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ESSAY

Mammoths and Reindeer: Speculative Design Imaginaries and Technoscientific Care in the Arctic

Martin Müller and Emilia Tikka

The future of the Arctic is highly contested. How to care for its fragile ecosystems suffering from escalating climate crisis, extinction of species, and vanishing of cultures? This article discusses and contrasts two cases of design-driven techno-scientific speculations on Arctic futures. The first part of the article addresses and problematizes contemporary synthetic biology, where design is understood as engineering: to protect Arctic ecosystems, the mammoth and other extinct species are to be "resurrected" with genome editing. The second part introduces an Arctic design collaboration situated in a reindeer herding culture in the Finnish Sápmi. The project aims to counter the hegemonic technocratic imaginaries, where nature is seen as inert matter for human design: alternative techno-science futures are materialized as other stories where the *living relation* to the land and reindeer is central.

Keywords: Arctic futures, synthetic biology, technoscientific care in the Anthropocene, speculative design, human–nature–technology relations

In the discourse of the escalating climate crisis, the Arctic region has received special attention. Global warming is occurring here four times as fast as the global average (Rantanen et al. 2022). Not only the Arctic glaciers are melting; nature, biological life, and ancient cultures and practices are in the process of dissolving at an alarming rate. Here, what the rest of the world will be threatened with is already becoming visible: the eschatology of the Anthropocene. Thus, the Arctic becomes the site of technoscientific action for climate rescue approaches and struggles over interpretation about what to do in the imminent crisis (Müller 2023, N4). Our article will contrast two projects that deal with the same question: How to care for Arctic futures? What kind of role can design play in this endeavor?

One predominant answer leads into the field of synthetic biology, where design is understood as the engineering of living entities. The first part of our article will discuss a project of "radical design" (Smith et al. 2020) in times of ecological mass extinction: the so-called resurrection biology of the woolly mammoth. In this case particularly, care appears to be a rather hylomorphic relation of active form-giving (bioengineering) and passive form-receiving (nature). Biotechnological making and designing is, for the most part, an expression of classical engineering in modernity, set in motion in the 19th century and increasingly advanced ever since – as the production, manipulation, and control of "natural things" (Schäffner 2022, 186). Synthetic biology denotes human domination over nature, which must bend to the will of the engineer. Care (and design) appears here as an anthropomorphic, universalist and teleological dispositive of a technological fix, in which the preconceived idea of the engineering object is implemented into the artifact and material worlds. The ecological crisis, brought about by the technical-industrial culture of modernity, is to be combated using even more technology. The promethean program is obvious: mastery of nature from atom to atmosphere (Müller 2022, 164–168).

The second part of the article introduces a different ontological approach to technoscientific care in the Arctic, aiming to move beyond the tragic dichotomy of pristine nature and technocratic progress. It focuses on a case study that is situated within the realm of vanishing reindeer herding cultures in the Finnish Arctic, where technological applications are rapidly replacing ancestral nomadic practices. It shows how speculative design is used to collaboratively explore technoscientific futures based on alternative ontologies of care and nature. The project fosters a contrasting position to synthetic

biology's hylomorphic approach to design. In the reindeer worlds, the land and the animals are not perceived as inert or passive *res extensa*, but as interdependent and living. Films and objects are part of the process of co-speculating and imagining alternative concepts of belonging, which draw from the idea of the *living relation* to the land and latest research on epigenetics. This fusion of knowledge systems and ontologies marks the possibility of different kinds of futures in the Arctic.

De-extinction

In the Arctic, anthropogenic climate warming can be observed at a breathtaking rate. Besides the eroding glaciers, the permafrost soils are losing their millennia-old layer of ice. Christian Frei's documentary *Genesis 2.0* (2018) shows not only the novel landscapes that are emerging, but also the traffic and business that is now starting in the Anthropocene Arctic. In the milder cold, its inhabitants traverse the swampy landscapes, navigate their boats on newly formed lakes, climb and dig into crevices that are now open. In Frei's portrayal, men in camouflage gear are searching for and sometimes finding the bones of long-extinct animals. The human-sized teeth of a mammoth are being transported away on snowmobiles. This new extractivism breaks with an old tradition: "To many Siberian indigenous groups, the mammoth is a sacred beast and mustn't be disturbed – to do so could mean death" (Wrigley 2020). The buyers of these remains from the last Ice Age are not only museums and collectors. Among the most important customers are the departments of biological engineering. The phrase new "white gold" is equally applicable to the Arctic tusk diggers and the global bioeconomy.

Synthetic biology has chosen a thoroughly mythopoetic genre in which almost unrestricted feasibility and thinking of all-constructibility is embodied: in Cambridge, Massachusetts – and in other labs around the world – scientists are working on the "resurrection" of the woolly mammoth. "George Church's lab at Harvard University's Wyss Institute reported their first successes in editing living elephant cells so that they contain gene sequences from the elephant's recently extinct relative, the woolly mammoth." As evolutionary biologist Beth Shapiro writes in the December issue of the prestigious journal Genome Biology, "Using CRISPR [...], Church's team replaced 14 loci in the elephant genome with the mammoth version of those sequences" (Shapiro 2015, 1). Previously, the mostly intact DNA of the Ice Age animal had been found in the Arctic. In comparison with its genome data, the genetic material of an elephant is to be processed in such a way that, after artificial insemination, a mammoth embryo produced from it can be

carried by an elephant cow – a distant relative of *Mammuthus primigenius*, which has been extinct for thousands of years. The goal of the project, made possible by the methods of synthetic biology, is a merely climatological affair: the plan is to bring the majestic woolly mammoths, should the experiment succeed, from the Harvard laboratories to the North Pole, where they will then circle in their hundreds to protect the endangered Arctic ecosystem. A program whose motivation is described as follows:

> [C]limate change, much of it driven by anthropogenic factors, is reshaping the distribution of habitats too quickly to allow species to adapt to the changes. As populations decline, species are increasingly threatened by secondary drivers of extinction, including disease and inbreeding. Genome engineering enables the reintroduction of lost genetic diversity, or the introduction of traits that evolved in related species, into species that are struggling to survive. (ibid., 2)

Despite, or perhaps because of, its vague program, resurrection biology and its figurations of necrofauna have attracted considerable interest, not only from the popular press, but also in the field of environmental ethics. The woolly mammoth is not the only animal in the de-extinction program: also of note would be the migratory pigeon (*Ectopistes migratorius*), the Australian dodo (*Raphus cucullatus*), the Pyrenean ibex (*Capra pyrenaica pyrenaica*), and the southern stomach-breeding frog (*Rheobatrachus silus Liem*). In 2013, the so-called Lazarus Project was established at the University of New South Wales in Australia, where de-extinction has progressed the furthest. There, they had accomplished what was the next step for the mammoth. The research team had enucleated the eggs of a related frog species and infused the nuclei from the frozen tissue cells of the gastric hatchery frogs into the “empty” eggs. Embryos of the extinct species grew; however, they survived only a few days. Nevertheless, this was regarded as an engineering proof of principle, according to which the approach of resurrection biology was technically possible and quite promising (Preston 2018, 81–104).

In her critical analysis, historian of science Sophia Roosth has rightly argued that, especially regarding the woolly mammoth project, these are mythopoetic fantasies built on an aporia: for an eventual “making” of “wholly synthetic creatures that will stand-in counterintuitively as resemblances of untouched nature, a latter-day garden of Eden seemingly unsullied by human hands, albeit generated by the most recent bioengineering technologies” (Roosth 2017, 170). We share this assessment and criticism, because bioengineers want to turn

nature back into a pristine and untouched state, which *de facto* never existed. The means for this are supposed to be those computer-designed beings that are as similar as possible to the primordial animals. These beings are then supposed to protect an environment in which they never lived. Precisely for this reason or despite it, the projects of the "resurrection of extinct species" are to be seen as "fantasies of ultimate biological control" (ibid.) with the means of engineering and design.

Universal Constructors

Synthetic biology's concept of design is fundamentally based on an explicit understanding of the genome's textual form and molecular performativity. As George Church and Edward Regis write, "[B]iological organisms could be viewed as a kind of high technology, as nature's own versatile engines of creation" (Church and Regis 2012, 4). In this technoscientific narrative, DNA-based life appears as an aeonian, non-human technology and is described as a billion-year-old machine of creation. The conceptual figuration of life as high technology advances thereby to the core of a design theory of synthetic biology. The technoscientific notion of the genome becomes obvious when the idea of genetic programmability comes into play: "Just as computers were universal machines in the sense that given the appropriate programming they could simulate the activities of any other machine, so biological organisms approached the condition of being universal constructors in the sense that with appropriate changes to their genetic programming, they could be made to produce practically any imaginable artifact" (ibid., 49). Church and Regis declare an organism's genome to be a universal production technology, whose material output is controlled by an inherent genetic program: "A living organism, after all, was a ready-made, prefabricated production system that, like a computer, was governed by a program, its genome" (ibid., 50). Design of genomes starts with code engineering. In the grand narrative of biological engineering, life no longer appears as a limited resource but rather as a medium of production for the unmitigated materialization of human projects. Church's discourse is by no means limited to the realm of technological imagination. Instead, under his direction concrete engineering practices are being developed for the purposes of "radical redesign." In April 2019 his team presented a new CRISPR process that can perform more than 13,000 programming actions at once in a single cell. Today, this Blumenbergian "readability of the world" is followed by the attempt at a biotechnical "writability and programmability of nature" as a consequent application of genome editing, which now appears

more and more clearly as the master discourse. In the words of the co-inventor of CRISPR, Jennifer Doudna:

> Using powerful biotechnology tools to tinker with DNA inside living cells, scientists can now manipulate and rationally modify the genetic code that defines every species on the planet [...] As long as the genetic code for a particular trait is known, scientists can use CRISPR to insert, edit, or delete the associated gene in virtually any living plant's or animal's genome. [...] Practically overnight, we have found ourselves on the cusp of a new age in genetic engineering and biological mastery [...]. (Doudna and Sternberg 2017, xiii)

This asymmetrical human–nature relationship of design-invasive ecomodernism is evident in the long list of contemporary projects of genome editing such as plant design, germline editing, etc. This hylo- and anthropomorphic world-making after the "end of Holocene nature" can be further problematized in the following example.

Ecological Machines and the Total Industrialization of Nature

The artist and designer Alexandra Daisy Ginsberg has done speculative design on synthetic biology. She has brought the visions of the synthetic biologists into the visual image and ontological articulation through the means of speculative design: *Mobile Bioremediation Unit*, *Autonomous Seed Disperser* and *Self-Inflating Antipathogenic Membrane Pump* – these are the names of the speculative life forms in her multimedia artwork, which combines and, as it were, embodies the subjects of ecological crisis and biotechnological futures. As a pivotal work at the intersection of Bioart and speculative design, it is entitled *Designing for the Sixth Extinction* (2015). The formula of the sixth extinction of species is not speculative, but owes much to prosaic empiricism, according to which the extinction of species and the heating of the Earth's climate are reciprocally dependent: at this point in time, more than one million of the planet's approximately eight million species are on the brink of immediate extinction. The warming of the climate caused by humans is fueling mass extinction, and the extinction itself is in turn accelerating the collapse of more and more ecosystems, which can no longer regenerate without the contribution of the extinct species. "The average abundance of native species in most major land-based habitats has fallen by at least 20%, mostly since 1900," a recent UN report on the subject concludes, "More than 40% of amphibian species, almost 33% of reef-forming corals and more than a third of all marine mammals are threatened. The picture is less clear for insect species, but available evidence

1 Detox for soils and trees, while other biotechnical "helpers" spread the seeds in the forest. Image shows a "Self-Inflating Antipathogenic Membrane Pump" from the work *Designing for the Sixth Extinction* (2015) by Alexandra Daisy Ginsberg.

supports a tentative estimate of 10% being threatened" (United Nations 2019). On the other hand, the number of people has more than doubled since the 1970s, rising from 3.7 to 8 billion. Against this backdrop, the question arises: How many planets have enough resources to support the nine billion people projected to live on Earth by 2050? In this "accumulation of the present" (Horn 2018), the images of a doomed world, which circulate in daily reporting as apocalyptic, are emerging. It is becoming increasingly difficult to distinguish between actual events and probable scenarios: the Gulf Stream is drying up, Arctic glaciers are about to melt completely, soon large parts of Southeast Asia and Oceania could become uninhabitable due to scorching heat and rising water levels. There is even talk of a possible reversal of the poles.

In view of these thoroughly eschatological discourses of a dying and eroding nature in the Anthropocene, Ginsberg brings the speculative element of design into play: where the natural species have disappeared, where nature can no longer

regulate and regenerate itself, that is where man-made, synthetic species take up their work: "In this version of the future," the British artist explains, "novel companion species are designed by synthetic biologists to support endangered natural species and ecosystems" (Ginsberg 2015). Designed in the lab and with the tools of bioinformatics, then produced in large numbers, they are released into the dying ecosystems. There they function as actors in an Anthropocene future, in which the consequences of the anthropogenic climate catastrophe, with these very anthropogenic "ecological machines" (ibid.), are to be kept in check. Yet the idea of these machines has a thoroughly early modern sound to it. It is almost reminiscent of the mechanistic visions of Bacon or Descartes. The machines of the future do nothing but filter, clean and pump in the ruins of the natural world (Bacon 1626).

In this speculation, the possible ecological machines appear as eschatological machines that only form the soft surface of a much harder engineering logic. Ginsberg touches on this "hard core" in an explanation of her own work. The question she poses there can be understood as the central vanishing point of a theory of the present that we would like to develop in this contribution: "If nature is totally industrialized for the benefit of society – which for some is the logical endpoint of synthetic biology – will nature still exist for us to save?" (ibid.). The total industrialization of nature is indeed the logical endpoint of engineering biology, pushing the opaque idea of "repairing" the damaged planet almost into the unthinkable (Müller 2023b, 185–200).

Practices of Care in the Reindeer Worlds: *Living Relations*

Following the critique of Arctic care projects based on molecular engineering of the living, we argue for a need to imagine different kinds of technoscience futures. What ultimately should be re-imagined is the underlying human–nature–technology relation, where nature appears as inert matter and *res extensa,* waiting to be appropriated and redesigned by technology and engineering. This chapter introduces an example of how human–nature–technology relationships are renegotiated collaboratively through an alternative approach to care. After the problematization of the described synthetic biology project in the Arctic, the woolly mammoth, the following paragraphs develop an alternative position through discussion of a speculative design and film project entitled *Mnemonia.* Here the artwork serves as a kind of contrasting foil to the engineering-driven care concepts of the synthetic biologists and creates a collaborative approach of designing with care through reindeer ontologies. The

collaboration project took place during 2020–2022 between one of the authors of this article, the designer and researcher Emilia Tikka, and a reindeer herder, Oula A. Valkeapää, and his artist-researcher partner Leena Valkeapää. The collaborative artwork is situated in the most north-western part of Finland, in the area of Sápmi, where Valkeapää is following his family's ancestral tradition of reindeer herding based on nomadism.

Technoscience is an imminent part of contemporary herding in this area. Ancient practices and ontologies exist simultaneously with drones, snowmobiles, and GPS tracking. In these worlds, where in many ways "multiple natures" are intertwined, binary divisions between "pristine" or "modern" are not useful to make. However these technologies are not developed from the cosmological perspectives of nomadic herding, and therefore they ontologically shift the practice. For example walking or skiing *in* the landscape creates a different awareness of it, as when moving fast *through* it with snowmobiles. In this way the technoscience ontologically "redesigns" (Willis 2006) the practices and ways of being in reindeer worlds.

The nomadic practice of reindeer herding is on the verge of vanishing in Sápmi in the Finnish Arctic. Some of the complex reasons include climate warming, but also politics of borders and infrastructure development projects. In the ancient nomadic reindeer herding cultures, humans migrate by following the seasonal rhythm of reindeer. The distances between pastures are often hundreds of kilometers. Migration is seen as "nature's way" to maintain balance in ecosystems regarding resources. When a herd of thousands of reindeer is grazing, the balance comes from changing pastures between seasons, giving the land an opportunity to rest and regenerate. However, this has been made difficult for the herders in Finland, where the fenced herding areas are not following the natural migration rhythm of the reindeer (Reinert et al. 2009). Some recent studies suggest that reindeer grazing would actually hinder climate warming (Beer et al. 2020). Furthermore, migrating with reindeer has a deeper dimension of cultural and social meaning to the herders. Sámi author Johan Turi has compared reindeer to migrating birds (Turi 1979, 73). Science and technology studies scholar Marianne Mäkelin interprets Turi: "For the birds, home is in this circular leaving and returning. A migrating bird does not belong to a place but to the movement that follows seasonal variations" (Mäkelin 2022, 12). Migrating does not only bind humans to the seasonal rhythms of reindeer, ecosystems and landscapes, but is also the actual home of the herders. "Home" for them is not about

living in one place, one building, but rather dwelling *in* the landscape.

Care in human worlds is often understood as a physically close activity of *taking care* of someone, as a human takes care of their child or cattle by feeding them. Care in nomadic reindeer herding cultures means something rather different (Reinert 2014). It firstly means to foster the animal's freedom to migrate according to their seasonal rhythm and secondly to respect their ability to fend for themselves in order to survive without becoming too dependent on humans. Environmental humanities scholar Hugo Reinert writes about how care manifests within Norwegian Sámi reindeer herding communities: "Distance was managed here, and cultured, as an element of moral obligation toward certain nonhuman others: in other words, as an attribute of moral responsibility, and as a practice of care in itself" (ibid., 52). In this practice, care is different from domestication and making the animal fully dependent on the humans. Instead, care means to cultivate interdependency. This is because by losing their ability to find food from nature, the animals would lose their agency and therefore become more separate from the ecosystem. Also, Maria Puig de la Bellacasa argues similarly: "Care is not about fusion; it can be about the right distance" (Puig de la Bellacasa 2017, 5). The underlying concept of care here is based on perceiving the animals themselves and the human relation to them with agency. This relation between humans and reindeer is part of the tacit knowing in reindeer worlds and we call it here *living relation*. This term is a translation of a word that Oula A. Valkeapää and Leena Valkeapää have used in their dialogues on human–reindeer relations with Tikka. The *living relation* itself constitutes the flourishing of the ecosystem. It is based on an exchange, a symmetric relation between humans, reindeer, and land. Letting the reindeer follow their natural migration rhythm, and being part of it as humans, is the core of keeping this relationship alive. Therefore, it is the dwelling in the landscape, following the ancestral paths and continuing the practices, that ultimately binds the humans in the *web of life* (Haraway 2016, 216). When migrating with the seasonal rhythm of the reindeer becomes impossible, the *living* ancestral relation to the land and reindeer vanishes.

Mnemonia, Stories of Hope in the Ruins

This fading *living relation* between reindeer herder, the reindeer and land is the focus of the artwork *Mnemonia*. The aim was to co-speculate alternative technoscience worlds and futures through the reindeer ontologies of care and the *living relation*. The work is a result of a dialogue-through-making

between the partners, in which speculation functioned as a mode where different ways of knowing and cosmo-ontological positions were equally valued as factual (Meskus and Tikka 2022). The installation includes three parts: two short films and a set of speculative objects. The first part is a film called *Bottažat* (Sámi for Short Moments), directed and shot by Oula A. Valkeapää. It was important for the partners that the work started with a story of the contemporary reindeer worlds, told and "seen" by Valkeapää. He was filming the material with a GoPro camera when he was living with his herd during the summer of 2021. The autobiographical story takes place in contemporary reindeer herding practice, where technological change is visible as motorized vehicles and the use of drones. However, the practical rituals of making fire, setting up the lávvu (temporary dwelling) and living in the landscape are ways of keeping the traces of the nomadic past alive. These are the cultural techniques that connect the herder to the *reindeer time* and to the living worlds of the landscape. As long as these rituals are continued, the *living relation* between the species is alive. The end of the film shows haunting images of a summer home of the Valkeapää's family that now lies beyond borders in the area where migrating is no longer possible. The film is a kind of a swansong to the deep ancestral connection between humans, reindeer, and landscape, slowly fading away when the ancestral nomadic practice becomes impossible.

The second part is a film called *Lauman Muistot* (Finnish for Memories of the Herd), directed by Tikka and written with Oula A. Valkeapää. This is a collaborative storytelling, where different ontological positions are present simultaneously. The story, in the form of magical realism, takes place in the year 2102. As a result of an escalation of global warming the Gulf Stream has collapsed (Boers 2021). The movie starts at a post-apocalyptic beach by the Arctic Ocean, where snow falls for the first time after decades without winter. In this world, nomadic reindeer herding has faded away. The film tells a story of a bioscientist, who has traveled from afar to find traces of her ancestors. She spends years wandering alone in the landscape, looking for material traces of the nomadic past. The story takes a new turn when she finds a deceased reindeer that carries the epigenetic memories of her ancestors in its bones. The film is a story of hope in the ruins (Tsing et al. 2017), where the toxic soils and the bones of deceased reindeer still carry epigenetic memories of past migrations. "Landscapes, as well as the bodies dwelling in them, carry signs of what has been. These can often be felt only indirectly, as eerie presences or absences, as traces [...]. Or, as ways of inhabiting landscapes and temporalities that become possible

2 A screenshot from *Bottažat*. (image credit by Oula A. Valkeapää 2022)

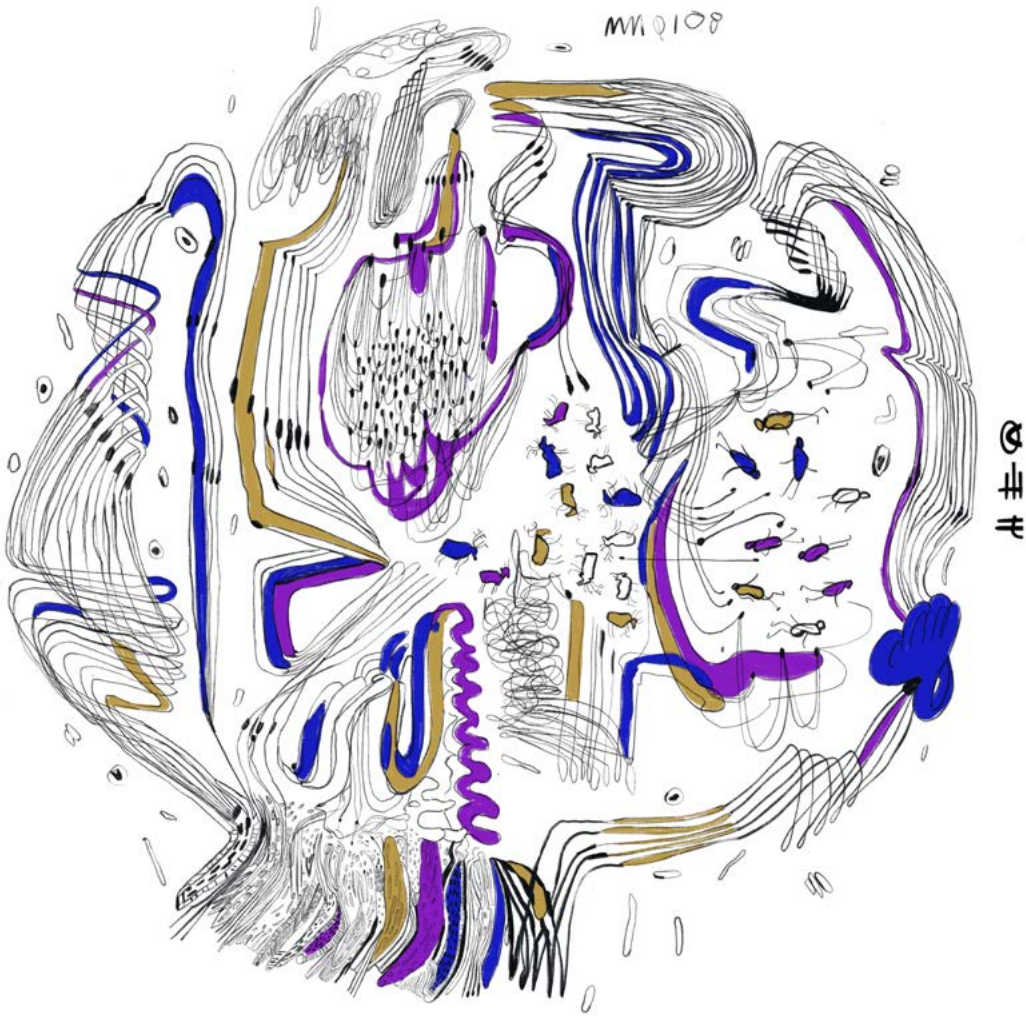
3 A screenshot from *Memories of the Herd* (photo credit Emilia Tikka 2022)

or impossible with the changing world" (Mäkelin 2022, 12). The memories here are not meant as subjective images of past events stored in the synapses of the human brain – rather, they are understood as embodied traces of the living worlds, which can be enfolded and re-remembered with the right sensitivities and practices.

Genes connect human bodies to past generations through the transmission of DNA. This has been the central grand narrative of heredity in Western science. Yet, epigenetics proposes another perspective, making the questions of genetic heredity messier, reaching beyond human bodies. Epigenetics is the study of heritable changes in expression of genes that are not caused by changes in DNA (Gibney and Nolan 2010). New studies in biosciences suggest that lived embodied experiences such as traumas or hunger can be inherited transgenerationally through epigenetics (Painter et al. 2008). Some scientists suggest that epigenetic particles may even move between bodies of different species (Chen and Rechavi 2022). How this process of transmission takes place is still unclear, but evidence suggests that bodies are porous and alternative ways of bioscientific belonging may be plausible. In *Mnemonia* new bioscientific relations are imagined through a lens of reindeer ontologies. The tacit knowledge of the *living relation* between humans, reindeer and the land is taken as being as much of a fact as the latest bioscience research. In this way the stories don't separate the tacit and bioscientific knowledge, but rather aim to weave them into new narratives of interspecies ancestry and sharing of embodied memories.

The third part of *Mnemonia* carries the story deeper into the future, in the year 2152, when nomadic reindeer herding cultures flourish. The newly established *living relation* between toxic landscapes, rewilded reindeer and herders leads to new kinds of nomadic cultures and technoscientific futures. The objects of *Designs for Nomadic Futures* are everyday items of a speculative culture where technological development is following the reindeer seasonal migration rhythm. One of the speculative design objects, a circular *Book of Mnemonic Biosciences,* tells the imaginary history of a new kind of bioscience that recognizes the ancestral connection between species. The drawing of a *Post-Genetic Family Tree* illustrates the ancestral connections between humans, reindeer, and the land. The *Biometric Visitor Visa* refers to an alternative border system that now allows humans and animals with the *living relation* to the landscape to migrate freely. These objects do not only embody a hopeful future for the vanishing nomadic culture, but they also materialize a society where technological

4 A page from the circular *Book of Mnemonic Biosciences*, illustrating *Post-Genetic Interspecies Family Tree* (image credit Emilia Tikka 2022)



development is based on ontologies and ethics of care of the reindeer worlds.

The Possibility of Other Worlds

One cannot accuse synthetic biologists of not being interested in ecological issues. On the contrary, they promise to take care of ecological problems with technological means, with "radical design." They invent, imagine, and project ecological futures. However, the idea of living beings as instruments becomes a thoroughly problematic matter. The worldmaking strategy of synthetic biology with regard to the extinct mammoth is speculative design in the true sense. However, the speculation is based on a precarious nature ontology. Synthetic biology's understanding of materials and nature culminates in Oron Catts and Ionat Zurr's ironic statement: "[L]ife is becoming bio-matter, waiting to be engineered" (Catts and Zurr 2017). This approach separates subject and engineering practices on the one hand and between a passivated and quasi-inert nature on the other. It is not surprising that this separation determines the design process, as ideal human imagination is inscribed in the passive material nature. (For a critical perspective: Petruschat 2022, 80–84; Schäffner in this volume.) Behind the spectacular promises and projects stands a thus antiquated concept of making. Here the promise of synthetic biology as an ecological take on care is failing due to the carelessness of design ontological questions: of the domination of form over material – as a classic hylomorphism of 19th century engineering. It is the outmoded conception of a thoroughly mythopoeic hylomorphism: as a separation of (metaphysical) form and (passive) substance. In antiquity, according to the well-known image from Aristotle's Metaphysics, the sculptor recognized the idea of the figure, which was already laid out in the marble. In the now dawning Anthropocene, the genome becomes a kind of quarry for the techno-scientific figures and natures of an "evolution from human hands." But can Homo faber be affirmed as Homo creator without further ado? One notices an ethos of *tabula rasa* and all-constructability that wants to build concrete bridges and redesign genomes (Müller 2019). The *will to engineer* aims at nothing less than the total industrialization of nature. In this narrative, living beings are smart machines, only tools, perhaps, that are the basis for the production of more machines for dying worlds. Daisy Ginsberg's scenes and scenarios are without people, yet they show the universal division of labor between engineers and soft machines, between master and servant. Donna Haraway criticized the universalist "view from nowhere" of modern science as "the god trick" (Haraway 1988, 581). Arguably, an "engineering from nowhere" applies to contemporary synthetic

biology. But for whom are these worlds made – who, or what, is supposed to inhabit them?

The Arctic care in *Mnemonia* is imagined with and designed for real people whose ancestors have lived and survived in the Arctic for centuries. However, they are not representatives of pristine nature–culture relations. Even if reindeer ontologies and worldviews can be distinguished from the scientific worldview of Western modernity, both have been shaped by technology and technoscience. Whereas the mammoth project promises the return of a "pristine" nature, *Mnemonia* stems from the ongoing collision of modern technology and ancient *living relations* to the more-than-human worlds. It does not repeat the master discourse of a technological fix, but it makes visible the open process of a permanent negotiation of an always fragile relationship between culture and nature, humans and animals, technology and traditions – between ancient pasts and possible futures.

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