteins. As long as the repair systems are intact, the bacteria can survive. The *D. radiodurans* also carries multiple copies of its genes on different chromosomes. If one or two copies are damaged by radiation, the cell can use another copy of the gene to stay alive while it repairs the DNA damage.<sup>5</sup>

## Cryomyces antarcticus



Planet: Earth

Domain: Eukaryota

Kingdom: Fungi

Discovery: Discovered 2005

*Cryomyces antarcticus* is a fungus of uncertain placement in the class Dothideomycetes, division Ascomycota. Found in dry valleys in Antarctica, it was described as new to science in 2005. It has been found to be able to survive the harsh outer space environment and cosmic radiation. Researchers have done test where they exposed *C. antarcticus* colonized rocks to martian conditions outside of the International Space Station. The result clearly showed that the *C. antarcticus* had strong resistance.<sup>6</sup>

<sup>6</sup> S Onofri et al., "Resistance of Antarctic Black Fungi and Cryptoendolithic Communities to Simulated Space and Martian Conditions," *Studies in mycology* (CBS Fungal Biodiversity Centre, 2008), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2610303/>

<sup>7</sup> Quoted in Cecilia Åsberg and Rosi Braidotti, eds, *A Feminist Companion To The Posthumanities* (S.l.: Springer, 2019)

<sup>8</sup> Peter Godfrey-Smith, *Other Minds: the Octopus and the Evolution of Intelligent Life* (London: William Collins, 2018), 10

<sup>9</sup> Donna Jeanne Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham: Duke University Press, 2016)

If we find life on Mars in the future, it would most likely be a microscopic organism, a microbe. If we from the start, in this scenario, don't place ourselves above any species in a hierarchical position could we then approach non-human life differently and co-exist in a new way? In other words, not to make the same mistakes as we have done on Earth? As one of the pioneer posthumanist Kathryn N. Hayles asks: "What happens if we begin from the premise not that we know reality because we are separate from it (traditional objectivity), but that we can know the world because we are connected with it?"<sup>7</sup>

In the following phase of the project we asked ourselves:

—How can we introduce nuances of what life is and shift our human-centred perspective?

—What does a lifeform, that we don't know exists, look like?

By speculating around what a lifeform on Mars would look and behave like, we hope to evoke new relations to something that otherwise is hard to comprehend.

In order for us to limit our human interference in the process of 'shaping' these new species we worked with a method to give us unique data. Influenced by the extremophiles and not by us. We had a look at life at its most basic 'building blocks', our DNA. Every human or plant - along with every other organism on Earth - contains the molecular instructions for life, called deoxyribonucleic acid or DNA. We are all built out of four different DNA nucleotides, each defined by a specific nitrogenous base: adenine (often abbreviated "A" in science writing), thymine (abbreviated "T"), guanine

(abbreviated "G"), and cytosine (abbreviated "C").

By looking at these 'building blocks' we wanted to strip down the biological hierarchy and shift our human-centred perspective.

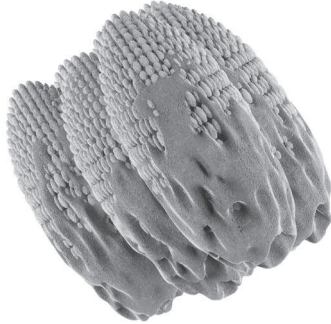
Based on DNA/RNA genome sequence data from the four extremophiles' RNA strains. We have translated the data to numeric values which will give different parameters in the 3D software. The unique combinations from each species will give different outcomes in the digital environment.

The results are four Martian species from a speculative future, all with their own qualities.

This project invites differences that are worth respecting and aim to introduce nuances when we think of life. By scaling up these microorganisms we want to make them more comprehensible, relatable and hopefully makes us perceive the kinship we have with them. Speculative design can evoke imaginative scenarios which is important in order to better understand what it means to be human and create relations to the unseen.

⋮ "Do bacteria really perceive their environment? Do bees really remember what has happened? These are not questions that have a yes-or-no answer. There's a smooth transition from minimal kinds of sensitivity to the world to more elaborate kinds, and no reason to think in terms of sharp divides."<sup>8</sup>

## Martian species #A

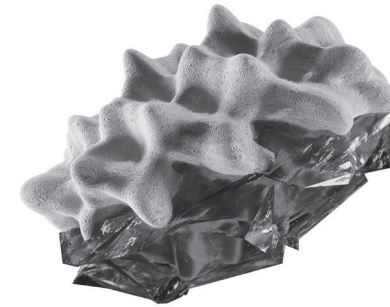


Planet: Mars

Discovery: Undiscovered (2020)

This microbe thrives underneath the northern polar ice cap on Mars by consuming hydrogen. Unlike in a biological process (eg. photosynthesis), the hydrogen has been created from water exposed to ionizing radiation from uranium-, thorium-, and potassium-bearing rocks in Mars' crust. The conditions for the survival of these microbes happens in a process that is called radiolysis. Which takes place when marsquakes periodically melt the ice and passes it down into the bedrock.

## Martian species #B



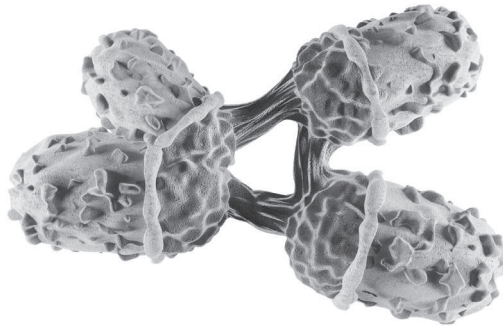
Planet: Mars

Discovery: Undiscovered (2020)

Martian species #B is a microbe living in the salty brines on Mars. It survives on magnesium chlorate, sodium perchlorate and minimum amount of oxygen.

By accumulate salt and sugar inside its cells this species protect itself from drying out. This process also offer protection from radiation by preventing the DNA double helix from breaking apart, it stops proteins and cell membranes from unravelling when it gets hot and dry out.

## Martian species #C



Planet: Mars

Discovery: Undiscovered (2020)

This specific organism is habited on the surface of Mars' two poles. Here it feeds by exposing itself to galactic cosmic rays which contains large amounts of ionizing radiation. Because of Mars' thin atmosphere the radiation is constant and the organism has evolved thick layers of melanin to help capture and break it down.

## Martian species #D



Planet: Mars

Discovery: Undiscovered (2020)

Because of the abundance of carbon dioxide in Mars' atmosphere, this microbe is flourishing as carbon dioxide is its primary source of energy. The species can utilize the carbon dioxide, making a steady consumption through its membrane. Living in great numbers along the equatorial line of Mars where the climate is warmest, this species is reproducing quickly.

We would like to end with a quote from Donna J. Haraway. From the book *Staying with the Trouble* and the chapter ‘Making Kin’, which the project got its title from.

: “I think that the stretch and recomposition of kin are  
: allowed by the fact that all earthlings are kin in the deep-  
: est sense, and it is past time to practice better care of  
: kinds-as-assemblages (not species one at the time). Kin  
: is an assembling sort of word. All critters share a common  
: “flesh,” laterally, semiotically, and genealogically.”<sup>9</sup>





*MOTHER CULTURE*

*by*

*MARIAH WRIGHT*

*Mother Culture is an investigation of our understanding of bacteria and the role it plays in everything from our evolution as a species to the everyday functions of our body.*

Although we are mostly unaware of the trillions of bacteria in and on our bodies, humans are in many ways more microbe than human. Of the 20,000 human genes that make up human DNA there are as many as two to 20 million microbial genes in our bodies. Our microbiome equates to 1.5kg of material in our body—roughly the equivalent weight of the human brain.<sup>1</sup>

The most essential way bacteria is introduced into the human body is through birth. The delicate balance of vaginal and fecal bacteria from our mothers forms the baseline for adult bacterial colonies to grow. Each mother and every family has its own distinctive microbial signature which is passed down across the generations. This bacterial baseline becomes one of the most complex and unique elements of our biology. While there is a 99.9% DNA match across all people, some people share as low as 10% similarity when it comes to their gut microbiome.<sup>2</sup>

Today, research such as The Human Microbiome Project,<sup>3</sup> which provided the resources to better understand how the microbiome functions, The Earth Microbe Project,<sup>4</sup> a research project to map microbes from around the world, and the American Gut Project<sup>5</sup>, which enables Americans to compare their gut bacteria with others around the country, have created a deeper understanding of bacteria and its role in our lives. As a

<sup>1</sup> Sebastian G. B. Amyes, *Bacteria: a Very Short Introduction* (Oxford: Oxford University Press, 2013)

<sup>2</sup> Rob Knight, “How Our Microbes Make Us Who We Are,” TED, accessed November 19, 2019, [https://www.ted.com/talks/rob\\_knight\\_how\\_our\\_microbes\\_make\\_us\\_who\\_we\\_are](https://www.ted.com/talks/rob_knight_how_our_microbes_make_us_who_we_are)

<sup>3</sup> “NIH Human Microbiome Project,” NIH Human Microbiome Project: Home, accessed November 19, 2019, <https://hmpdacc.org/>

<sup>4</sup> “The Earth Microbiome Project Is a Systematic Attempt to Characterize Global Microbial Taxonomic and Functional Diversity for the Benefit of the Planet and Humankind,” Earth Microbiome Project RSS, accessed November 19, 2019, <http://www.earthmicrobiome.org/>

<sup>5</sup> “American Gut,” American Gut, accessed November 19, 2019, <http://americangut.org/>



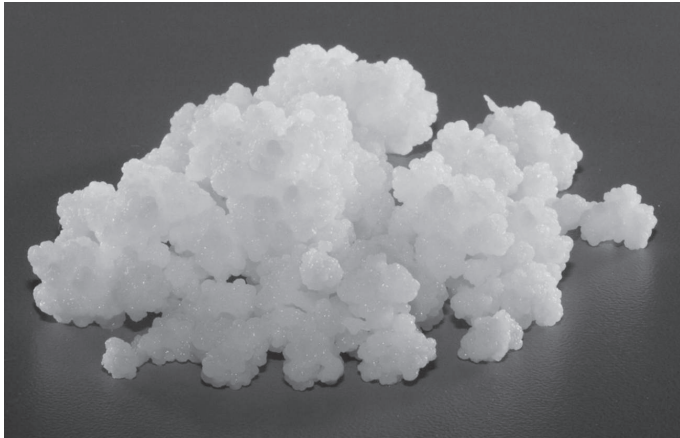
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Baby born via caesarean section. The number of births by caesarean section is on the rise, climbing from about 16 million (12.1% of all births) in 2000 to 29.7 million (21.1% of all births) in 2015.<sup>6</sup> Today, more hospitals are exploring exposing caesarean section babies to their mother’s bacteria as a result of new studies that show the long term health benefits.

result, how bacteria is valued and understood in relationship to human health is being reframed. Practices such as ‘Bacterial Baptisms’, in which c-section babies, who would otherwise not benefit from their mother’s bacteria, are swabbed with bacteria from the birth canal, are becoming both more accepted and mainstream.

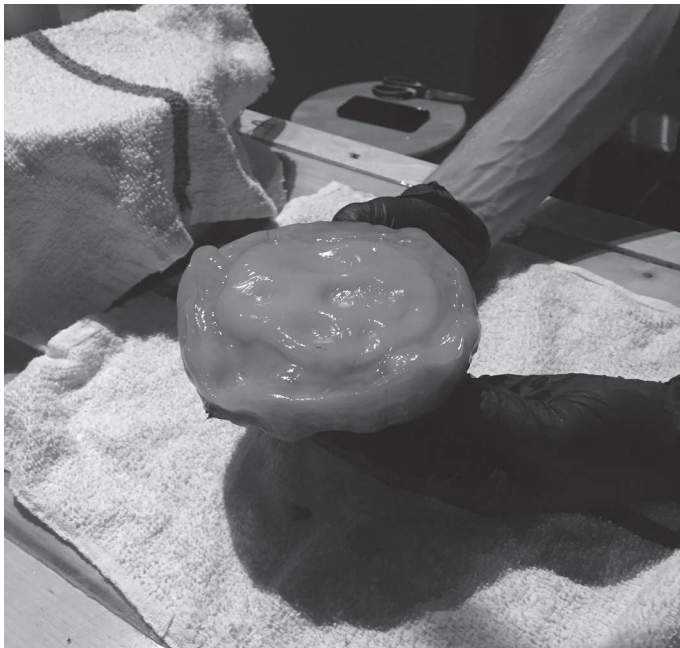
This awareness has created a culture that is more empowered and conscious about other ecosystems of life within their bodies and how those multitudes contribute to our overall health and wellbeing. This shift in thinking can be seen in the boom of do-it-yourself biology, a social movement that strives to bring the

<sup>6</sup> Ties Boerma et al., “Global Epidemiology of Use of and Disparities in Caesarean Sections,” *The Lancet* 392, no. 10155 (2018): pp. 1341-1348, [https://doi.org/10.1016/s0140-6736\(18\)31928-7](https://doi.org/10.1016/s0140-6736(18)31928-7)



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The newly in vogue Kefir-Kefir grains (depicted above) is a mixture of yeasts and bacterias responsible for the bacteria rich milk beverage.



A SCOBY (symbiotic culture of bacteria and yeast) removed from a kombucha fermentation before bottling.

knowledge of biological research institutions and corporations into the public and hobbyist sphere, as well as in the revitalization of bacteria-rich historic fermentation practices in popular foodie and health culture. In the last decade, probiotic pills, raw dairy, cultured yogurt, kefir, kombucha and kimchi have quickly grown from niche products to mainstream commodities. According to Research & Markets insights, the global human microbiome market is projected to cross \$1.73 billion by 2027.<sup>7</sup>

Despite this growing awareness, very little is known about bacteria beyond our planet. The first study looking into the effects of long-term space travel on bacteria in humans was completed by NASA this year.<sup>8</sup> Although the results of the study are still initial, changes in microgravity do change to the makeup of our bacterial communities and raise questions about the adaptability of bacterial ecosystems when pushed to unprecedented extremes. These findings highlight, as biology professor and co-author of the study Fred Turek, asserted;

“If we are going to send humans to Mars or on long missions to the moon, it is essential to understand the effects of long-term exposure of the space environment on us—and on the trillions of bacteria traveling with us.”<sup>9</sup>

One of the biggest challenges in creating a healthy, symbiotic future for humans and bacteria is how little is known about human’s ability to conceive or give birth in space or

<sup>7</sup> Research and Markets Ltd, “Human Microbiome Market by Product (Prebiotic, Probiotic, Food, Medical Food, Drug), Application (Therapeutic), Disease (Infectious, Metabolic/Endocrine, Cancer, Blood, Neurological), Research Technology (Proteomics, Metabolomics) - Global Forecast to 2027,” Research and Markets - Market Research Reports - Welcome, accessed November 19, 2019, <https://www.researchandmarkets.com/reports/4833275/human-microbiome-market-by-product-prebiotic>

<sup>8</sup> “The NASA Twins Study: A multidimensional analysis of a year-long,” Science 2019, (2019), <https://science.sciencemag.org/content/364/6436/eaau8650.full>

<sup>9</sup> “The NASA Twins Study: A multidimensional analysis of a year-long,” Science 2019, (2019), <https://science.sciencemag.org/content/364/6436/eaau8650.full>

on other planets. The lack of gravity and extreme conditions pose substantial and life-threatening risks to future space natives. Fundamentally, our lack of understanding of the complexity of human life and the delicacy of our interdependence on other lifeforms and systems will be the essential hurdle for future human adaptation on this planet or beyond. As Dr. Kris Lehnhardt, Deputy Scientist for Exploration Medical Capability at the NASA Johnson Space Center stated;

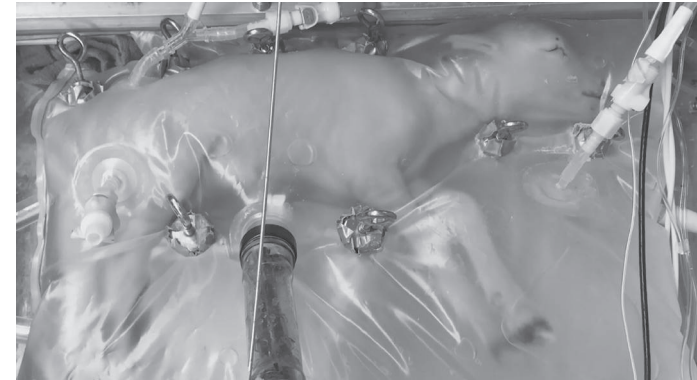
“All of our big tech gurus out there who want us to be a multiplanet civilization—this is a key question that no one has answered yet. Everyone is focused on the hardware, and the hardware is great, but in the end, it’s the squishy meat-sack that messes everything up. Ignoring the human system, if you will, in future plans and designs is only going to lead to failure.”<sup>10</sup>

Going forward, the extreme new realities humans face will require an expanded scope of design—considering the intersection of machine and man within the multi-species context that our survival is so inextricably linked to.

In this scenario, to ensure fragile interplanetary pregnancies go to term, babies are artificially conceived and incubated in an external womb.

Despite the security of these artificial wombs, babies born from them would be born essentially bacterially sterile. To merge bacterial and human life in space, Mother Culture explores how this symbiotic relationship could continue into the future by cultivating the human microbiome outside the human body. By making the human/bacterial relationship more explicit, the project

considers how our future relationship with bacteria could become more conscious and connected. Ultimately, the project seeks to undermine the concept of human exceptionalism by making our codependence on other life systems more immediate.



Children’s Hospital of Philadelphia design for an artificial womb which successfully grew a premature lamb to full-term.<sup>11</sup>

<sup>10</sup> Nadia Drake, “Can Humans Have Babies on Mars? It May Be Harder than You Think.” What science says about having babies in space, December 10, 2018, <https://www.nationalgeographic.com/science/2018/12/can-humans-have-babies-on-mars-space-it-may-be-harder-than-you-think/>

<sup>11</sup> UA/UV Biobag system design. Emily A. Partridge et al., “An Extra-Uterine System to Physiologically Support the Extreme Premature Lamb,” *Nature Communications* 8, no. 1 (2017)

**Cathrine Disney** is a London based critical artist, designer and creative researcher exploring the blurring boundaries and entangled relationship between materials, emerging technologies and the human species.

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**Fred Erik and Pleun van Dijk** are fascinated by the endlessly evolving world they live in. By observing and analysing moments of transition within society they generate alternative perspectives on our future lives. The occasional duo shares a strong desire to move forward, away from what is obvious and known.

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**Agi Haines and Nicholas Tamás** are designers who both use sculptural fabrication methods to make physical artefacts that imagine new and often strange states of the post bio-tech-body.

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**Nonhuman Nonsense** is a research-driven design/art duo creating near-future fabulations and experiments somewhere between utopia and dystopia. They seek the contradictory and the paradoxical to tell stories that open the public imaginary to futures that currently seem impossible. It consists of Leo Fidjeland and Linnea Våglund.

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**Thomas Pausz** creates narratives using a variety of media: artefacts, living systems, films and publications. Pausz's projects reflect on social and environmental change and questions the technologies and mythologies of production systems and species hierarchies.

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**Oscar Salguero and Zack Saunders** explore alternative designed realities via research, fictional storytelling, and object-based installations. By probing emerging technologies and philosophies, they aim to unveil new potential issues, attitudes, or materials that we might encounter in a rapidly changing century.

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**Wang & Söderström** is an art and design practice with a focus on digital/physical explorations and fabrication. They strive to create mind tickling and unexpected experiences through materiality and technology. Wang & Söderström is comprised of Swedish spatial and furniture designer Anny Wang and architect Tim Söderström.

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**Mariah Wright** is a designer and researcher focused on sustainability. Her work comes to life in a range of media including product and material design, writing, cultural insight and brand consulting. Mariah holds a master's in Material Futures from Central Saint Martins and is the founder of the design collective Circular Union. She currently lives and works in NYC.

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Designers	Agi Haines and Nicholas Tamás (UK/US), Cathrine Disney (UK), Fred Erik & Pleun van Dijk (BE/NL), Nonhuman Nonsense (SE), Mariah Wright (US), Pleoforma, Oscar Salguero & Zack Saunders (US), Thomas Pausz (FR), Wang & Söderström (SE)
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Open call jury	Prof. Martín Ávila, University of Arts, Crafts and Design, Sweden. Dr. José Eliel Camargo-Molina, Imperial College London, UK and Dr. Rowan Bailey, University of Huddersfield, UK.

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