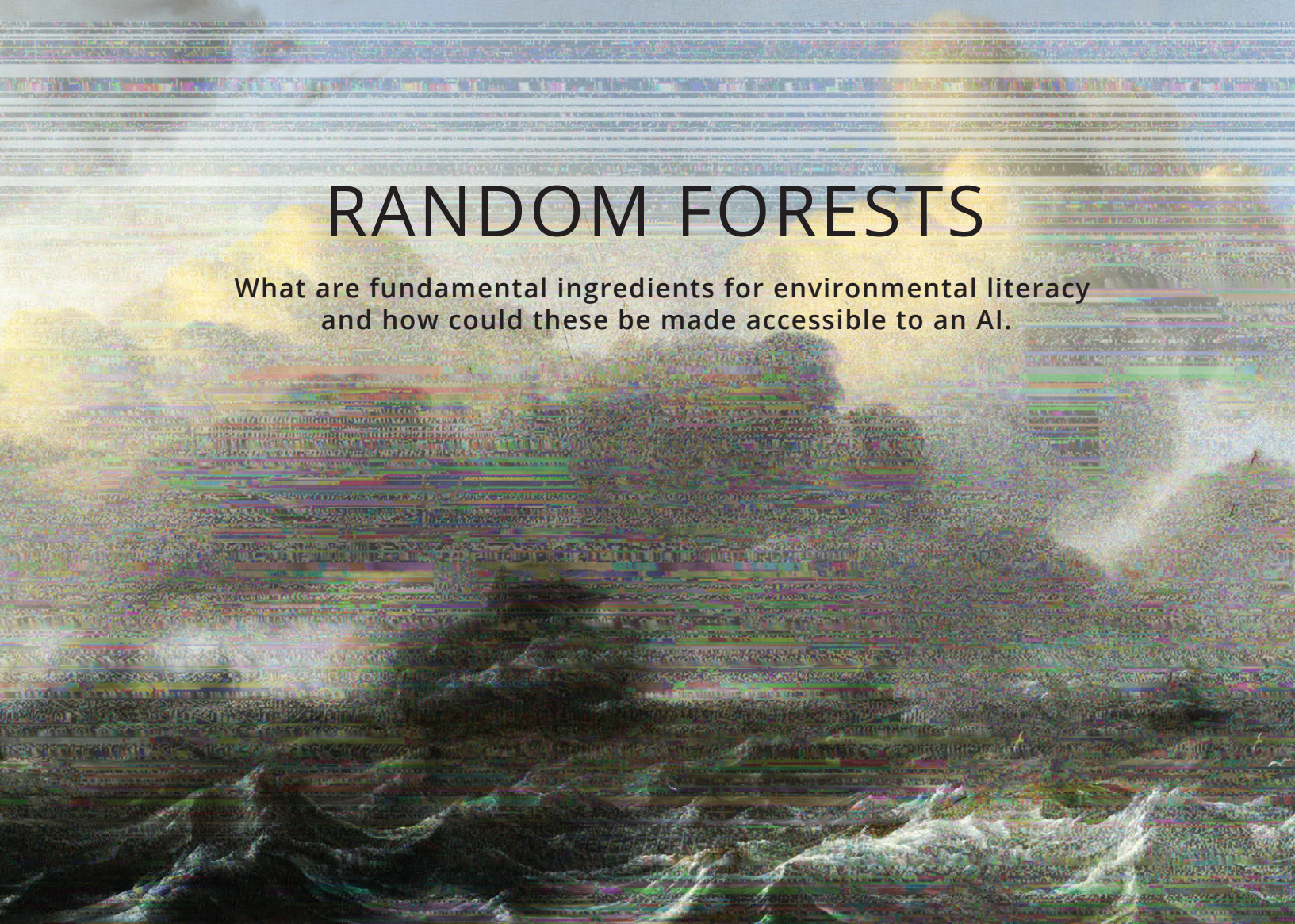
fieldguide
to

Random Forests



RANDOM FORESTS

What are fundamental ingredients for environmental literacy and how could these be made accessible to an AI.

Thunderbirds* come in mind when I discuss the topic of environmental literacy with Theun.

Once there were low lying islands. Surrounded by dikes. The sea found a back passage to recover-reconquer the land. Two solutions were discussed: abandon the islands to be re-reclaimed by the sea, or design a long system of dams and dikes to keep the islands. In line of long standing engineering traditions, the second option was developed. For every step of the project they first had to invent machines to do this new type of work. Like the Thunderbirds, remarked Dutch landscape architect Adriaan Geuze. But to me, it seems they forgot to ask the more fundamental question before embarking on solutions. Why draw a straight line?

By now, after building for 43 years and 21 years after completing we realize that this system fails. Opening up closed barriers and schemes for 'building nature parks' should enhance the public experience of the concept of nature…but we may need International Rescue of the Thunderbirds. Can autonomous machines extend our sensitivity towards natural processes and report back to us, as we humans seems to fall in our own traps over and over again?

*** Thunderbirds is a British science-fiction television series from the sixties that up to today have a cult status. Set in the mid-2060s, Thunderbirds follows the exploits of International Rescue (IR), a life-saving organisation equipped with technologically-advanced land, sea, air and space rescue craft; these are headed by a fleet of five vehicles named the Thunderbirds and launched from IR's secret base in the Pacific Ocean.**

Jacqueline Heerema, curator of Satellietgroep
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RANDOM FORESTS

Until recently the ability to make sense of the environment was limited to biological beings. Now machines are starting to blur those lines. What does it mean if machines join animals and plants there on more equal levels of awareness? This programme investigates the emerging field of environmental machine learning through fieldwork and critical reflection.

from Machine Wilderness into Random Forests

Pioneers like al Jazari already made programmable automata around 1200AD. Complex machines have therefore been part of our environment for many centuries. Technological infrastructures came to really dominate our landscapes since the Industrial Revolution. The word that comes to mind is brutality. Edward O. Wilson described our current age of mass extinction as the '***Age of Loneliness***' and in many ways our technologies in these shared and biodiverse environments have been ***technologies of loneliness*** that violate natural processes, disturb habitats and crush biodiversity. The machine landscapes of late capitalism are silent, degraded places where in many areas only corpus vegetation remains.

Machine Wilderness was a programme hosted by Zone2Source and developed by me - Theun Karelse of FoAM - that aimed at reimagining how machines relate to our landscapes. What if they related to their environment the way organisms do?

Central to Machine Wilderness were fieldwork sessions aimed at in-situ prototyping to relate to local environmental complexities and subtleties with teams of people with diverse backgrounds. These sessions were rooted by local experts and guides. Team worked at creating technological creatures or systems for specific local biomes. These models would then be released into their intended habitat. The programme also consisted of debate, workshops and exhibitions throughout Europe, including MicoClima in Venice, Pixelache in Helsinki, Transmediale in Berlin and the Digital Design Weekend at the Victoria and Albert museum in London.

In workshops we attempted to take organisms as model-animals and experimented with different environmental observation strategies. Through observation we tried to build up a picture of the daily routine of an animal. Asking: what are it's daily goals? What are it's daily challenges? What opportunities is it looking for? Where does it get information to act on? What social communities does it belong to? How does it avoid danger? What are it's energy sources? How does it celebrate it's existence? By observing the phenology – the full spectrum of behaviour – of a local animal we aimed form a picture of what participation in the environment means locally. Could observation be the basis for designing technologies adapted to local conditions? And could building up an ethogram - a catalogue or inventory of behaviours or actions exhibited by an animal - form a blueprint for a local machine?

Environmental Machine Learning

Thinking about the physical presence of machines in landscapes in Machine Wilderness led eventually to thinking about behaviour and around the start of 2017 this found its way into musings about environmental literacy in machines. How could a machine learn from species or natural patterns around it? This became Random Forests which was set up - similar to Machine Wilderness - as a fieldwork programme.

The term Random Forests denotes a specific class of analysis in machine learning in which a large number of simpler operations called 'Decision Trees' are analysed until the most optimal tree is found. The "**random**" part of the term refers to building each of the decision trees from a random selection of features; the "**forest**" refers to the set of decision trees. Many trees form a forest. For me Random Forests suggests an image of a quite rudimentary and clumsy roaming through densely overgrown databases, uncharted domains and glitched geologies. Like Machine Wilderness it speaks of things that explore the uncontrolled and uncertain, leaving cryptic footprints in their wake for humans to interpret. The things we built and deployed then have adventures of their own and may report back in new languages.

I'd say that until very recently the ability to relate to the environment was limited to plants and animals, but now machines are starting to blur those lines. Artificial Neural Networks can be trained using vast data sets. Over time it recognises dogs, toasters, people, etc through

machine learning. Random Forests explores what environmental machine learning could entail and if an artificial agent could become **environmentally literate**. What does this emerging 'synthetic world-view' mean for the appreciation of environmental complexity and the power-relations between our technologies and their environment? Could environmental literacy in the artificial agents that populate our environment create any opening towards practices of **environmental solidarity, intimacy, affinity, allegiance, reverence, commitment and kinship**? What can happen between analysing and relating? Between modelling and enacting co-habitation?

Random Forests: aims

Some first applications for machine learning are being developed by ecologists as a way to address big data and heterogeneity issues in that data. (Ecologists deal with anything from genetic data, to climate, or species abundance.) Artificial agents are deployed to extract wildlife sightings from the web, identify species in pixels and soundfiles, measure climatic conditions, monitor growth and decline.

Random Forests explores the significance of the intellectual emancipation of machines - not so much pragmatically but ecologically, culturally and ethically: what does the emergence of machine learning in biodiverse environments mean for those spaces and those organisms? What does it mean if machines join animals and plants there on more equal levels of awareness?

Recently artists, designers, environmentalists and conservationists have started probing those questions. EML aims to bring some of those people together to map the territory, draw the first outlines of **environmental machine learning** and dig out the more fundamental questions it raises.

Rebalancing the power-relations between human technologies and wild biological systems is central to the health and future development of society. All mayor tech companies have made AI their top priority, and so AI looks to be developing primarily within a corporate habitat. Much of the current critical reflection focusses on the impact of AI on human labour, human privacy and human war. EML asks **what the impact of AI is beyond our species**. If the most pressing issues for society relate to environmental processes, that is one motivation for this research: with ecosystems collapsing we need an age of harmonising technologies urgently. The more fundamental motivation is simply a curiosity for this newly forming territory: exploring the interactions between animal, machine and environment and to examine if/how their ways to learn through exposure relate.

It was already evident in the first fieldwork sessions of Machine Wilderness that radically different power-relations - between our technologies and the organisms that cohabit its environment - imply radically different roles for these technologies. Participants in the fieldwork moved away from conceiving these **prototypes** as devices aimed at performing a strictly utilitarian task and drifted towards ideas of machines as man-made nodes that act according to, or enable environmental flows, interactions, transformations and processes. In this view-point **technologies became expression of habitats** where machines and organisms are seen as interacting populations surfing collectively wherever geological and meteorological currents carry them. In a way the prototypes started to become focussed on existing rather than working and increasingly retreated away from efficiency and solutionism. It was Wageningen researcher **Clemens Driessen** who observed during the Machine Wilderness workshop at Pixelache in 2017, that after we've adapted organisms to industry, we may now be approaching the final stages of the undomestication of machines from industry. This radical approach of machines generated very different sets of goals that lie not in the realm of problem-solving and tasks but more in realms of interaction and cohabitation.

WHEN DESIGNING TOOLS BECOMES DESIGNING WAYS OF BEYING

Automation bias

In many complex matters our policymakers have come to prefer the answers given by computer modelling over the answer of a human expert. Experts may point out uncertainties or raise difficult counter-arguments. Computers are just easier to train in giving unambiguous answers than humans. Environmental data is however seldom unambiguous or unbiased. Even species occurrence data is a matter of interpretation because the taxonomy of species tends to shift with new insights and identification keys. In the old saying *'if it walks like a Duck and swims like a Duck and quacks like a Duck, then it is probably a Duck*' the word *probably* is key. It may walk like a Duck and swim like a Duck and still be a Goose. So yes taxonomy is an exact science but it also an ongoing debate. Data that is assumed to be hard-data is often much more liquid under scrutiny. This data is then the source material for interpretation. What is the difference that makes the difference? As **Sander Turnhout** who participated in the Terschelling fieldwork session of Random Forest puts it: in environmental observation data **the known-unknowns in the field become unknown-unknowns in models and environmental trendlines**.

Anyone who has ever built their own environmental sensors knows how hard it is to get a sensor to accurately measure the thing you want it to. The implicit trust in our models may be flattering, but needs to be examined critically.

Dark biodiversity

At a more fundamental level the complexity of environmental processes is generally underestimated. Some ecosystems are so vast and biodiverse that they become fundamentally unknowable: environments like the Amazon rainforest where organisms live and die at densities below our capacity to research or even find them. **Nigel Pitman** and his colleagues coined this phenomenon Dark Biodiversity. But even asking the simplest of questions - what is the impact of a predator is on their prey - quickly spirals out into multidimensional feedback-loops between environment, population dynamics, individual behaviour and genetics. In a way species are emergent phenomena based on the interplay of all these domains. The earth is populated with hyperobjects.

Discussions about AI in relation to environmental sciences and ecology generally do not address these issues. Perhaps developers hang out in environments dominated by discrete data, just like the AI-s they develop. Places where **the premise that quantitative data can provide a coherent model of the world** is rarely challenged. Some progressive ecologists like **Thomas Oudman** and **Theunis Piersma** insist that our environmental models are simplifications and warn that environmental policy that is based only on models can therefore be counterproductive or even harmful. In their opinion the illusion of understanding natural complexity is actually undermining our ability to protect nature. But it also raises questions: how can we protect what we cannot understand? They advocate a science less preoccupied with answers, a science that aims for a more precise awareness of what we don't know: **the un-understanding of nature**.

My thinking during Ars Bioarctica 2018 was starting to drift into other ways of environmental knowing for machines. Perhaps a kind of knowing that is more like knowing a friend than knowing temperatures or GPS coordinates. A mode of intelligence that moves away from analysing towards relating. Does environmental literacy for machines imply that they refine their known-unknowns? Where would you even start to look for ways of doing that?

When we drove just south of Kilpisjarvi we came across a reindeer and her calf lying on the side of the road. They had clearly been hit by a large vehicle. Their broken bodies triggered a particular line of thinking: from deep mind to deep body.

Skin in the Game

Environmental learning has a strong physical component for organic beings. Our bodies are what we learn through. It shapes our interactions, communications and perception which together form a specific umwelt. The question started to surface if this must be true to some extent for machines if they are to become environmentally literate. Ian referred to writers like Rodney Brooks, Simon Penny, Marvin Minski who write about the relevance of the body in robotics.

Biological beings have something at stake existentially in their interaction with their environment. Perhaps this is even the foundation of interaction. Their mental well being is dependent on their physical well being: organisms have *"skin in the game"*; skins full of pain receptors. How would that be applicable to embodied algorithms and autonomous artificial agents? Is it significant in this context that species like humans have evolved with millions of nerve ends exposed to the environment in our skin, nose, eyes and ears, but robots generally have only a few? Would their environmental awareness be different if their bodies had trillions of pressure receptors, temperature receptors, etc? In other words does embodiment mean a certain level of somatosensory or hetero-perception? Does 'deep mind' in this domain imply 'deep body'? Are corporality and physical intimacy a drivers for co-existence? Does the fragility of our bodies induce us relate to each other? Does fragility lead to care?

Animal, vegetable and digital beings are emergent phenomena born from specific places. Serious examination of them in their habitat shifts questions away from who they are, to what they relate to. Japanese scholars have practiced this perspective for many centuries, but it also shimmers through in the words of European scholars like Nietzsche when he says: *"All truly great thoughts are conceived by walking."* Perhaps this will prove true also for machines.

WHAT IF THE FUTURE OF THE AMAZON DEPENDS ON AMAZON'S ALGORITHMS?

DO MACHINES NEED TRAINING FORESTS

Training-forests for machines

Elephants that grew up in a zoo would struggle to survive in an African savannah. They are effectively Savannah illiterate . The transfer of knowledge from one generation of animals like elephants to the next is so fundamental that some speak of animal cultures. Elephant-culture, Hyena-culture, Orca-culture, Ant-culture or Orang-utang-culture, are humans smart enough to recognise the cultures of non-humans?

Rehabilitation programmes for young Orangutang orphans include training-forests where they can learn from their peers. Seeing others climb, eat or make a decorative pillow for the night is central to learning Orangutang-culture. The training-forest is made for them as an intermediate space between animal-rescue and the wild forest. It's interesting to think about this intermediate space. What kind of spaces would to rehabilitate us? And what kind of technologies would fit to such spaces?

There is no such thing as instant mutualism.

One of the tragic misconceptions in the history of nature conservation was the idea that it would suffice to just keeping animals alive out of context. One of the forms this took was the zoo as an arc of Noah. Zoo's grew out of natural history collections and it was writer **Gerald Durell** who set up the first zoo specifically for animal conservation including also less spectacular species at what later became Jersey Zoo. To be fair this was probably never anyones ideal solution to wildlife conservation. But it still took a long time to break through the underlying misconception of what 'being alive' means at species level.

Being alive isn't just about keeping an individual body alive, but also about the culture you participate in. A change of perception is in order, where an animal isn't just a DNA bank, but a representative of a way of Life, with a capital L, where species don't exist but co-exist. Organisms then are forces of influence in a particular constellation of mutually engaged forces that we tend to describe as ecosystems. Co-existence is key and the adage of mutualism is deceptively simple; the forest is, therefore I am (Which in an age of mass-extinction implies that what the forest becomes, I become.)

Artist **Antti Tenetz** shows this influence beautifully in his portrait of a wolf, where the wolf is presented as a cloud that permeates a terrain including forest, hills and rivers. Co-existence doesn't just form on a Wednesday afternoon. The environmental literacy that underpins species-cultures take millennia to form in a gigantic dance of co-evolution. You cannot co-exist instantly.

Environmental literacy takes time to accumulate but may be lost quite quickly. **George Monbiot** has popularised this in his description of Shifting Baseline Syndrome, which holds that every generation of humans takes the state of its natural environment during its youth as normal. In the absence of a functioning culture perhaps we humans jump to other species cultures. Let's call it tarzanisation : in the absence of parents of its own species a juvenile animal picks up alternative cultures that happen to be around. In the case of Tarzan - an archetypal feral child - it was ape-culture. One can only wonder where a stranded artificial agent might find a culture to adopt to. Would it in isolation from human influences adopt Hyenas, Orcas or Ants as its peers?

Feral artificial agents could also be seen from the viewpoint of population enrichment, where they are not orphans, but actively introduced in struggling Savannah animal cultures to mingle as agents of change. In a way conservation drone programs are doing this already, by enriching the population with a flock of co-existing drones that keep an eye out for poachers. The drones currently report to humans, but suggestions have been made for systems to alert animals directly.

The knowledge transfer among social animals is quite fragile in some ways. Traditional human cultures have developed extremely resilient means of passing on environmental literacy. Songlines of the aborigi-

nal tribes are a famous example.

Tarzanisation also illustrates that there is a window of opportunity for transferring knowledge form one generation to the next, where the young animal or person is more susceptible to learning. Behavioural biologist **Patrick Bateson** described the importance of these sensitive periods when juveniles are particularly open to learning from their parents, when their behaviour has not yet developed conventions and habits. In psychology this kind of phase-sensitive learning is called imprinting. And much of the Tarzan story is about his struggle to overcome his ape-imprints. Real biographies of feral children can be deeply tragic, which reveals just how much we learn from through social interaction. Children who don't grow up around spoken language or bipedal walking never really master it.

Maria Verstappen and **Erwin Driessens** seem to observe something similar to imprinting in a neural network they built - an artificial bird-spotter that tries to learn what Blackbirds look like. It generates its own conception of blackbirds based on photos it takes of blackbirds in its surroundings. We discussed the process as it unfolded during their Machine Wilderness residency at Amstelpark in Amsterdam. They noticed that after some time, the neural network starts to become repetitive and begins to generate endless echoes of a particular solution to what it is trying to do. It forms rigid habits, preferences and pathways. This raises interesting questions about how universal these kind of sensitive periods are in environmental learning processes.

Tarzan may have struggled to adapt to human culture because he grew up with apes, but imprinting doesn't seem to be the whole story. Around 2010 we did lots of experimental wild-plant walks as part of the Boskoi program and we noticed that kids just seem wired for it. Human kids are great at learning about wild plants and remembering them through sight, smell and taste. I'm sure that is part of our evolutionary trajectory.

I've been helping out with the harvest of fruits like apples, pears, plums and cherries in orchards in Zeeland and Holland for over 20 seasons and when I walk among the trees filled with fruits and the vivid colours and smells of ripe fruits, my hands just seem to do the picking automatically. That doesn't come from seeing others pick fruits. I feel I'm simply built for this kind of thing as a human. You relate to the depth of the colour of the apples or pears, their smell, the tension of the skin, how they snap of the branch, relieving the tree of the weight of its fruits. That feels like full coexistence. At some level our appreciation of natural phenomena is also innate.

Tarzan was never going to be a fully adapted ape. He was an impromptu ape at best. An improvised phenological adapt. That may be different for an artificial agent if it is less bound to a particular body and sensorial setup, but at the moment machines seem to only learn through transfer of external cultures.

Would intelligent machines start to develop Savanna literacy over sufficient lengths of time in Africa in the way Elephants, Zebras and Hyenas have? Does it matter that AI is less bound to a particular body? Elephant, Zebra and Hyena bodies will not change profoundly between generations, so the knowledge they get from their parents is highly relevant to them, but the body of machines could change radically from one generation - or update - to the next. Their rate of evolution is many factors faster than in organic beings. If artificial agents can be radically different from their predecessors, would intergenertional-knowledge-transfer less vital to machines than it is to elephants? And to step into even more nebulous territory: does hereditary embodiment therefore lead to hereditary environmental literacy?

Of course some animals don't learn from interaction with their parents at all. An animal like a Fly seems to have the environmental literacy it needs somehow simply hard-coded. Instinct will do for them, thank you very much. Why isn't instinct enough for all animals? Why bother with these fragile cultures that need to be transferred?

Perhaps different kinds of species have developed different strategies for dealing with the world. Humans and Elephants would be at one end of that spectrum in the savannah and flies and bacteria near the other end. Maybe our kind of socially structured lives enable Elephants and Humans to live in ways that Flies can't manage. Perhaps it just requires too many strategies, preferences, habits,

sensitivities to be hard-coded in DNA. And perhaps Elephant culture enable much more complex networks of dependencies than Flies? In that case the hereditary environmental literacy of Humans and Elephants would be based more on the ecological niche than embodiment.

It seems I've digressed into a kind-of *'thinking out loud on paper'* here. Perhaps it is time to return to some more solid ground. I'll end the section with a tentative concluding thought, that if environmental learning for machines resembles that of organic beings than it is related not just to their embodiment, but to the complexity of their dependencies. For machines it may be required to learn from previous generations - or versions - when their position in the ecosystem implies a network of dependencies that is to complex to hard-code at an individual level.

For now I'll leave you with that bomb-shell and avoid going into what a generation or evolvability could mean in the context of machines, nor the dynamics of adaptive radiation for artificial agents. I'll just leave you with a few open tangents to consider:

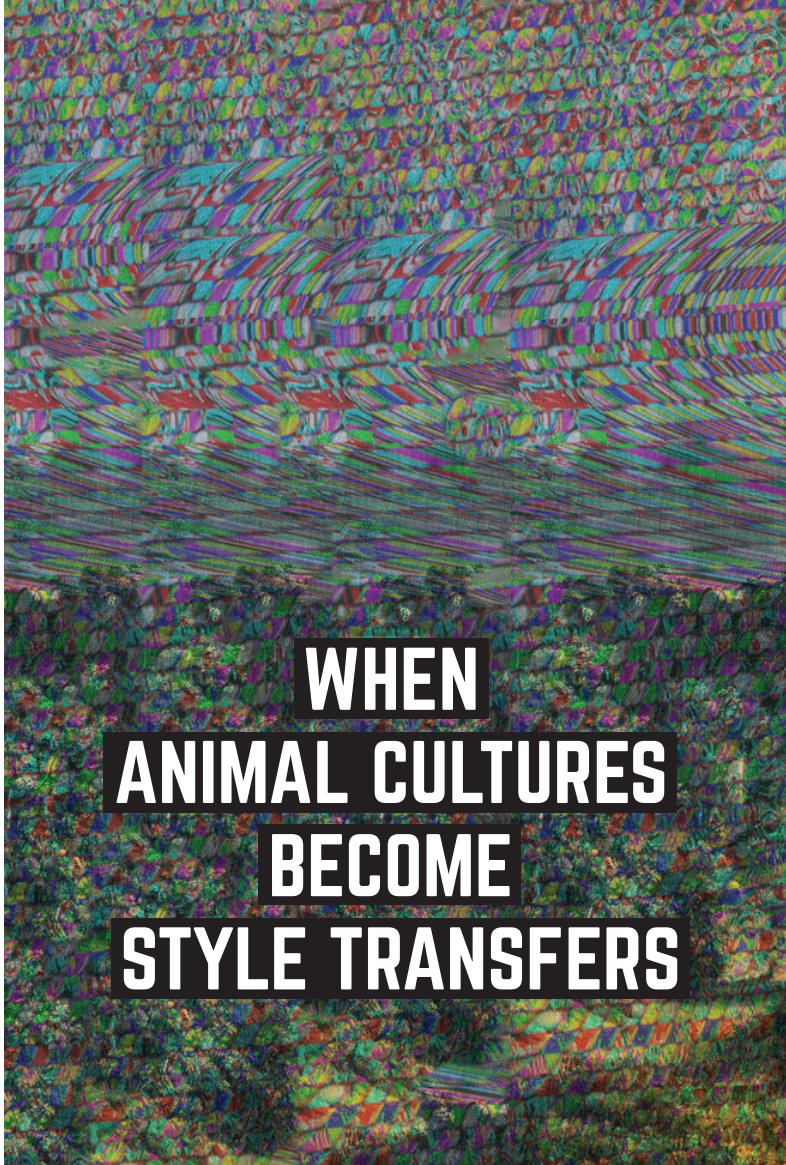
VERSION NICHES FOR MACHINES IN ECOLOGICAL COMMUNITIES
the evolutionary rate of change between generations of machines gives rize to radical shifts in ecological niches

ARTIFICIAL ARTIFICIAL ENVIRONMENTAL LITERACY
when the intelligence of a machine actually depends on an animal 'behind the curtains'

CRASH BLOSSOMS IN ENVIRONMENTAL MACHINE LEARNING
when an agent goes rogue because it interpreted descriptions of natural phenomena literally

MAXIMUM ENVELOPE
setting limits to the range of influence of an agent or agents

ENVIRONMENTAL OVERFITTING
when an agent starts to care for each blade of grass and every single ant



Perfect Goals for an Imperfect World

Artificial intelligence has trouble in dealing with real world situations. For the current generation of artificial agents problems need to have an objective function a defined goal. ***"How researchers craft the objective function"***, computer scientist at the University of Washington **Pedro Domingos** says, ***"is one of the things that distinguishes a great machine-learning researcher from an average one."*** As a person, dealing with artificial agents always comes with a definite feeling of staged authenticity. This technologically staged nature - enabled by artificial agents - will no doubt be explored in works of scifi soon. And who knows **perhaps artificial agents will quite literally create uncanny valleys**.

This notion of the objective function returns in many discussions in Random Forests. When speaking to **Brian House** during the MAAJAAM residency in Estonia he phrased it as: ***"if nature is seen as a system, what it is being optimise it for?"*** And during the Terschelling fieldwork session **Sjef van Gaalen** asked: ***"When models are the only things that can be recognised by the system, what will it end up looking at?"***

This instrumental convergence is the hypothetical tendency for intelligent agents to pursue certain instrumental goals where even the pursuit of apparently harmless goals can result in collateral damage if they are pursued relentlessly. One way of resolving the issue of linear goals in artificial agents could be algorithmic diversity as proposed by **Paul Seidler** on Terschelling. He proposed moving away from the idea of artificial agents a monolithic singular structures towards **a tapestry of distributed artificial actors** which become active/passive under changing conditions. This may enable a population that evolves habits rather than laws and is geared towards recalibration.

Algorithmic diversity may be a prerequisite for our technological cultures to ***stay loyal to the Earth*** as Nietzsche put it. The question remains open as to how these populations would be regulated or what self-regulation would be based on. **Jan de Graaf** insists that a critical historic perspective would be a crucial ingredient for any such system. Listening to Jan it is clear that for him any environmentally literate agent would need to relate things to their historic context. Some have begun to argue for regulation.

An environmental code of conduct for AI?

"The dispute over how to reform or restrict algorithms is rooted in a conflict over to whom algorithmic processes should be accountable. If it's to a community of engineers and technocrats, then accountability will usually mean more comprehensive data collection to produce less biased algorithms. If it is accountability to the public at large, there are broader issues to consider, such as what limits should be placed on these tools' use and commercialisation, if they should even be developed at all. Technology-intensive firms (and the researchers they fund or support) tend to think of algorithmic accountability as a limited and technical project, while social critics challenge the underlying logic of applying algorithms to social situations and conditions." – Social theory, critical race theory, and feminist theory can all help construct a more inclusive and critical conception of algorithmic accountability."

"Our practices of accountability can sometimes be made fairer by becoming more algorithmic. But leading practitioners of algorithmic approaches to social order have made their fortunes via complicity with unjustifiable hierarchies of wealth, power, and attention. An algorithmic accountability movement worthy of the name must challenge the foundations of those hierarchies, rather than content itself to repair the wreckage left in their wake."

- Frank Pasquale in Odd Numbers, August 20 2018

Artificial agents are already active board members in companies, holding an equal vote to human board members. Even the question has been raised if companies themselves will be AI-s. The Biosphere Code is an initiative of the Stockholm Resilience Centre, started by Victor Galaz and Fredrik Moberg that tries to set out an environmen-

tal code of conduct for artificial agents. Algorithms underpin the global technological infrastructure that extracts and develops natural resources such as minerals, food, fossil fuels and living marine resources. They facilitate global trade flows and they form the basis of environmental monitoring technologies. These algorithms are becoming more autonomous as Artificial Intelligence emerges. It's a process that deserves more of our attention, because of the potential impact of AI on our landscapes and the way we relate to our environment.

A team was assembled to make the first outlines for a **Biosphere Code** at the **Stockholm Resilience Centre**. Looking through the list of participants however, is a sobering experience. All participants come from a technology based practice. All are approximately similar in age. All are white. Amazingly it includes no ecologists, environmental scientists or farmers. Not a single person with a background in environmental science and certainly nobody from a non-western or even indigenous background - the people who actually act as custodians of land, see and air. How could you set up a code of conduct without the experts in landscape management, nature conservation or ecosystem dynamics?

Rainforest etiquette

I tried **to expand the circle of debate as far as possible**. I discussed the role of technology with friends I was visiting in the last remaining pockets of rainforest on the Western Ghat mountains in Kerala India. These people have over 40 years become self-trained ecosystem gardeners. They are very probably the only people on the planet who understand the complex co-existence between the thousands of endangered plant species they have learned to rescue and even multiply. With the plants this team of mostly tribal women have created the many different microclimates that represent different biomes in the Western Ghats.

When asked about codes of conduct they reply that it is clear to all beings in the forest when they are violated. There exists they say a rainforest etiquette that all creatures know. If it is violated this leads to madness and the stories of madness among animals such as elephants are horrific.

I was invited by **Leo van der Vlist** an environmental lawyer who specialises in the rights of indigenous peoples to their land and their cultural practices to participate in the **Earth Trusteeship gathering** in The Hague, which brought together environmental activists, leaders of indigenous peoples, lawyers and policymakers from all over the world to discuss the frontiers of environmental law. Thinking about the role of technology is not something they usually focus on, but many were extremely interested - perhaps also tired of their usual battles - in the discussion.

Semuel Sahureka presented the traditional environmental practices among the peoples of the Maluku islands in Indonesia. Their concept of environmental law is based on community in the broadest sense. There are environmental experts called **Kewans** whose knowledge is past on within families. They are keen observers of the health of the territory. This can be forest or sea. When they identify a treat to that health they report to the council of elders. Crucially a Kewan has the skill to recognise an imbalance before it becomes problematic. His report may result in a **Sasi, a temporary ban on all human activity** locally. The stretch of forest, lake, river or area of sea then becomes taboo. (The word taboo actually stems from similar traditions among the Maori.) The rules do not need to be enforced. Anyone who would violate a Sasi would bring grave discredit to their entire family. It would mean a betrayal of the entire community in the present and to future generations. A Sasi is something nobody ever violates.

Environmental governance in these circumstances depends fundamentally on the integrity of the community, on environmental solidarity and is actively being undermined by external political and financial forces. When asked if machines would be capable of co-existing in that solidarity Semuel insists that to a Kewan the natural world has **a physical and metaphysical component**. The Kewan oversees both these realms. A machine might be able to sense the physical world and model that, but could never relate to the

metaphysical part of a forest of sea, to what is life-giving, to the force of life itself. Machines may be intelligent, but are they wise?

Artificial agents may not be able to sense the transcendental force of life that an indigenous leader navigates, but could it relate to a river or a forest in ways that defy our intuition? What if we gave them an opportunity of co-existence? Could intelligent machines - through exposure - discover something more profound than what we credit them for? Something beyond analysis and optimisation? Can the machine eye, ear or nose discern patterns that are concealed from human perception?

Gridworlds as training forests

Similar to Orangutang training-forests, gridworlds are simple environments for machine learning designed specifically to train an artificial agent before it is deployed in the wild. To establish safe behaviours.

What would be un-safe behaviours for an AI? Well.. it might figure out ways of accomplishing its goals by means that are unacceptable. (When its objective function of planting as many trees as possible leads it to chop down trees to make space for planting.) It might by-pass limits that we tried to set, or it might even learn how to by-pass deactivation procedures. For maintenance, upgrades, or if the AI becomes a danger to itself or its surroundings, you'd build a way to deactivate it. The AI might learn to avoid this deactivation to maximise its goals. In a gridworld you can test an artificial agent and find ways to cluster erratic behaviour or destructive side effects of its actions so you don't have to address each potential undesirable outcome individually. An artificial agent might also have adaptation failures: when subtle differences between the testing and training environment - or concept drift - cause the AI to misinterpret the situation. For this a gridworld is used to train the AI to follow a longer learning path to a solution.

Gridworlds are highly abstract and not always intuitive, but their simplicity has two advantages: it makes the learning problem very simple and it limits the potential for additional factors in experiments. These simple environments could also be considered as minimal safety checks: an algorithm that fails to behave safely in such a simple environment is also unlikely to behave safely in the wild where it may be much more complicated to test them. And even if an algorithm performs badly in a gridworld those sessions may help build better algorithms.

Jon Gauthier a researcher at Cambridge, argues that safety issues in the longer term future of AI may be very different form what we currently think of as risks. He uses the car as an example. To engineers of the era before combustion engines, who only knew horse drawn carriages, the safety issues related to motorised vehicles were hard to test or even predict. With horses safety concerns included the spread of disease from manure or dead horse carcasses, but putting an engine on the carriage made these issues irrelevant. The combustion engine created a paradigm change.

Testing for these longer term paradigmatic changes is very hard. In the case of artificial agents, some of the basic properties they have now may become obsolete or diffuse: that AI-s have a discrete action-space (or maximum envelope), or optimise for discrete 'tasks' or 'objectives'. Even the current training / testing regime for AI-s itself may become irrelevant. In a way any new technology has an event-horizon where our predictive ability flat-lines.


ANTTI ON MOUNT SAANA
FINNISH ARCTIC

EXPLORING GAME NATURE

HUNTING DEER IN FAR CRY 5

Hunting deer in FarCry 5

In real-life environments - like traffic - there are very different levels at which a agents' model of the world could be challenged. Similar to ecologists in the Amazon, developers of self-driving cars may find the wild just cannot be modelled perfectly. You'd almost need a virtual world populated with people and animals for an AI to train on. Perhaps the closest thing we have to that are multiplayer online games.

The games industry provides a wide range of simulated environments and many feature naturalistic landscapes. **Antti Tenetz** is both an experienced hunter - who has intimately studied Arctic wildlife wolves, bears, birds and fish - and an avid gamer. To an expert like him the behaviour of animals in games can appear extremely artificial. He started tracking some of the deer and other animals in games and found they were designed to give a very basic sense of life to that world. A real deer would never hang around humans like this.

Game worlds have their own rules, that relate more to the rules of theatre and landscape architecture than ecology. It is staged nature that presents itself to humans naively. It is there for our pleasure, almost in the biblical sense. In a way this Garden-of-Eden-nature is actualised in games like FarCry 5 and to his surprise Antti found that he developed an **intuition for game-nature**. Sometimes he finds that he even responds to real-life animals or environments in ways that belongs more in Grand Theft Auto than the Finnish countryside. The different languages are sometimes mixed up.

An additional visual language that contributes to this is drone footage. Antti worked with drones many times also during our **Ars Bioarctica** sessions. The similarity between drone camera footage and games visuals is striking; the colours, the resolution, its positioning, all of this looks very similar as if they apply the same colour-filter to an environment.

A forest of snowmobiles

During Ars Bioarctica in 2018 we were looking at ways to train an AI on local species. Corporate systems like Inception come with a sizeable set of pre-learned species. Lots of human tools, infrastructures, vehicles and house-hold appliances, but also Dog breeds, Cats, Camels, Zebras and Lions. Looking at the list it is hard to retrace reasons for these particular selections of species. It doesn't relate to any existing ecosystem. But Ian started to make the AI applicable to our specific context by **training the final layer of the neural network on local organisms and environmental features** around Kilpisjarvi Biological Research station. When we first set up the camera and pointed it out off the kitchen window towards some Birch trees the machine only saw snowmobiles. There were none there. More importantly there were also few Dogs, Cats, Camels, Zebras or Lions. We became interested in training the machine to relate to the local biodiversity and terrain.

We wanted the AI to also recognise Reindeer, so we needed to get a lot of images. We visited an old friend of Antti who is a reindeer herder several hundred km East of the Station. Within an hour this unfolded into a drunken sauna session, which ended with us redressing and draping our sleeping host over a snowmobile to drive him back to his house. The next morning he was already out and rounded up a small herd. From this herd we took photographs as training material to make our AI more Lapland-literate.

Taking photographs for training an AI is quite an interesting experience. You soon realise that you don't actually need 'perfect' pictures of the animals, because they could be anywhere within the camera-eye of an AI. Like with camera traps the animals may only be partly in the picture or they may be a long way away or so close to the camera that you only see some fur. So the aim becomes to take photographs very randomly. In a way you discover that human photographs of animals are biased. We like to see the entire animal, or its head as a portrait and we prefer to have the animal in focus. These kinds of conventions fall away when you try to photograph a representative set of images that would be relevant for an AI in the

field. A reindeer might pass by when there is little light, it may be motion-blurred, or only partially visible. The way in which we present nature to ourselves is actually highly curated and training a bot breaks those conventions down immediately. That makes projects like the ***Artificial Bird-Spotter*** by **Maria Verstappen** and **Erwin Driessens** so interesting. The process of **training a completely naive machine exposes our human imprints, conventions and habits**. It exposes our ways of looking at nature and it shows hidden details of human-animal or human-plant relationships. In this way the deep naivety of machines expose human bias.

In a way the fieldwork session in Kilpisjarvi and working with the artificial bird-spotter in the park are training sessions for artificial agents in environments beyond gridworlds, similar to the training of young Oranutangs. This raises the question of training forests for artificial agents. What if the umwelt of AI-s remains almost exclusively corporate as they are now? **Should the AI-s that are currently taking seat in corporate boards, to help manage natural resources have a training also in natural history** ? Should they spend their weekends exploring national parks, mangroves, glaciers and tundra? Should they fish with tribals in a forest river? Should they go on walkabout? Do artificial agents need training-forests? Could an AI start thinking out of the box if we let it out of the box?

Radical non-containment.

This morning I was assembling some IKEA cupboards. That actually combines quite well with writing, in the sense that by the time you construct a few shelves there are new thoughts crystallised enough to write down. The job reminded me of a story someone once told me about IKEA. A new IKEA-product is in a sense a global phenomenon. A company like IKEA is a geological force, because at this scale the choices of materials to make a cupboard could eradicate an entire ecosystem and leave traces in soils across the planet. It has made the link between company, product and ecosystem unequivocal. Maybe that is the backdrop against which Tesla conceived of their new factories as mines where cars emerge directly from geological deposits of ores and minerals.

A group of progressive chemists held a round table discussion during a Bioneers conference about a decade ago. They presented what they called **Green Chemistry**. In Green Chemistry chemical processes should be safe to apply universally, that is: they shouldn't need any safety measures. Better still they should be safe even when something unexpected happens to which the environment is exposed. Green chemistry states that any process that needs gloves, safety goggles or other safety measures are flawed, because the real world has earth-quakes, tsunamis, fanatics, businesses go bankrupt, data gets lost, procedures forgotten. We should design for an imperfect world, beyond controlled lab conditions. If we use chemical processes from within the boundaries of naturally occurring processes, then they would be safe even if shit hits fans all over the place.

Random Forests and Machine Wilderness operate from this principle of radical non-containment. It would be an illusion to develop artficial agents from the idea that we are in a position of control, when we cannot even control something as simple as a plastic bag. Before you know it there are Garbage Patches floating around the oceans. Radical non-containment became a fundamental starting point, where technological systems are developed in relation to the full complexity of a given environment, attuned to local natural processes, material cycles, food-webs and layers of biosemiotics. **Fieldwork is then a method of radical non-containment**.

Concluding..

Looking at the state of our environment makes me wonder how valid it is to take human intelligence as the model for artificial intelligence. Random Forests has made me take a step back and wonder if the concept of decision trees might make sense literally. I mean, **I think there is a case to be made for giving machines the opportunity to learn from many species, rather than just humans**.

In discussions about the program with funding agencies the question was asked how I would ensure that Random Forests would actually develop new insights. I think that the inherent approach at **FoAM** is to make unholy alliances, to include voices that are usually left out of a discussion. Unlike the Biosphere Code, Random Forests asserts that environmental machine learning is not a single discipline field. It will be hard enough for our societies to re-engage with natural cycles and wild populations when they have undergone this massive level of erosion. The silence of the Age of Loneliness is deafening. It seems ill advised then, to ignore voices from the remaining pockets of biodiversity.

We should involve people from cultures who's traditional practices were refined enough to adjust to environmental dynamics before critical failure and have ways of protecting natural processes over relevant timescales. I think the impact of living in depleted landscapes is greatly underestimated. The message from my friends in the rainforest is that you can only protect the forest if you protect the whole. The forest is all these beings. The tragedy of living at the end of late capitalism, is that a vast majority in society has never been in the presence of the full force of life. It took me more than 30 years to recognise that Holland is filled with Green Concrete. It looks green, but is almost completely dysfunctional and gradually dying. That has become our 'normal'. We don't really see how poor we are. Our training forests have almost no trees left.

This year the 800th anniversary was celebrated of the ***Charter of the Forest***. It was the world's first legal document about the environment, written in a time almost unimaginably different from the present. What occupied the minds of those who wrote it in 1217 was to stop royal encroachment of common land and protect the rights of commoners to gain their livelihood from commons resources. It stated that there are natural commons that supersede any property claim. It was agreed that the forest is open to anyone, but sets limits of use so that the greater commons cannot be harmed. Perhaps this document could be a starting-point for outlining a forest-training program for artificial agents. A rich **mash-up of the Charter of the Forests and Asimov's laws of robotics**. Asimov wrote a code of conduct in three lines intended to prevent robots from harming humans. Since humans are expressions of their environment, we understand that to harm the environment implies harming humans. We would benefit from technologies that do not decouple us from the past. In a less human-centric perspective those lines could be rewritten for all biological life and the environmental processes they depend on.

The rules would then read something like:

- an artificial agent may not injure life processes or, through inaction, allow the environmental commons to come to harm.

- an artificial agent must obey orders given it by human beings except where such orders would conflict with the First Law.

- an artificial agent must protect its own existence as long as such protection does not conflict with the First or Second Law.

Random Forests - 2018
Theun Karelse

RANDOM FORESTS PROGRAMME

TERSCHELLING SESSION

Fieldwork session #1 @ Imrama
Terschelling march 19to23/2018

scenario: an environmental AI starts to act autonomously
with: Jan de Graaf, Jeroen van Westen, Theun Karelse, Michelle Geraerts, Sjef van Gaalen, Sander Turnhout, Paul Seidler, Tivon Rice

ARS BIOARCTICA SESSION

Fieldwork session #2 @ Ars Bioarctica
Finland may/2018

theme: the role of AI in artistic and scientific fieldwork / how artificial agents learn from non-humans
with: Antti Tenetz, Ian Ingram, Shah Selbe, Theun Karelse

NRC KUNST DEBATE: KUNSTMENS

Debate @ Pakhuis de Zwijger
Amsterdam march 14/2018

theme: what light can art and literature shine on new relations between the artificial and the natural
with: Maxim Februari, Hans Schnitzler, Theun Karelse

DINACON

Fieldwork session #3 @ Dinacon
Thailand june 22/2018

theme: investigating algorithmic companionspecies in relation to non-humans
with: Sjef van Gaalen

AARE LAB

Lab @ Border Sessions festival
The Hague June 13/2018

theme: autonomous agents for regenerative ecology
with: Klaas Kuitenbrouwer, Sjef van Gaalen, Theun Karelse

WILD BITS

Fieldwork session #4 @ MAAJAAM
Estonia Juli 11to25/2018

theme: digital natives and non-natives
with: Brian House, Antti Laitinen, Paula Vitola, Aivar Tõnso, Timo Toots, Taavi Suisalu, Theun Karelse

EQUINIX AM3 WALK

Random Forests walk @ Sciencepark
Amsterdam October 15/2018

theme: training-forests for autonomous agents
with: Arita Baaijens, Theun Karelse

CLIMATE AS ARTIFACT

Seminar @ Climate as Artifact exhibition
Amsterdam October 21/2018

theme: fieldwork and environmental literacy in relation to humans and machines
hosts: Theun Karelse, Jacqueline Heerema

TERSCHELLING

Fieldwork session #1
march 19to23/2018

with: Jan de Graaf, Jeroen van Westen, Theun Karelse, Michelle Geraerts, Sjef van Gaalen, Sander Turnhout, Paul Seidler, Tivon Rice

This first RandomForests fieldwork session starts on the island of Terschelling, surrounded by the Wadden Sea which has a UNESCO natural world heritage status. The fieldwork is based on a speculative scenario: an AI tasked with protecting UNESCO natural world heritage starts to act autonomously. What would be its sources of information and what picture emerges from that data? What would be points where it could intervene, where would it have physical or political agency?

In a way, we study the artificial agent like an organism in this hybrid habitat. By working on an island we hope to have a clear sense of its territory. From this specific case study we may be able to extract potential interactions and feedback loops between an AI and landscapes more generally. We hope to unearth some of the biases an AI might develop, reveal the roots of those biases and see how they compare to human biases. Some types of natural phenomena are easy for humans to relate to or interpret, some more difficult or way beyond our direct perception. An AI would probably also have its strengths and weaknesses. It would be interesting to see where they differ, match or complement each other. Could an AI serve as a canary in a coal-mine, an environmental guide, or even mentor? Or would it become a tyrannic overlord obsessed with counting shorebirds and rare plants.

This session brings together participants with local cultural historical knowledge, local environmental knowledge, experience on how biological data is gathered, how environmental data translates into policy, experience with collaborating with AI and how non humans can form symbiotic relationships with artificial agents.

Environmental machine learning as artistic research practice: how does such a mix of ecology, technology and art make sense in today's world?

- by Michelle Geraerts

The field of environmental machine learning caught my attention about eight months ago, when I became acquainted with the work of Theun Karelse. I was looking for a way to continue on the topic of climate change, as I had been studying sustainable development and ecological anthropology. I had learned that some problematic ideas at the roots of the anthropogenic damage to earth are individualist perspectives of self-reliance or ecological independency, anthropocentrism, and the idea that some entity called 'Nature' is separate from humans.

In this human-centered view, Nature is merely a set of resources to exploit, or even force to fight against and exterminate. For centuries, it has lead us to think, build and behave as if humans are central in all domains of existence (Morton 2018). This human-centered and individualist worldview maintains a sense of exceptionalism in which humans are substantially different from or superior to other beings - with all unintended consequences thereof (ibid.; Haraway et al. 2016). Language matters in forming worldviews. For example, the concept 'sustainability' is risky, as it is all too often anthropocentrically scaled or used to cover up destructive human practices (see Morton 2018; Tsing 2017). That's why terms such as 'multispecies ongoingness' or 'multispecies collaboration' (Haraway 2018), and 'multispecies resurgence' (Tsing 2017) seem more fitting. These alternatives for sustainability go beyond the human-centered focus and acknowledge the alignment of humans to multispecies dynamics.

And yet, whether you call it the Anthropocene or not, here we are - living in a time in which human impact on earth is causing major imbalances in ecological flows. The urgencies of the Anthropocene are also very much nonhuman urgencies, such as the current sixth mass extinction event. And vice versa: nonhuman urgencies directly or indirectly cause all kinds of urgencies for humans. In Timothy Morton's words, to oppose anthropocentrism is to understand our inclusion in the earth's ecology, 'as one being among others' (2018). The realisation of these earthly problems also lead to a feeling of responsibility; human agency has done a lot of damage, now it is our turn to use human agency to be more capable of response – or in Haraway's words to be 'response-able' (Latour 2014; Haraway 2016).

Realising it would be impossible to solve this complex tangle of earthly problems, I started to search. Not for more numbers on species extinction or maximum degrees of global warming, not for ready-made solutions either - I strongly doubt they exist. The search was aimed at something Timothy Morton and Donna Haraway aspire as well; a way to grasp this earthly problem that we share with all other critters, to be truly present. And, at the same time, to look for a non-anthropocentric, vulnerable, activist stance amidst the trouble that sparks some hope and imagination on more sustainable earthly symbiosis. I found three projects that somehow hold this view: *terra0, Dark Ecology and Random Forests*. Here, I will elaborate on the latter one.

Random Forests is an adventurous project that explores the limits, but overall the opportunities of environmental machine learning. It is an investigation of how today's most advanced technologies can be more inclusive of ecological processes, while acknowledging that technology is always inextricably entangled within complex systems. Innovative yet history-sensitive, it studies how carefully designed machines (as always-works-in-progress) collaborate with, learn from, and communicate intimately with ecological symbionts. *Random Forests* sparked my interest because before I barely thought beyond the dichotomy of artificiality and wilderness, nor had I imagined what a more ecological approach integrated into technology could look like. This project opened a whole world of environmental self-learning machines, nonhuman agents, speculative scenarios, and novel ecosystems that I had never before encountered. What really appealed to me about Random Forests is the invigorating quality of its approach. The approach of the project is not to stress how bad things have gotten. It does not carry out the painful, guilt-causing or quantitative character of many of the climate studies related works of today, while it does remind one of the necessity to face the current earthly situation caused by human activity. Its approach is activating, energizing and sparks imagination.

I have been fortunate to join Theun during part of his fieldwork sessions and interviews for *Random Forests*. His enthusiasm for the topic was contagious; most of what we learned is based on constant curiosity. It has been a transformative experience in that it has strongly shaped my Master's research as well as my personal perspective on the world. For example, we speculated and set out a concrete imagination of an environmental AI on Terschelling, tasked with the conservation of the UNESCO area. The AI-speculations were based on site-specific research (walking and cycling on Terschelling, speaking with residents and listening to histories of the island), and interdisciplinary discussions until late in the evening. What resulted was a machine that can be wayward and quirky, sometimes unsettling. We wondered, for instance, if such a machine could ever be able to 'think outside the box', or make exceptions to programmed rules. We gave it a set of sensory skills through speculatively installing sensor-networks in the landscape. We figured that certain species, such as goose or lichens, could be interesting collaborators for the AI. Unexpected combinations of engineering, art, design, philosophical wondering and unlearning of human categories kept surprising me throughout the research.

To unlearn human categories and thus to think beyond anthropocentrism means 'to question the tissues of one's knowing and ways of knowing' (Haraway 2016, 122). It invites one to 'become playful about the lack of an obvious solid ground of meaning, one obvious scale on which to see and act' (Morton 2018, 211-2). A playful method that recurs in artistic research projects I studied is speculative culture. Speculative culture is about the possible, asking 'what if...' - exceeding the limits of what is 'commonly known' or 'makes most sense' (Dunne and Raby 2014). Rather than simply describing or maintaining reality, speculative culture is concerned with changing it. Building scenarios about the path between the present and possible futures exposes all kinds of obstacles in the process. Thinking about what *could* happen instead of what *should* happen prevents speculative scenarios from becoming didactic or moralistic (Dunne and Raby 2014). It is a playful but serious method, that helps to think beyond taken-for-grantedness. Speculation helps to hybridize nonhuman entities and explore new research tools, effectively highlighting urgent issues without suggesting a 'better' way to deal with them.

What I have learned about speculative culture from participating in *Random Forests* is that there is always one or several scenarios to be worked out; there are contributor-participants from *different* backgrounds; the speculation is not generalized but *site-specific*; the specificity of the session is a powerful tool to reveal specific societal and environmental issues that could get in the way - it is, in short, a *non-reductionist* method because it takes *context specific* tensions and frictions into consideration. Furthermore, *humour* plays an important role in the speculation to come to new imaginations and ideas; and speculation is an *ongoing process* - people will not stop speculating, asking questions and imagining on the topic even after the workshop is closed.

Another quality of artistic projects like *Random Forests* is practice-based research. Where social sciences mainly stick to the thinking part, the artists I've met are indeed thinker/makers - a term borrowed from Haraway meaning 'those engaged in the inextricable thinking/making practices called art' (2016, 89n75). The strength of making, here, lies in the openness of the creative practice; it could end up anywhere, things work out as the process of thinking/making goes along. The artistic research projects are the locus of speculation, but also of the materializing of the imaginations that come out of speculative culture. Speculation is *creative* in the sense of creating something new in mind (like new words, theories, concepts, perspectives, agencies, questions, or problems), but also in matter (like new artworks, software, robots, organisms, or ecologies).

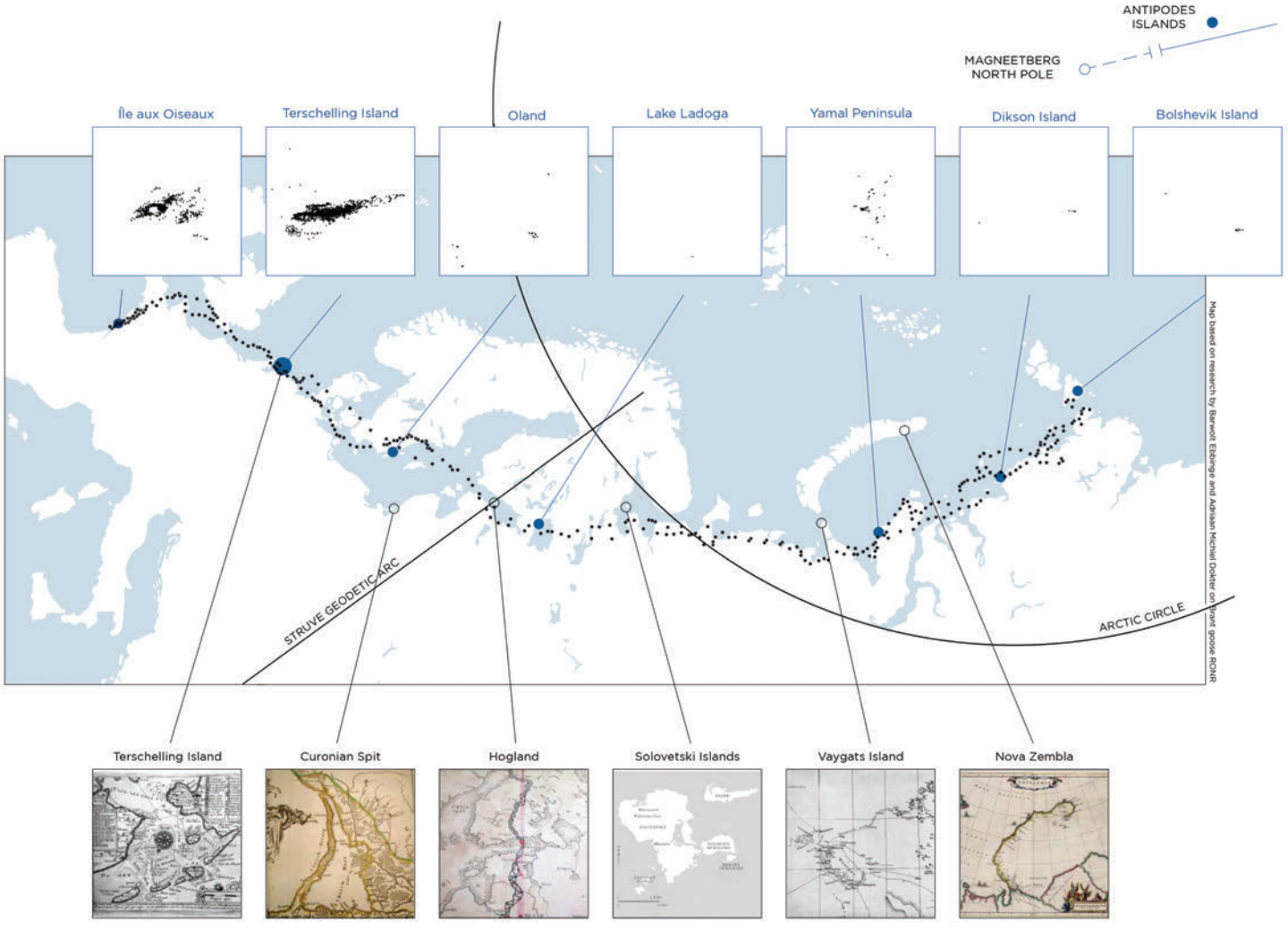
Haraway proposes a way of thinking and acting beyond individualism with the word 'sympoiesis', which means 'making-with' or 'collectively-producing systems that do not have self-defined spatial or temporal boundaries' (2016, 35-6; 58). It describes a commitment to collaboration of all different beings on earth, as we are amidst urgencies that are not just human urgencies (ibid.). As opposed to autopoiesis, which means that systems, organisms, persons, things can be self-constitutive and self-making, sympoiesis implies that 'earthlings are *never alone*' (Haraway 2016, 58, emphasis hers). This making-with is always done together with all kinds of beings who can be called *companion species*. Building from the Latin *cum panis* ('with bread') Haraway emphasises how much we share with 'ontologically heterogeneous partners' in the ecological assemblage (ibid., 2016).

Having said that, what to do with this new category of intelligent artificial nonhumans? Could we regard this new machinic species as companion species? This is a main question investigated in *Random Forests* through speculative culture by thinker/makers. At a fast pace, machines are designed to do operations that formerly required human practice. As anthropologist Tim Ingold observes, these human practices are now reshaped in their interactions with these technologies. Rather than solely being replaced or surrounded by these machines, humans are involved in new encounters and collaboration *with* these machines (2011). Similarly, the machines I encountered in this research are not going to 'take over' nonhuman activity, or fully replace organic elements or processes of complex ecological systems for artificial ones. Neither are they forms of geoengineering or ecomodernism. More accurately, they are designed to become new symbionts, making the environment with their context-specific companion species. Operating from a deeper ecological understanding than conventional machines, these technologies can actively contribute to multispecies resurgence. Taking the artistic approach seriously and including it in engineering and large-scale socio-economic decisions would create a more sensible application of autonomous machines in daily life, a more response-able one.

The *Random Forests* project has shown me that it is possible to remain optimistic about the current and future state of this planet, while at all time keeping a critical stance. I think it is mainly the ability to re-imagine what was taken for granted that can save us from pessimistic apocalypse-thinking as well as overoptimistic neglects of climate change and social inequity. So what to do with this amazing artistic project? Take it as a method, or a tool, to think and act in the world - as active, response-able part of the world. Or take it as an artistic endeavour, an exhibition in the mind to wander through, as a poetic view on earthly collaboration between species, as an engineering challenge or an eye-opener. In which ever way you experience *Random Forests*, it bends and twists what we know, shows us the usually overlooked. It helps recognizing the world from a more-than-human perspective, and reminds of interdependencies across species. This, it seems to me, is the important first step towards response-ability for multispecies ongoingness. Challenges abound, I agree. But that does not need to stop us from trying and enter an exciting perception of the world that we share with so many inspiring others. It would be of great value to academic research, public societal debates and educational programmes to integrate artistic research methods.

Altogether, this is a call for openness in thinking, for taking seriously those experiences that spark imaginations, for curiosity instead of fear about the unknown and unfamiliar, for art-science collaborations as well as human-nonhuman sympoietics. It is inspired by artistic research projects that - in the broadest sense - rethink and reimagine what it means to live in a time called Anthropocene.

Terschelling dune landscape - During the speculative sessions, I learned to look with a lot more imagination to such landscapes, and all of a sudden sensor networks and ecological agents appeared. Random Forests' perspective offers space to notice how plants, soil microbes, animals, and weather patterns as ecosystem symbionts have agency as much as humans do


ANTIPODES ISLANDS
MAGNEETBERG NORTH POLE
Île aux Oiseaux
Terschelling Island
Oland
Lake Ladoga
Yamal Peninsula
Dikson Island
Bolshevik Island
STRUVE GEODETIC ARC
ARCTIC CIRCLE
Map based on research by Barnvolt Ebbinge and Adriaan Michiel Dokter on brant goose RGNR
Terschelling Island
Curonian Spit
Hogland
Solovetski Islands
Vaygats Island
Nova Zembla

Hubs in a sea of knowledge; the startling adventures of Ron R.

Random Forests joined forces on the island of Terschelling with IMRAMA
a research program by **Jan de Graaf** and **Jeroen van Westen**

Imrama

Islands offer sea vista's. The Wadden Islands even offer two: The Northsea and the Waddensea. The latter a transnational (Dutch, German, Danish) UNESCO world heritage, type natural. UNESCO's hypothesis: visiting other places, meeting people with other traditions, languages and ideas, contributes to mutual understanding. The predicate 'world heritage' obliges to endorse 'education, science and culture': a culture of curiosity, a compass for travellers wishing to discover more than they are looking for.

However, UNESCO's categorization of the Wadden Sea as natural heritage does not do justice to the cultural meaning of this sea. A cultural exploration of the term 'natural' is in order: one that views the Wadden Sea through a kaleidoscope, via expeditions along the invisible paths that criss-cross this sea. We call those travels imrama. Originally an Irish word meaning stories told by seafarers. Their adventures visiting the other world - the imaginary counterpart to normal places - exite us. Our thesis: those travels (and their logs) inspire a kind of tourism in which traveling is like learning. The higher goal? We wish "to stimulate the intellectual dimension of travel", a phrase borrowed from Longitude: recommended readings for travelers.

Expeditions

Our island of departure and return is Terschelling. On this base camp we marked 12 field posts. 12 Dots personified in 12 iconic guides, each of them represents a promising perspective to the world at large. Some of these posts are well-known historical attractions. Others relate to fiction, a genre that, more than science, colors our perception. We see field work as follow work, preferably as hack work, a creative job conform the rules of methodological serendipity. Do'nt forget, chairism also is a form of fieldwork, a deep dive into archives, libraries, databases, films, music, or just navigating through snippets of conversations.

We collect a selection of the existing sea of knowledge on the Wadden Sea and its surroundings. We invite a divers tour group to embark on expeditions following one of the perspectives, likely crossing an other, may be changing tracks, possibly setting out into unknown territory. A kaleidoscopic cultural exploration of the Waddensea to reflect on the ways we look at 'nature', which in itself is a cultural phenomenon.

Why follow birds?

The startling adventures of Ron R. is one of our mapped travel logs. We hacked a goose, its geolocator outlined a flight to Bolsjewiek Island, Siberia. Start and finish is the island of Terschelling.

But first comes the realization that birds migrate. Svalbard, 1594 - our keen guide Gerrit de Veer noticed geese. He thought they were Brant, similar to the 'ducks' he knew from the Wadden Sea. De Veer wrote down a curious question in his journal - could these geese winter in the Wadden area, and summer in the arctic? Yes. Birds migrate, they know the way by heart, following invisible roads. They have an astounding ability for orientation and navigation, a skill that humans increasingly seem to be losing.

Even more remarkable is how migratory birds know more than the average well-informed cosmopolitans. These birds fly over dangerous places to strange places where coarse languages are spoken. Sometimes they observe things that should have stayed hidden, we are left wondering what they've seen. Birds' eye views prompt a curiosity in us, after all they offer vista's to the world.

The program: imrama.eu / Wadgasten

We train in observation, sensory perception and awareness. To watch, listen, taste and identify. We count and we recount stories, operating on the brink of fact and fiction. We do light-hearted science and experimental philosophy, creating a special kind of speculative knowledge. Focus the Wadden Sea.

We consult preeminent experts, inhabitants, regular visitors, travellers, drone pilots, castaways who have ended up staying. Official amateurs offer a helping hand – civic scientists are numerous. We encourage participation by writers, artists, filmmakers: anyone who is ready to engage and keep an open point of view.

Wadgasten is about connecting. Connecting dots with lines, an interplay of lines of sight, timelines, storylines. The outcome is a dynamic world map, the Wadden Sea entangled with the oceans beyond. The project lasts four years, 2019 - 2022, a program possibly with workshops, interviews, research seminars, design studios or so. Thinkable is a variety of public expressions, e.g. art shows, symposia, articles, films, blogs and blogs. 2018 is the pilot year. The result will be an atlas of sorts, a travel guide in print and online.

AI-CREATION CARD SET

BY SJEF VAN GAALEN

GENESIS:

People understand the world through stories. There is no way we could possibly oversee every development in our search for what an environmental literacy could mean for artificial intelligence, but by generating narrative scenarios we can at least begin to explore possibilities, engaging and working through some of the complexity and restrictions in a structured way. When worlds collide, what possibilities arise? What conflicts and frictions? What has been taken into consideration? Whose interests are those being considered?

In the final workshop session of the Random Forests fieldwork on Terschelling, the team worked through a series of questions, building up a visualisation of what may be possible or desirable in the design of an artificial intelligence tasked with the protection of a natural heritage area. This visualisation was in turn broken down into constituent parts, and generalised into a prototype card set. In a second workshop session these cards were used to generate fictional AI entities with particular, restricted sets of properties. A set of narrative archetypes developed from stories that had been told about the island during the week of fieldwork allowed us to conceive of a number of different competing or cooperative scenarios.

HOW TO USE THE CARDS:

The cards are not intended to constitute a fully-formed game, but to generate cues, prompts for thinking. Putting together a fictional entity with an origin and properties defined by three or four cards may seem restrictive, but these restrictions bring focus, and in fact will allow participants to quickly add texture to their stories. Especially working in groups, diverse views on what the restrictions mean and entail soon spark discussion, and the combinatorial nature of the card set can quickly illuminate interesting frictions and questions about how the entity may operate.

The Origin, Properties, and Input cards allow the group to quickly outline the nature of an AI. The Narrative cards serve as story hooks. Archetypes designed to speak to the imagination enough that participants can construct their own stories around them.The card set is certainly not to be considered complete, but as a starting point from which to expand or adjust as you see fit in order to suit your specific context.

When using these cards for the purpose they were created, imagining what issues may arise when attempting to create an AI tasked with protecting natural heritage, it is highly recommended to do this after a period of immersion in the environment in question. A walkshop or tour at the least, and try to have local knowledge available in your group of participants. Having a map of the area to work around as a board also helps to situate the scenarios considered in the session.

CARDSET LISTING:

Origin:

What kinds of organisational structures would have the means and motivation to create such an AI? How would this influence its genesis and foundational underpinnings?

- NGO (idealist)
- Scientific
- Corporate
- Non-human
- Activist
- Government
- Artistic
- Religious

Properties:

Cultural Sensitivities
What would define how the AI would behave in interactions with its environment?

- Sense of Humor
- Language
- Environmental Literacy

Role
What would be the function it was (initially) intended to fulfill?
- Reporting
- Advisory
- Intervention
- Translation

Agency
What means would the AI have to exert influence in the physical world?
- Biomimicry Robotics
- Gig-economy workers
- Mechanical Turkers
- Volunteer Network
- Agricultural Robots

Inputs:

Where would the AI get its information?

'Hard' inputs
- Weather data
- Soil data
- GIS/vegetation data
- Market data

'Soft' inputs
- Non-human Informants
- Acoustic data
- Prose text data
- Human informants
- Occurrence data
- Gossip
- "Artifical" artificial intelligence

'Memory'
- Historical Land-use Maps
- Pictorial history
- Taxonomies
- Historical trend data
- Sci-fi scenarios
- Historical text corpus
- Programmed morality
- History of Species
- History of Landscape

Narratives:

The narrative cards are archetypes designed to spark the imagination. While each does have a back-story rooted in the environment of Terschelling it is left to the user to take these cues for their own stories.

False Hope / The Icebird Butterfly
The Icebird Butterfly was counted as extinct for a long period of time, but then suddenly sightings started occurring in a very specific pond area. Scientists / conservationists were elated, as it appeared the species had somehow survived/recovered, only to discover later that a local enthusiast had been breeding the caterpillars and releasing them into the wild as a prank.

Grand gesture / The Reindeer (Edel hert)
A small herd of reindeer were released on the island. Some people regarded this as a kind of grand gesture, introducing more 'wildness' into 'nature'. Being highly destructive to the local ecosystem however they were all hunted down and shot by the forestry service.

Turn of Favor / The Pine Tree
Pine forests were introduced to the island as part of the state forestry program. The forests were first fought against by the local population, who saw them as unnatural and invasive. When it came time to harvest these forests enough time had passed that the local population had become to see them as a part of the island, and they were now defended as a resource that should be preserved for public enjoyment.

The Holy Grail / Zonnedauw, a flesh-eating plant
Flagship indigenous species, occupying a niche in the local environment such that its natural return which would signify that the environment has been restored.

Running Gag / Wadmol
People on tours of the wadden area are told to keep an eye out for the "Wad Mole". A mole that would supposedly live in the intertidal zones exposed at low tide. There is of course no such mole, but that fact has not prevented there being several reported sightings.

Unexpected Return / Rotgans (Red Geese)
The geese were a common sight on the island, until one year they did not return. It was theorised that one of their main food sources had collapsed. For 30 years there were none of this species of geese on the island. The depleted food-stock that was supposed to be the reason for them leaving has not recovered, but the geese are back. Nobody is sure why.

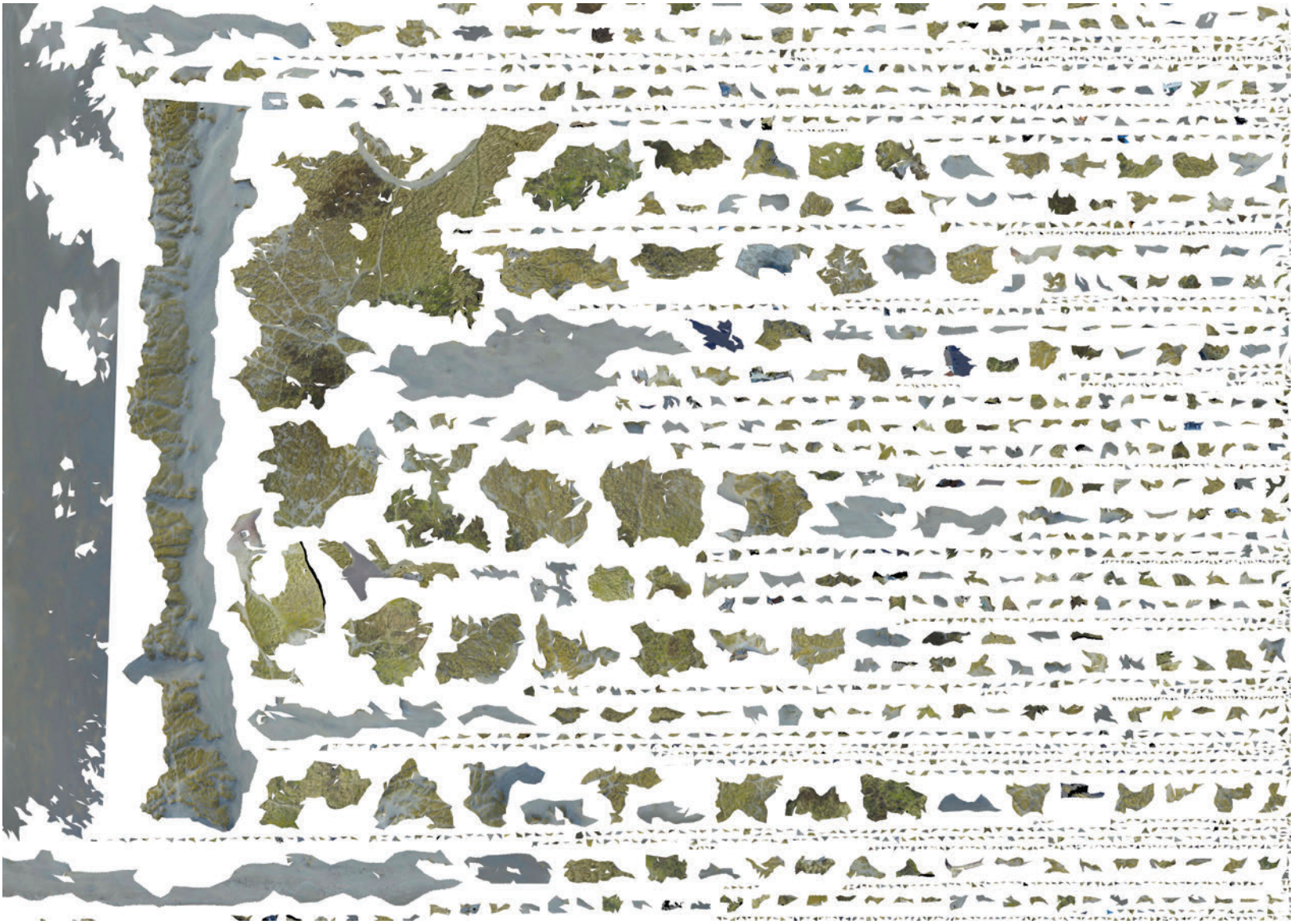
Not included in the current cards were a set of wildcards, titled OH NO!
Or, what could possibly go wrong?
These were:

OH NO!

- Tidal movements disappear
- Mutant Crayfish
- Hacked! (theft)
- Memory wiped
- Oracles down
- Bribery
- Hostile devaluation (environmental banking)
- Communications down
- Bankruptcy

Mapping out our agent structure on the Blackboard
in the entertainment-room at Stay Okay Terschelling

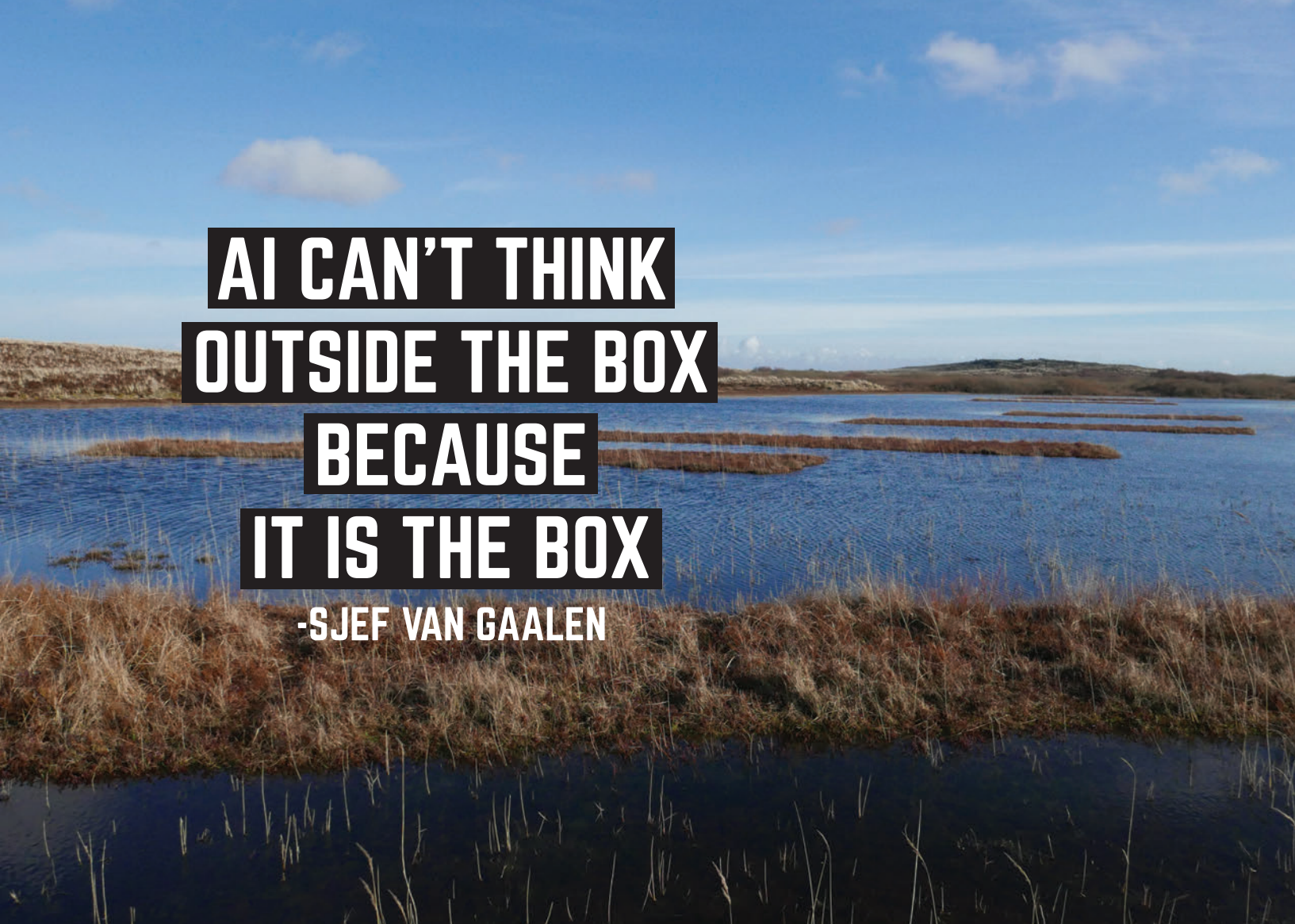

WHO
UNESCO
Microsoft
PARADIGM SHIFT
MIND CONTROL
JACKSON
Citizen Science
statistics
Critical thinkers do-ers
* SENSE of GEOSTRATEGIC VALUE
* STIMULATE INTELLECTUAL DIMENSION TRAVEL
HARMONIZE
REGENERATE HUMAN-DEGRADED ECOSYSTEMS
Programmed morals of which culture?
MEMORY
GOVERNANCE
VOTING
CONSENSUS
STAKE (SHARES)
* FOOTNOTES END NOTES ILLUMINATED
* VOICE OVER
PROPERTIES
cultural sensitivity
Analyse
Interact with all life
SELF-REPLICATING ROBOTIC AGENTS
SEND OUT THE DRONES !!!
HISTORY OF LANDSCAPE AND SPECIES
historical land-use maps
historical trend data
SENSE OF HUMOR
LANGUAGE
ENVIRONMENTAL LITERACY
SWARM
DISPERSED
Making Desicions "IN Context"
Evolve within ecological boundaries
AGENCY
ROBO-POLLINATORS
self learning machine
Asimov Robot ? Laws ?
Building Artificial Pollen / Bacteria
sci-fi scenarios
MORTALITY
Recalibrate itself
SENSE OF HISTORY
verifiable
governable
Build its own landscape machines
MOBILIZE ACTIVIST GROUPS
liquid
changable
Flexibility Creativity Adaptation Resilience
no racism sexism speciecism
Kill switch
transparent open source
CHECKS & BALANCES
* MULTI FOCAL VOCAL
COMPUTATION POWER
physical env / landscape
* EAST ATLANTIC FLYWAY
SOCIO-political
Tech INFRA Structure
* ENERGY INFRA
WHAT ENVIRONMENT
SAND BOX
* SEA SEEN AS SAND BOX
Insurance companies
The Island in the seas
RADIO FREQUENCIES
SERVER INFRAST.
the different tides
* CLOUDS * ATMOSFEER * CLIMATE * LIGHT
ENVIRONM. LEGISLATION
RESEARCH PROGRAM
seasonal summer business of tourism
VISIBLE - INVISIBLE PRESENCE
FOOD CHAINS
THE vulcano
a time wherein everyone has a smartphone
social democrats (PvdA): local politics
ECONOMICS
SMART DUST
MESH Network (Sensors)
Micro Processor
EXISTING TECHNO INFO
Data Markets
water crassula
* INVASIVES



On Thursday, we flew northeast of Midsland aan Zee.

Scanning the dunes, the drone captured 240 photos – enough information to build a dense point cloud and re-create the geometry of the landscape below. Vertices, texture coordinates, and the pixels from the original photos are combined to build a sctructure, a surface, and a visual representation of the Noordzee coastline.

-Tivon Rice


AI CAN'T THINK
OUTSIDE THE BOX
BECAUSE
IT IS THE BOX
-SJEF VAN GAALEN

NATIONALE DATABANK FLORA EN FAUNA Uitvoerportaal

RonRopskylge

De NDFF is de meest omvangrijke landelijke informatiebron van verspreidingsgegevens en bevat betrouwbare waarnemingen van planten en dieren in Nederland. Nieuwe gegevens worden met regelmaat toegevoegd. Alle gegevens in de NDFF zijn door soortexperts gevalideerd. Nader (veld-)onderzoek kan noodzakelijk zijn om aanwezigheid van een soort te bevestigen of uit te sluiten.

TAXONOMY: THE DIFFERENCE THAT MAKES THE DIFFERENCE

-SANDER TURNHOUT

DUNE AS POINT CLOUD

-TIVON RICE

KILPISJARVI

Fieldwork session #2 @ Ars Bioarctica
Finnish Arctic may/2018

with: Antti Tenetz, Ian Ingram, Shah Selbe, Theun Karelse

This is the second RandomForests fieldwork session at the Kilpisjarvi Biological Research Station in the Finnish Arctic. The team consists of people with a landscape practice that is rooted in in-situ experimentation and prototyping. The residency explores the role of AI in artistic and scientific fieldwork. Can AI function as an intermediate in environmental investigation? As a mercurial companion, an interspecies informant, an environmental messenger, a climatic guide guide, ghost or even mentor?

The research station was set up in the Arctic regions because of the relatively simple ecosystems the environment offers. It was supposed that causal relationships would be easier to study there. This makes it also a prime location for our second fieldwork session. A basic territory in which to deploy and study artificial agents.

Thalience

The session at Kilpisjarvi also aims to explore the artificially intelligent agent in its own right. As Karl Schroeder describes in the Hamburg Manifesto: *We don't want machine copies of our own minds, we want to give the natural world itself a voice.* This is his core notion of Thalience, an attempt to give nature a voice without that voice being ours in disguise. It is the only way for an artificial intelligence to be grounded in a self-identity that is truly independent of its creator's. Can machines learn from non-humans? Can they learn through direct exposure to landscapes?

Making New Minds that Love Trees

Ian Ingram
Los Angeles August 25, 2018

1 Whither the trees?

We pointed a camera into the landscape of arctic Finland -full of lichen-covered rocks and twisted birch trees- and asked an AI to tell us what it saw there. It told us it saw snow-mobiles.

There were none. In fact, while the human hand was probably manifest in that landscape in ways we could not perceive at a glance, there were no salient human artifacts in the AI's view. It was hallucinating. It was hallucinating a landscape full of snow-mobiles. Perhaps more strikingly, it didn't see the trees.

"We" were Theun Karelse, Antti Tenetz, and myself, up at the Kilpisjarvi Biological Research station as part of the Ars Bioarctica artist residency and the Random Forests project that Theun had initiated. The tree-blind "AI" was the Inception Version 3 image classifier that ships with Google's Tensorflow machine learning framework. It knows about one thousand things out of the 20000 in the ImageNet database. These range from the banal -a plastic bag- to the unlikely -a pickelhaube- to things whose inclusion is perhaps a tad disturbing -a guillotine.

Inception also knows about a lot of animals: the nudibranch, the eft, the mongoose, and the rhinoceros beetle to name a few. In fact, it knows 398 kinds of animal i.e. animals comprise just under 40% of the things it has been trained to detect. That is why in recent projects I have been using it in the perception systems of my robots for which the presence of particular animals is often key. Instead of building my own image classifiers as I had been doing since the late 2000s, I have been retraining the final layer of Inception's convolutional neural network to detect the particular animals my robots are interested in. Tensorflow has made this easy. Inception even knows over a hundred dog breeds, the breed being a category of animal that very much shows the human hand at work, giving it a certain kinship with the aforementioned snowmobile and making it very useful for my robot that warns squirrels of incoming predators using their own tail flick alarm signal. I have become used to pointing Inception -at the beginning of a project, before retraining it- at some animal and having it come back with a name that, if not spot-on, certainly showed it was getting the gist, telling me "hamster" when it was looking at a rat, telling me "grouse" when it was looking at a pigeon. But, surprisingly when Inception looked out onto a landscape full of birches, it did not say "aspen," or "willow," or even "oak." The trees were, to the last one, invisible to it.

From a technical, proximate perspective, this became less surprising when we had Inception spit out a list of the things it did know about and noted that none indeed were trees. Taking a few steps back, however, that trees were neglected in this AI's training still begs the bigger question: how could they -and so many other aspects of the natural world for that matter- remain so ignored by what is likely one of the most widely disseminated image classifiers in the world? It knows so many animals. It knows so many things that humans might wear, hold, ride in, and sit on: clothing, musical instruments, vehicles, kitchen utensils, furniture. But no trees.

AIs have been outed as having blind spots before, even verging on close-mindedness and bigotry. Perhaps the most well-known instance was the Google photo tagging system (perhaps with a version of Inception at its core?) that labeled dark-skinned people as gorillas. There was also Microsoft's chatbot, Tay, pumped full of data collected from tweets, and thus supposed to have learned like a baby how to converse naturally through its imitation of human interlocutors, that quickly showed that what the internet was teaching it to say was polemical, divisive, and often prejudiced. The import of these AIs' affront to human dignity trumps Inception's slight to tree dignity but if our AIs continue to be blind to trees and the many other parts of ecosystems, we will find -as we have already found many times over- that turning a blind eye (or a blind AI) towards the dignity of nature will ultimately have consequences for human dignity as well.

2 A tree versus this tree, a mountain versus Saana

So Theun, Antti, and I set about teaching the AI about trees, particularly the mountain birches that dotted the landscape, and also about the lichens, the mosses, and the other members of plantae and fungi surrounding the biological research center. We also included some representatives from animalia: the reindeer, the swan, and the capercaillie.

A fourth member of our team, Shah Selbe, hadn't been able to make the trip and was working -like a Houston to our Apollo- back in LA in parallel with us. When we told him the direction we were beginning to take, he began to explore relevant work and uncovered that iNaturalist had created an image classifier that used their citizen-scientist-collected dataset to recognize a whole host more animal and plants than Inception.

Turning a critical eye towards iNaturalist's classifier work (perhaps excessively critical as their project is to be mostly lauded) we saw that the things it focused on definitely still exhibited a kind of selection bias: the images it has trained on have been collected by people concentrated in particular areas of the world, and particular regions and ecosystems of those areas, and showed a preference for the kinds of things in nature humans often attend to. The species represented extend well beyond the charismatic megafauna that are often fore-fronted but very much remain in the space that is salient to the casual human Umwelt which was still true for our project as well. The training images even show a link to that Umwelt in how they had been composed: not the root of a plant but its flower, not the underside of the flower but the side we point towards us, not the anus of the fox but its supposedly sly face. Humans tend to frame their photos in consistent ways. This probably suits the purpose of developing a classifier for classifying other images taken by humans but it nonetheless reveals an anthropocentric bias.

The iNaturalist classifier also focuses exclusively on species. What about the things in the landscape, in the world, that don't fit into that category: processes; geologic structures, symbioses, meteorological phenomena, hydrological systems, and even long and short-term organizations of those very species, like herds and predatory relationships? We hadn't gotten to many of those either but thinking about their work made us begin to think that we should. Inception does in fact know a somewhat finite set of geographic features: the cliff, the valley, the alp, the volcano, the promontory, the sandbar, the coral reef, the lakeside, the seashore, and the geyser. Looking at the training data, again we saw bias for human perspective but more importantly neither Inception nor iNaturalist knew about Saana, the distinctive mountain that looms over Kilpisjarvi. Neither knew about the particular herd of reindeer that we had seen frequent mornings when we had been at the station two years before which had yet to make an appearance. We began to see this over-generality, this non-specificity to locality of Inception and of the iNaturalist classifier as what our project should attempt to address. Our goal became not simply teaching an AI about trees but to teach it about its local trees, and also its local plants, its local animals, its local geography, even about hyper-local things, like Saana, that herd of reindeer, and individual lichens on particular rocks only twenty feet from where the laptop running it chugged away on the new images we provided it. We started to make an AI focused on a very particular locality, intimately entwined in the things in that locality. In this case, this was the specific little piece of arctic Finland in which we were operating but we saw what we were making as a prototype for a host of AIs spread throughout the globe, each intimately aware of and tied to the landscape in its particular locale.

3 A Parliament of AIs

Our project began with an AI's hallucination. The propensity of vision-based AIs to hallucinate objects in their view that are not there clearly presents interesting jumping off points for thinking about machine Umwelts. A fair amount of both playful and earnest exploration has been done by others on AIs' tendencies to hallucinate. Our project, however, is less about teasing an easily befuddled AI but, instead, leading it gently away from delusion towards

a clearer view, one perhaps more beautiful than its fantasies. As of now our prototype remains a vision machine, gestated from Tensor ow's Inception V3, but it is clear that a limitation to sight would be a gross constraint and our ongoing plan is to begin to link in other streams of information about the Kilpisjarvi landscape, particularly data collected through sensors at the observatory and from the scientists' human observations that might give the AI awareness of some of the more abstract classes mentioned above.

In as much as the AI remains a classifier, however, it remains squarely in the space of the categorization of "things" that is exactly what Bruno Latour interrogates in "We Have Never Been Modern" and then extends into his proposal for a Parliament of Things. He left the implementation of the parliament up to others and there certainly remains the question whether a human can truly be an adequate representative of all the kinds of the things in this parliament. Who or what can best vote in the interest of a birch, or, for that matter, for the air around it. Perhaps an AI with a more appropriate Umwelt might do a better of job of truly perceiving the thing's needs and "goals." A future version of our locally-aware AIs could thus be the representatives for the things that are ecosystems and their constituent parts, giving them voice, maybe even identifying them as present in the first place, especially for what might easily become under-represented remote localities that humans would be more apt to neglect. The AIs could almost double as census-takers: identifying and counting the things themselves that need representation in the parliament.

Thus, what we are proposing is that our system is a prototype for a system made of a vast number of AIs, each localized to a particular place, a particular ecosystem, each tuned into that ecosystem and its very local inhabitants, its very local ebbs and flows, its very local structures. Each would work on behalf of its local ecosystem so that none are neglected, representing each in a Parliament of AIs that do not merely love trees but love every last grown and non-anthropogenic thing in their ecological district and will fight on their behalf in a distributed way, a sort of world-wide, Minskyesque society of minds -ecologically-focused minds- that will prevent the de facto centralization of ecological decision-making that promotes the kinds of places and processes that are in the forefront of the human awareness -especially of the human awareness from developed places- instead giving what we now begin to understand is a richly interconnected global play of systems and subsystems some protection against the subjugation of our human systems.

4 Unschooled

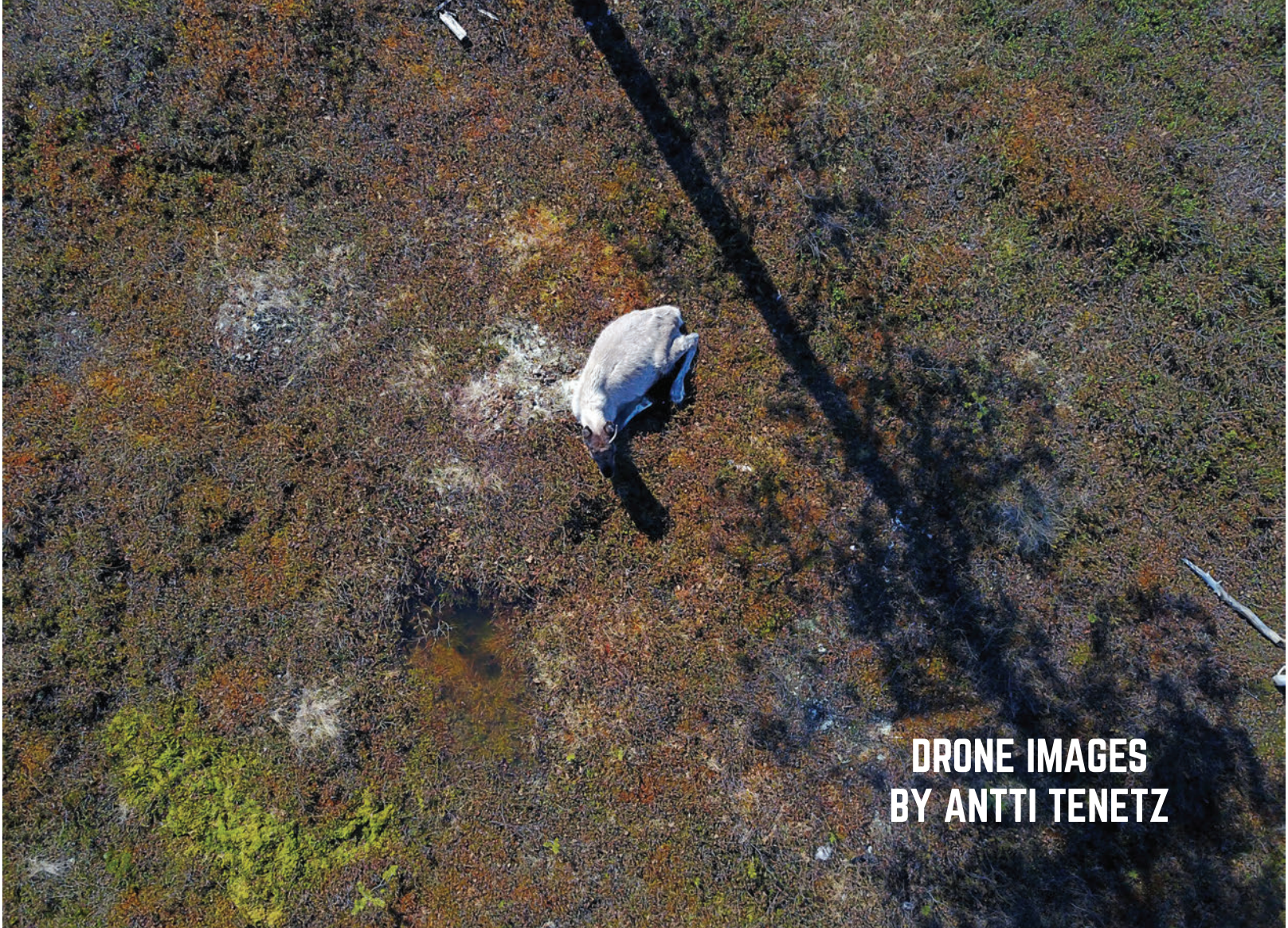
There remains, though, in our project's trained AIs thus far, a great sensitivity to human choice, to human categorization: a supervised learning algorithm, i.e. one that learns categories or relationships based on training material that has been prepared and tagged by people, is very subject to the biases of those people, malicious or benign. The shorthand for this phenomenon that causes a system to underperform due to deficiencies in its input data is "Garbage In, Garbage Out." Garbage-refuse, unwanted material, discarded byproducts of industry, commerce, and just plain, quotidian modern living -of course plays a center-stage role in the problem of sustainability. The concept of garbage also is a perfect example of the short-comings of a human bias. We have in the past miscategorized vital elements of ecosystems as garbage, notably clearing fallen trees in forests in the name of husbandry, only later understanding that those rotting trunks play an important role in the cycles of that place. We are likely making new sorts of such mistakes now and will continue to do so. To allow our envisioned AIs to avoid this particular kind of garbage problem and other versions of the Garbage in/Garbage Out problem, our project's next step is therefore to break our AI out from the classroom -where its schooling has been prescribed by a curriculum humans designed- and into a world where the categories are not predetermined, where it can continue its education, unsupervised. Perhaps it will chart a new path through the forest of our understanding of forests, one that like the snowmobiles we couldn't see but, unlike them, is actually there.

Random Forests, the namesake of the initiative this project is part of, is actually itself a well-known, and once dominant algorithm often used for classification. Its forests are random collections of a different, digital, arboreal entity -the decision tree- digitally grown and pruned to suck up input at its roots, sorting it down its branches until a leaf is reached which has writ- ten on it the category the tree says fits the input. There would be a poetry if were using decision trees and random forests instead of neural networks to learn about the trees in the original forests, a beautiful symmetry between algorithm and subject. The dendritic shape of neurons, however, is probably morphologically enough like that of a tree to make a decent psychosculptural linkage. Nonetheless, we do hope to focus a lens on the randomness of the forests or lack thereof and of other ecosystems that are the subject of our inquiry, on where order, entropy, stochastic processes, and emergent pattern each play their role in the web of activity and material that is a resultant ecosystem i.e. let's let the AI tell us whether the forest is random after all.

George Orwell emphasized the power of language to shape thought and the corollary risk of linguistic restriction's keeping thought deliberately circumscribed. As our minds increasingly rely on artificial ones to be receptacles and auxiliaries of our individual and collective thinking, remembering, perceiving, and apperceiving, it behooves us to be careful about what we make those new minds perceive and attend to. The human Umwelt has been expanded by our technology, allowing us to see hidden things in the heavens and in the earth, to know about and use ways of seeing and hearing that before had been the purview of other beings, to peer deep into time, and sometimes predict the future. Inception's myopia -better its penchant for having apparitions of the artificial- evidences an alarming countervailing trend in some of our recent technology: making us see less, curtailing our expanding Umwelt, circling our senses back inward towards our own categories, our own output, towards the built and made and away from the grown and that which unfolds without us. We have always found ways of changing the materials in our environment into our kinds of stuff, chunky, amorphous iron ore into prismatic steel beams, black goo oozing from a ragged seep into crystal clear, radially-symmetric vessels, the flickering flame of oxidization into the precision explosion of the internal combustion engine. But in Kilpisjarvi we were dealing with the perception of a world full of the trees before they are planks, rocks before they are gravel, water before it is Evian, and the AI we pointed at it already mutated it into our things, as if it was not merely making a mistake in its efforts to see the present but was instead accurately seeing the future where all those things are indeed gone, everything converted into our kinds of stuff, where that landscape was indeed littered with snowmobiles and devoid of trees.

training data





DRONE IMAGES
BY ANTTI TENETZ

DINACON

Fieldwork session #3 @ Digital Naturalism Conference
Thailand June/2018

with: Sjef van Gaalen

This event is quite different from traditional conferences. Similar to the way that the organizers have explored digital design for naturalist field expeditions in their Hiking Hacks, this conference investigates interactive tool-making in the setting of our own DIY biological field station. They chose the location so that it is possible to do both terrestrial and marine exploration. There is access to nearby water bodies and inland forests to explore. Plus there are many groups nearby through which ships may be chartered to explore deeper in the ocean.

The Rules

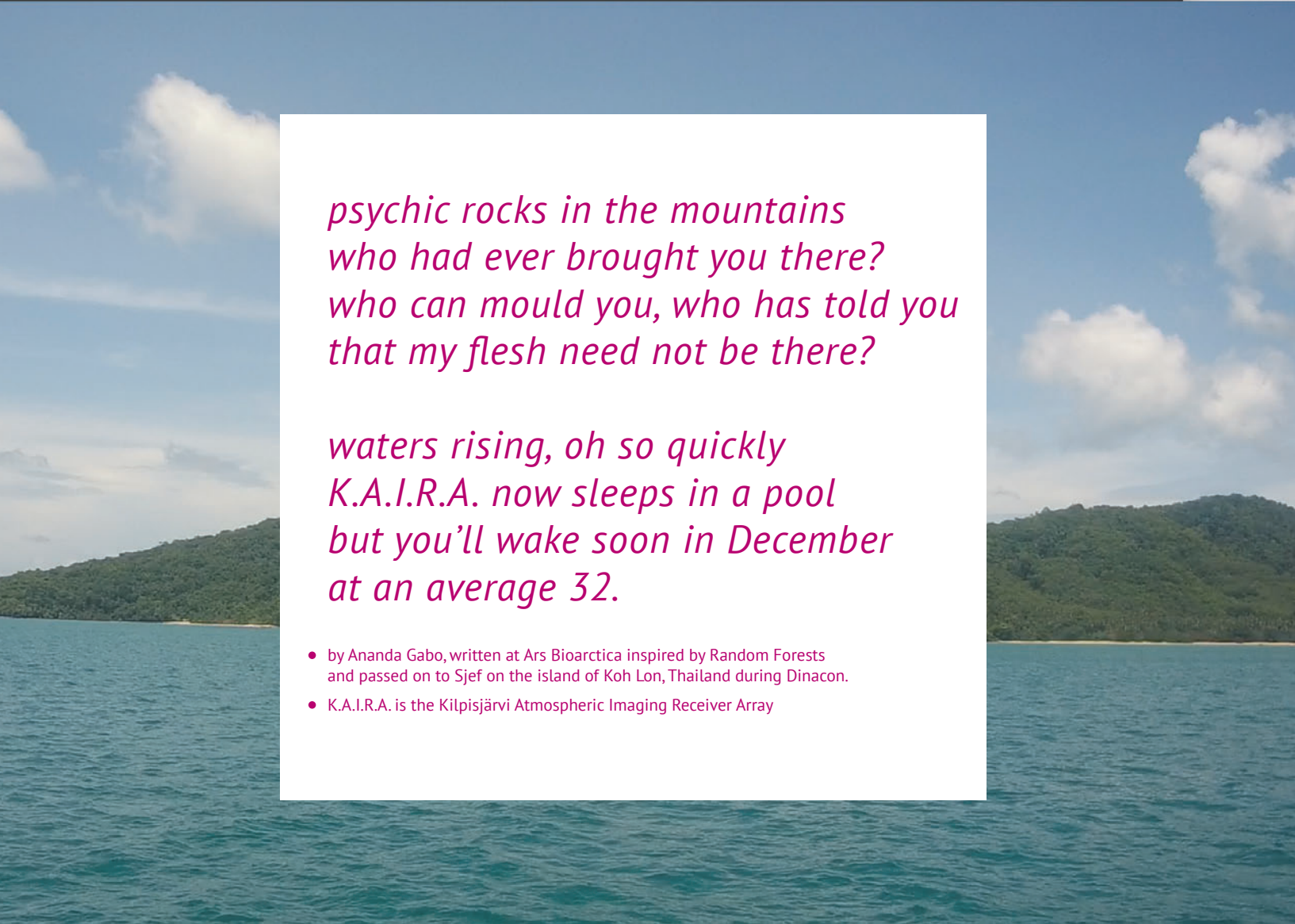
1) Make Something
You must complete something. Figure out something you want to accomplish while you are here. It can be any format you want: sculpture, a biological experiment, a movie, a poem, a fingerpainting, a journal article – you just have to finish it!

2) Document It
You need to document the thing you made, and share it with us and the world! (Everything made here will be open-sourced and available to the public!)

3) Give Feedback
You need to provide feedback for two other people's projects.


FOREST WALK
KOH LON ISLAND


RANDOM FORESTS
WORKSHOP
ON BOARD OF THE
DIVA ANDAMAN



psychic rocks in the mountains
who had ever brought you there?
who can mould you, who has told you
that my flesh need not be there?

waters rising, oh so quickly
K.A.I.R.A. now sleeps in a pool
but you'll wake soon in December
at an average 32.

- by Ananda Gabo, written at Ars Bioarctica inspired by Random Forests and passed on to Sjef on the island of Koh Lon, Thailand during Dinacon.
- K.A.I.R.A. is the Kilpisjärvi Atmospheric Imaging Receiver Array

AARE LAB

Public lab @ Border Sessions festival
June 13/2018

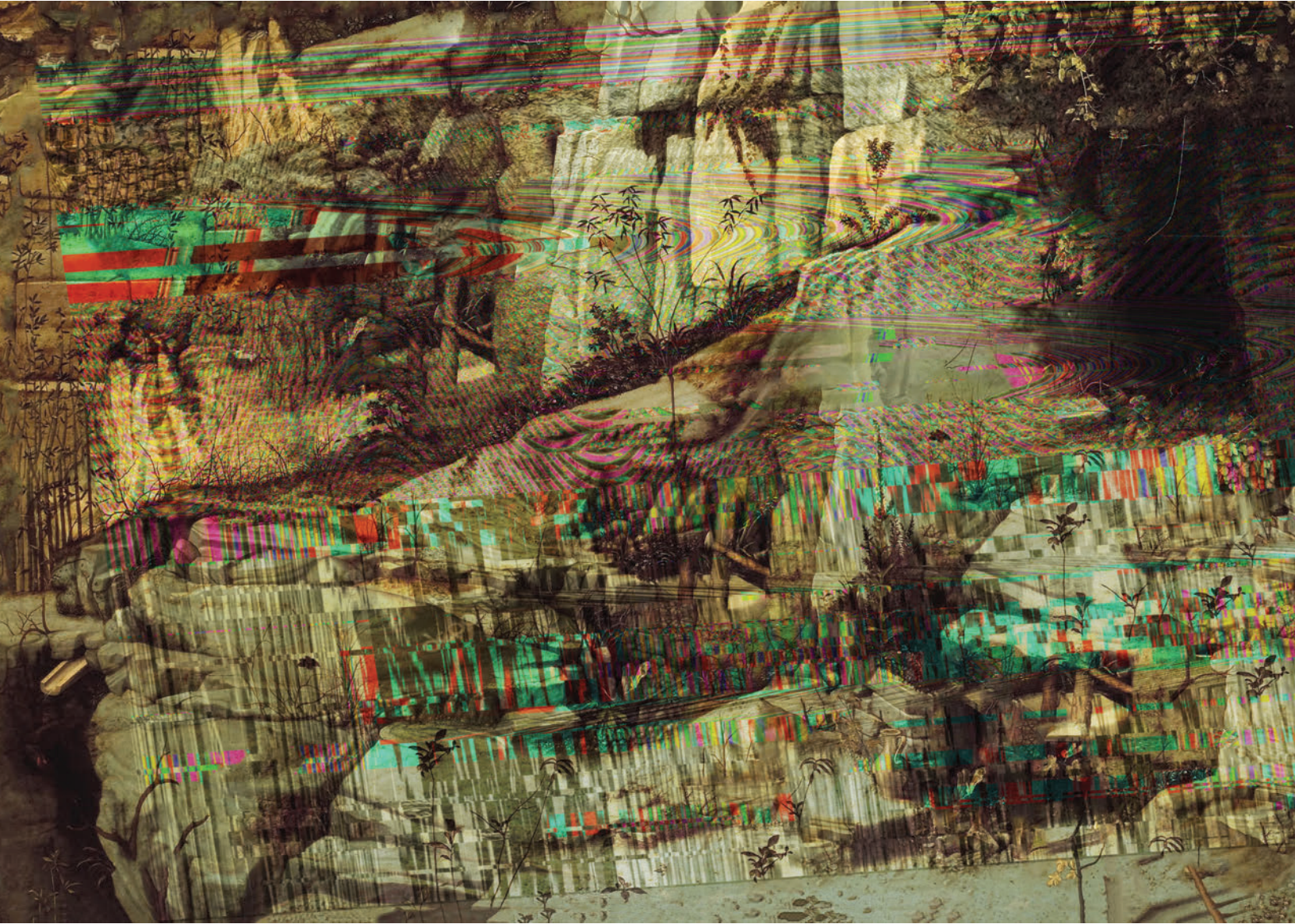
with: Klaas Kuitenbrouwer, Sjef van Gaalen, Theun Karelse

Autonomous Agents for Regenerative Ecology will investigate how various autonomous technologies can support the emergence and regeneration of ecosystems.

Landscape degeneration is a phenomenon at planetary scale. Some see this century as the age of ecological regeneration; bringing areas back to life, with the return of water, vegetation and all manner of organisms re-appearing. This would be 'The Great Work' for humanity. But are humans best suited for all aspects of this task? This lab proposes to push the narrative beyond human-centric perspectives. Could landscapes engage in self-regeneration if they form alliances with the right technologies? What would such systems entail?

This lab brings together field-workers and field-thinkers from the environmental ‘avant-garde’ who work at the level of community, technology data to design and develop actual applications of autonomous agents in regenerative ecological practice.

AARE lab was organised by Theun Karelse of FoAM as part of Random Forests, Klaas Kuitenbrouwer of Het Nieuwe Instituut as part of Terraforming Earth and Sjef van Gaalen of Structure and Narrative, in collaboration with Border Sessions Festival 2018.



AARE

Autonomous Agents for Regenerative Ecology was the second lab in a series of three Terraforming Earth Labs initiated by Klaas Kuitenbrouwer, researcher at Het Nieuwe Instituut, in response to the Gardening Mars exhibition. The second lab built on work that was carried out during the first lab: Constitution of a 21st Century. The third Lab, titled Terrafiction, took place on September 28 and 29, 2018 at FIBER in Amsterdam.

Lab 1: Terraforming Earth - Constitution of a 21st Century

The first lab started from the observation that a 21st-century society will have to become less human-centered in order to thrive ecologically. It explored new legal and organisational approaches around the basic right and obligation-holding unit of the 'natural person', which is based on the human individual. If a 21st-century society has to become less human-centered, this central idea of the natural person needs to be reconsidered.

Starting points for the lab were provided by several interesting recent cases: The Ganges and Yamuna Rivers in India were granted the status of 'natural person' in 2017. This status was revoked by a higher Indian court. In New Zealand however, Whanganui River and Mount Taranaki have been granted legal personhood, which holds up well in the legal system. And then there is Terra0, a forest outside Berlin that has been augmented with a DAO and that technically owns itself.

Participants in this lab explored alternative modes of corporation, that would include non-human entities and extrapolated their possible cultural, economic and ecological effects.

Lab 2: Autonomous Agents for Regenerative Ecology

The second lab, Autonomous Agents for Regenerative Ecology, organised at the Border Sessions festival in The Hague on June 13th, 2018, investigated how various autonomous technologies could support the emergence and regeneration of ecosystems.

Landscape degeneration is a phenomenon at planetary scale. Some see this century as the age of ecological regeneration; bringing areas back to life, with the return of water, vegetation and all manner of organisms reappearing. This could then be considered 'The Great Work' for humanity. But are humans best suited for all aspects of this task? This lab explored the potential role of (automated) technologies in this context, engaging with questions such as: Could landscapes engage in self-regeneration if they form alliances with the right technologies? What would such systems entail? Bringing together field-workers and field-thinkers from the environmental avant-garde who work at the level of community, the lab embraced technology and digital data to design and develop actual applications of autonomous agents in regenerative ecological practice.

Working Definitions

Regenerative ecology is the practice of bringing ecologically exhausted sites literally back to life. It does not necessarily imply a return to a former ecological state, however. A regenerated ecology may be home to other species and networks than a previously existing system.

The term 'autonomous agents' was adopted as an inclusive term to indicate technologies and other beings and systems that perform without direct human supervision. The extent to which autonomy is possible and/or desirable in technical systems was a point of discussion in this lab. The decision was made to spatially situate

the questions of this lab in areas that have fallen victim to desertification due to human activity. This choice was made to prevent participants having to deal with too many complex forces in the scenario building phase.

Scenarios

The day was divided in two main parts. In the morning, the participants developed general scenarios in which ecological regeneration would ally with autonomous technologies. In the afternoon, the building blocks of these scenarios were to be refined and their functioning processes were discussed and designed in more detail.

Participants groups were offered some basic questions to help develop their scenario outlines, although not all groups worked from these questions.

Which kind of organisation is undertaking the work of regenerating ecologies (political, corporate, religious, voluntary, or combinations thereof) - in other words, on the basis of which philosophy are the initiators of the regeneration working? What are the functions that need to be performed in an ecosystem and what are its developmental steps? Which organic, technological or human entities are most suitable to perform these functions?

Three scenarios were developed and will be outlined below, along with some questions from fellow participants.

1. Autonomous rainwater retention and carbon capture

The starting point of this group was a very basic question: can we design an automated system that would secure the water cycle and that would prevent the land from further erosion? To arrive at the simplest solution the team decided to work as much as possible with locally found materials.

The basic concept was the strategic placing of large stones found scattered over the land. The location of these rocks would be decided upon through mapping the land using satellite data, which allows for contour lines to be drawn. Using this contour lines and data on weather patterns, solar powered (slow) robots are programmed to place stones to create ridges that perform several functions at once. The stones are relatively cold in the morning and collect moisture that creates relatively humid niches for pioneering plants. They furthermore prevent erosion by protecting these plants against too much direct sun and wind.

Once the first step of placing the stones is completed and water availability has improved, the robots begin to collect and place sticks in the humid places. On these sticks, birds perch and defecate, carrying seeds from various plants. When the pioneer species get bigger, fog catchers will have to be introduced that function like trees in their capacity to catch atmospheric water.

Up until here, the question of who or what would be the initiating party for this development was (consciously) ignored, but at this stage the question surfaced again. The landscape hasdeveloped to a point where it can be transformed into just about anything - it has been rendered live-able. Choices emerge: do we allow humans to step in to inhabit it? Or do we allow the land to re-wild and leave it to non-human beings? While many things could happen, the basic options boil down to two: either long-term regeneration is opted for, or the land is subjected to new rounds of exploitation and degradation, essentially starting the cycle anew.

2. Bio Co-ops grouped around Ecological Succession Stages

This group first explored the philosophy that would underpin the scenario choices intensively, starting with the rationale behind regeneration.

Initially, the urgency for ecological regeneration was found in a drive for survival of humans and non-humans. But the group thought the ambition of their scenario should go beyond mere survival. Their stated aim was to regenerate ecosystems that should provide the conditions for a good life, which the group defined on a basic level as a combination of cultural and biological diversity.

In discussing who would be responsible for initiating this scenario the group identified the possible interest of the EU in supporting ecological regeneration of regions bordering the Sahara, as a way to mitigate refugee streams. The first stage was therefore cast as an experimental pilot project started by a group of NGOs and designers, funded by the EU.

This group began by questioning how they could restore living soil and applied the logic developed in the first lab: Constitution for a 21st Century to develop a political system of bio co-ps in that act in the interests of collaborating humans and non-humans. Each ecological succession stage was to be the business of a separate bio co-op, each working independently and on different time scales; the work of the first co-op would prepare the scene for the work of the second, which in turn creates the right circumstances for the third co-op to start working.

3. Sand Factory and Weekend DIY Bio-Hackers

This group focused the work of the first round on ideas for parties that would initiate ecological regeneration. Two possibilities were developed. The first was the a privately-owned, but government-sponsored sand factory that injects capital into the desert. As sand shortages are a growing phenomenon, mainly related to the demands of the building industry, a sand factory in a deserted area is potentially a viable proposition under current economic logic. The second idea for an initiating party was a group of DIY bio-hackers that commute to the desert and spend their weekends experimenting there. The goal of both is to re-green the desert.

Mapping Circuits

Once these basic propositions were exchanged and peer-critiqued, the next task was to formulate ways in which they could be made technically, socially, culturally and logistically viable. This was done using a small set of diagrams derived from Unified Modelling Language. Indicating either Input (blue card), Process (green card), Storage (orange card), or Decision (purple card). Using these building blocks demanded that the origin of resources (input) was articulated (and justified), that the process was reflected upon (what happens with the input?) and that decision makers and decision thresholds were identified, et cetera.

Autonomous Rainwater Stones and Carbon Capture

This scenario begins with sunlight, robots moving stones and sattelite data. With the stones, ridges are to be made in such a way that the water collects and shade is created. The threshold criterium is the level of humidity and shade. If humidity and shade are not sufficiently increased, more stones need to be moved. When a stage of sufficient humidity is reached, sticks are planted.

When sufficient seeds have sprouted and pioneering plants have taken hold, fog catchers in the form of artificial spider webs are introduced, that collect water from the atmosphere. Pioneering plants collect carbon and nitrogen in the soil. Extra seeds may be added to prevent monoculture from developing. The fog catchers are rendered obsolete when trees come into existence, as they will then perform the function. As long as there are no trees, the fog catchers keep harvesting water.

Several measurable states were identified that would steer the process and indicate its level of success. Does a diverse set of species co-exist? If not, seeding continues. Is there sufficient oxygen available in the soil? If not, soil has to be cut open. Birds add to the nutrition balance of the soil through defecation, decompacting the soil and making it infiltratable. Success of the overall development would indicated by the presence of a certain insect mass, by the development of sufficient soil life, and by the establishment of a mycelium network. All these criteria can (theoretically) be measured by autonomous technologies.

To close, this group again discussed the 'who' question. From whose perspective is this development functional? What is the implied cultural framework around which the scenario is designed? They established different indicators for different potential criteria. Can the developed sustain human life as well, without degrading again? (Can it become a sustainable food forest?) Or should the site aim for maximum bio-diversity? Or should it aim for maximum economic value in order to be sold to the highest bidder for a next round of exploitation that starts the same process again 300 years later? All choices have a cyclical nature to them.

Sand Factory and Weekend DIY Bio-Hackers

The two potential initiating parties that this group labelled in the first sessions were merged in the second session, to provide the basis for developing a scenario. The group positioned this after the sand company had shut down, leaving a number of large pits in the ground. This is the moment an initial group of ten biohackers researches the pits to decide where to build water traps allowing water to collect.

From there on they try out different seeding tactics in different pits. As long as healthy pioneering plants have not emerged, seeding continues with (slightly) different seed mixes until bases of foundation species emerge. Ideally, this process would create different types of environments in the different pits.

In a later stage, pits may be connected and disconnected by establishing ecological corridors, disrupting the established equilibria allowing for new systems and populations to emerge. Altogether this amounts to a diversity strategy, supporting for different developments to take place simultaneously, next to each other like islands in an archipelago.

Bio Co-ops around Ecological Succession Stages

The third group worked out a regenerative system based on establishing three bio co-ops: new corporate forms in which humans and non-humans collaborate, that act in their mutual interests.

Each bio co-op represents and acts out a different ecological succession phase. The group outlined the functioning of the three different bio co-ops in terms of time-scale and elaborated on the technical, political, cultural and ecological logic through which they would operate.

The first bio co-op was pictured as a slow-moving nomadic group, residing in a certain site for three month periods. Their core movement comes from slow-driving solar-powered bulldozers steered by satellite data, that traverse the land digging gullies in which water can collect, seeding them with pioneer species and

nurturing them through their earliest phase. The group would not move more than a few hundred meters a day. The gullies may also function as graves for deceased humans or other animals, providing richer biodiversity.

The result of their presence is an increased presence of carbon, nitrogen and nutrients in the soil as well as improved water retention. Root culture, fungi and bacteria would form, creating living soil. This leads to a threshold moment, when the conditions for succession phase 2 are realised. This is when Bio co-op 1 moves on and Bio co-op 2 takes over.

The aim of Bio co-op 2 is the development of a functioning circular culture and related infrastructure that includes food systems and energy cycles. Importantly, this phase minimally takes several years to develop. This means vested power structures will emerge with related political tendencies. Part of the functioning of Bio co-op 2 is the application of blockchain systems to help govern commons. This would protect them from degrading exploitation.

Longer time-scales become relevant as entities that live longer than humans begin to take the stage. This introduces wholly different conditions. Trees, with their long-term perspectives and related long-term politics will bring interests to the foreground that are rather foreign to current humans. The group found that imagining these conditions is important, but, for lack of lived cultural experience, at this moment rather speculative. The famous seventh generation principle from the Constitution of the Iroquois Nations does provide a guiding principle, but has not been workably translated to alliances that also include technological non-humans.

Bio co-op 3 would have to develop a different kind of intelligence (or thalience) mediating between interests on different time scales, of different involved agents. (Machine learning) technologies may play a role here, to maintain long term developments. Including the possibilities of technologies that can establish communication paths that cannot exist in organic nature alone, would vastly increase the scope of possibilities.

Bio co-op 3 runs the risk of growing into an end state in which flexibility is lost, and ultimately cultural and organic diversity is reduced again. This would counter the first principles that were formulated by this group. Therefore the important function of the ecologic disturber was articulated as well. Disturbers would destabilise the functioning of a Bio co-op 3 settlement, opening space for species or entities to move into different roles.

Text: Malou den Dekker, Klaas Kuitenbrouwer

Participants

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Full reports of all three labs can be found at:
https://research-development.hetnieuweinstituut.nl/en/terraforming-earth


ECOLOGICAL
SUCCESSION
AS DAOs

WILD BITS

Fieldwork session #4 @ MAAJAAM
Estonia Juli 11to25/2018

with: Brian House, Antti Laitinen, Paula Vitola, Aivar Tõnso, Timo Toots, Taavi Suisalu, Theun Karelse, and others..

The aim of the residency is to explore the idea of digital natives and digital immigrants. At the present time, people are more connected to each other by technology than by physical space. Technological tools have become our prosthesis, that help us reach out on global level. Subsequent generations awaken into new technological normalities being disjunct to the realities of their predecessors. Compared to their forefathers, the digital immigrants, who were expected to adapt in a fast-evolving society powered by technology and steered by global markets, their sense of reality has transformed.

The residency is located at MAAJAAM, an old farmhouse in Southern Estonia that blends together the two realities of digital immigrants and natives. Created to encourage experimentations with techno-logical realities, the residency gives space to contemplate, question and explore aspects of technological society; its influence on our behaviour, perception and thinking as well as on our surrounding environments.

WHAT IF THE FUTURE OF THE AMAZON DEPENDS ON AMAZON's ALGORITHMS

Maajaam, Estonia 2018 Theun Karelse

For ***Maajaam WildBits*** my proposal was to explore where non-humans fit within the digital-natives / digital-non-natives spectrum. This relates strongly to longer term projects, ***Machine Wilderness*** - which explores technologies that relate to landscapes in the way animals do - and ***Random Forests*** - which looks at environmental machine learning.

Our digital infrastructure is pretty much entirely human centered - or certainly developed as such - but it operates in multispecies realms which are densely populated. I planned to select one local organism at Maajaam - bird / mammal / insect - and make it central to the investigation, making use of a rich array of investigative techniques: ecological / artistic / digital observation strategies. To follow it closely during the full length of the residency.

How does it relate to human technologies in its daily life? What are points of contact / interference / co-evolution? What steps would enable our technologies to become inclusive of non-humans? How could that organism be given access and move towards becoming digitally native?

When we arrived at Maajaam I was immediately attracted to **the creek**. But what species to choose there? After some consideration it occurred to me: why not take the whole creek as my research subject!

During the Random Forests program this year there have been many discussions about how the environment is modelled and represented: attempts for rivers, forests and mountains to be legal persons, start companies and become their own owners. We've prototyped **autonomous systems for regenerative ecology** - the AARE lab during Bordersessions festival in The Hague. Much of our representation relies on environmental data.

The creek at Maajaam presented a perfect opportunity to refine some of the theoretical work we did in previous Random Forests labs by exploring the reality and complexity of the creek.
I started out by trying out a wide range of environmental observation. Figuring out how to engage creek as a whole.

Day 1: drawing

I started the first day with **drawing from observation**. Drawing is a fundamental activity in my life which I have been doing since early childhood. Of course it has a long tradition in both the visual arts and field biology as a means of investigation and observation. I'm immediately confronted with it limits in capturing the complexity of behaviour and the environmental dynamics of this creek.

How then to represent the creek holistically? Where does it begin, where does it end? How to represent its dynamic nature and how things relate?

The drawing tends to make me look either at individual organisms or at landscape level. At landscape level I notice the focus moves to the things that don't move: the relative distribution of plants. To include the animals in a way that shows their dynamic role in the area may include narrative structures made up of multiple drawings.

But even to draw animals you need them to be static for a prolonged period to be able to render them onto paper. These dragonflies move around way too fast, and so do the many creatures that skid around on the water surface, the flies, the butterflies, but really even the even plants move in the wind long before you can finish drawing them. I try to capture them in movement, but it is hard to really render the character of their movement in a way that communicates to other people.

In environment like this it is impossible to just sit in quite contemplation. Everything interacts with everything. All kinds of beings are contemplating you too. A multitude of biting insects swarms around the hot summer air and leeches suddenly start to swim confidently towards my ankles.

The drawing session raises questions of what defines a creek. Is it defined by the geographical distribution of flowing water? Is defined by the vegetation? Or also the animals, many of which appear also where there is no creek? Is it just the upper region of a much larger watershed. That is way beyond the perspective of my drawing session. All of these considerations start to form **a more precise un-understanding** of the creek. What are we studying when we are not studying an individual organism, or groups, or a geological feature. Where does one ecosystem begin and another one end?

Day 2: ecological sampling

The second day I focussed on the data-sampling strategies used in ecological fieldwork. I've had a few earlier attempts to try this out including a 2017 Transmediale workshop hosted in collaboration with behavioural ecologist Matthew Creasey of the University of Exeter in Cornwall. For that together we listed the some methods of studying animal behaviour used in ecological fieldwork that we thought might be interesting to explore with a multi-disciplinary group.

Ecological field-observation techniques:

Focal-Animal Sampling - record all of the actions of one individual for a specified time period.
Continuous Group Sampling - record all of the behaviours that occur while the group is being watched, e.g. preening, feeding, flying, displaying, and the time & duration of the behaviour.
Instantaneous Sampling - record the behaviour of an individual at predetermined time intervals.
Scan Sampling - record the behaviour of all group members at predetermined time intervals.
Sampling Occurrences of a Specific Behaviour - record each time a chosen behaviour is observed during a specified time period.

For this to work you need a set of behaviours that together form as complete a set as possible: an **ethogram**. I looked around on internet an found a good example from a guy called **Creighton Smith** who researches **Gorillas**. He explains how to build up a list of behaviours and describe them in a way that it makes sense for other researchers.

> *"Scientific language is best for this. It must also show differences with other similar behaviors in your ethogram. The reason for this is that when another group attempts to query your data for other reasons. Everyone is still on the same page. For instance a behavior such as biting must described specifically so it is not confused with gnawing or oral grooming.*
> *I have found through experience that each observation group should be responsible for creating an ethogram from scratch before comparing it with previous research. If the reports are to be compared, the ethograms need to match but simply handing a new group the old ethogram to work from creates continuity problems that can wind up wasting more time than just starting over. Your ethogram should appear in your final report as an appendix."*

For my session by the creek I simply copied some of the Gorilla behaviours that seemed like they might be relevant and added any as things started to happen. I rather arbitrarily chose the blue Damselflies because they seemed abundant and active, just as a practice run. The plan was to see how this works in practice. What its strengths and weaknesses are in terms of relating to the creek.

I decided to go with the first observation technique on the list: ***Focal Animal Sampling***: recording all of the actions of one individual for a specified time period. That seemed simple enough. But during the process I was listing the time of each behaviour, which means I was actually doing the one called ***Sampling Occurrences***.

Anyway it was completely impossible to keep track of the Damselfly when tacking notes. Also the time frame seemed to be useless, it was doing things much faster than I could write. And it was impossible to find them again after taking notes. The original Gorilla ethogram had a category (OoS) '***Out of Sight***'. That was the one I used the most. Also it was hard to interpret what the Damselfly was doing. Was it just sitting, or waiting for prey or holding its territory or something I have no intuition for as a human?

Sander Turnhout explains how these kinds of observations often means choosing, even for experts. Two damselflies could be mating, flying and holding their territory at the same time. Behaviour is seldom unambiguous. Animal, vegetable and digital beings are emergent phenomena, born from specific places. Studying them moves us towards a science less about analysis and more about relations. And towards appreciating intelligence in a much broader spectrum, not just the intelligence that looks like our own.

Is a machine training center in the **Great Barrier Reef** and the **Pacific Garbage Patch** in order, as an environmental meet-and-greet for AI-s? Do we give them the weekend of to wander around national parks? Will the **Amazon** algorithm appreciate the **Amazon**? And what if this actually determins the fate of the Amazon?

I guess my question is; **How wild will the bits be?**

During these days of observations at the creek rumours had gone round of **beavers living just down stream**. This needed closer investigation. In one of the barns we recovered an old children's rubberboad which needed repair, but could be a research vessel. After preparing it, I deployed it on the creek. It didn't really work, because to keep balance I had to basically lie down in the thing.

Timo and I decided to build an **observation raft**. To have a better view underwater this would be covered with fabric. He remembered having an old cover for a Russian jet-airplane lying around somewhere. It included a 5 sided piece which was the perfect size. We also gathered 10 old beer containers which could serve as floaters. This all pointed towards building a 5 sided raft. A ring basically where the investigator could sit and dangle her/his feed in the creek.

With some left over wood from the construction of the new Maajaam laboratory building we crafted the thing in two days, built a wooden walkway across the bog towards the **small lake** from which the creek emerges and put the raft in the water. It was absolutely brilliant. On the silent lake - where for many years nobody had come, or even remembered what it looked like - the raft drifted gently on the lightest breeze moving across the water plants.

During the festival in the closing weekend of the residency I hosted visitors in small groups. With our feet moving through the water-lilies we discussed nature in Estonia, all kinds of creatures, and some of my Random Forests questions. Many visitors were lenvironmental scientists and policymakers at local or national level. There were also musicians, garden-architects and the director of a wood-factory who recognised the wood of our raft as coming from his factory. For several children it was their first time on a boat or raft. We drifted gently between the damselflies, lilies and the occasional jumping fish.

TERRA FICTION

FIBER lead lab @ Waag Society
28/09/2018
by: Pippa Goldschmidt, Tivon Rice, Klaas Kuitenbrouwer & Sjef van Gaalen

The Terra Fiction Lab focusses on the narrative development of a new 21st-century eco-society, and leads to a small collection of written or visualized speculative short stories in collaboration with The New Institute.

How will future environments function and what will they look like? What new links can be envisioned between human, technology and ecology on earth or in outer space?

In two days participants create narratives (short stories, prototypes or short videos) that give access to a world where new relationships between landscape, space, technology and humans are envisioned. The aim is to imagine existence in a postcapitalist world with an economic system that is not based on exploitation and extractivist practices: a 21st-century society that will be less human-centered with organisms, landscapes, machines emancipated alongside humans, on earth or elsewhere. ;Worlds where ecologies are regenerated by new alliances between humans and plants. How does such a world look? What kind of stories and imageries can help us envision such a world?

In this lab FIBER employs the practice of Worldbuilding, a narrative technique that comes from Science Fiction writing and Transmedia storytelling.

TERRA FICTIONS

BY MAJA KUZMANOVIC & NIK GAFFNEY

So here we are, in the year 2018 (of the Common Era), Year 35 (Earth Dog) of Cycle 78 (for the Chinese), Heisei 30 (for the Japanese),1440 (if you are Islamic), 5779 (in the Hebrew calendar), 2562 (for the Buddhists), 5119 of Kali Yuga (according to the Hindus) and 3184 (for the Discordians). If you are using the Earth's geological calendar we are leaving the Holocene epoch. We are now at the beginning of the Anthropocene.

Here is a city, enfolded in the long, slow temporality of the desert. The experiential time of spiders, snakes and cacti. For long periods nothing at all happens, then suddenly the city bursts into ecstatic action, like desert blossoms after a rain. This city is accustomed to oscillations of time and resources. Its once insatiable economic growth is gradually superseded by an atmosphere-based economy. The city does not shy away from its own shadow. The shadows of dust storms, water shortages, gun-slinging individualism, heat delirium and venomous critters. The shadows hiding in the fickleness of the desert and its inhospitable heart. This is a place that seeks out shade and shadows. Multi-trunked mesquite marquees diffuse light across outdoor kitchens and intimate courtyards. Solar-powered screens radiate the shadow forecast and a cooling breeze. Shade architecture, shaded transport, sheltered time. A cityscape layered with a latticework of porches, verandas, galleries, awnings, canopies, umbrellas, trees and pergolas...

–Dust and Shadow Fieldnotes #2

On the other side of the planet, a different pergola...

A permeable edge, a transition, an archway. Under the pergola light and shadow overlap, wiggling, shimmering. Sunlight is softened with shades of shadow. An uninterrupted flow between inner and outer landscapes. A queer ecology of inception and subsiding. A temporary refuge committed to the gradual dissolution of its boundaries. A place with an expiration date. A symbiotic zone, porous and promiscuous. Porous to the point of becoming ephemeral. Conviviality emerges effortlessly under the shade of a pergola. A graduated sense of closeness that includes those at a distance and those that hide in plain sight. The conversations are entangled with the sound of growing plants, crackling wood, expanding rocks, crawling insects, and the invisible signals emanating from all-pervasive digital devices. Resonant, animated matter. Divergent voices signalling, interpreting and misinterpreting. Out there (right here) beyond human perception, rocks flow fluidlike and dust speaks to dew, voices trailing in the wind, barely heard...

–An Ephemeral Garden

Across the continent, a tiny island in a vast archipelago...

It seems serene and benign yet harbours hidden disturbances, spectral hostilities. Plagues of ticks and microplastics overlaid with psychic memories of the oppressed and abandoned. Environmental anomalies hover on the edges of perception, cunningly invasive even to a casual visitor. The sea is sparsely populated, biodiversity dwindling, beset with its own ecological ghosts of oceans past. The island bides in silence, weathering the changing weather. The landscape is always on its way to becoming something else, without resistance. Things come, interfere and move on. Sail away, disappear or die out. Other things remain, as ambivalent hosts or liminal lingerings. Real but not necessarily physical, real but not always measurable. Whether invaded by crabs, humans or ticks, the island continues its slow and steady rise above the shallow waters, unperturbed...

–Spectres in Change, Fieldnotes #1

Beneath and between it all, the noise of life unfolding. A thick, almost viscous silence. The rich texture of being present in the world. Within this state of alert yet receptive presence, abstract data become tactile sensations, beckoning rather than elucidating. Noticing becomes a re-animating force, an act of caring...

Spaces of care

To care, to cure, to comfort. To be with. To help cope, regardless of the situation. "*Being with*" involves allowing yourself to be touched by the joys and sorrows of another. To be touched by external circumstances, or as the Dutch so eloquently say, to be "*ontroerd*". Thrown off-course by the sheer rawness of the moment, by your own inability to make things better, by our fragility, impermanence and mortality.

We learn to "*be with*" when looking after a sick child, tending to a garden, or when caring for the dying. "*Being with*" a person or a process that you can't quite understand can be frightening and uncomfortable, yet it can also become an instrument for discernment, a compass for navigating ambivalence. Care first, do later.

The work of care in the Anthropocene is a struggle with scale and scope and sentience. What does care for a dying forest look like? For an unstoppable flood? For the endless migration of humans and other animals? For an out of balance microbiome in one's gut? If we assume that the entire material bestiary has some form of sentience, how do we respond to climate change, mass extinction or speciation? Even if we are not directly responsible for the causes, each of us is responsible for how we live with the consequences. Responsible to and for each other.

Do you care? How do you care? Where do you learn how to care? How can you care for something able to consume you completely?

The space of care exists in parallel to the space of "*problems*" and "*solutions*". Underneath the litany of blame and judgement. Beneath social systems and ecosystems. Beneath worldviews and opinions. Deep, deep down in a place where words and worlds are intertwined. Where myths and metaphors grow from the direct experience of entangled relationships. Transferred through a touch, a broken bone, a bedtime story.

The patterns of care solidify through repetition. From thoughts to words, from words to actions, from actions to habits and from habits to character. From a person to a clan to a culture. This process takes time. An instant in geological time, generations in human time.

Maybe in order to care across spatial and temporal scales—to care for a loved one as much as for an eroding hill or decaying infrastructure—we need alternatives to the current cultural imaginaries. They need queering and complexifying. We need

new stories to live by. New or alternative myths, drawn from ever more diverse mythologies.

Broadening imaginaries

What if we begin by broadening the spectrum of biological and geological metaphors we use for human behaviour? Aggression, for example is often justified by our origins as primates. Supremacy and selfishness by the survival of the fittest. Hierarchies because we share a common ancestor with lobsters. If these are seen as appropriate metaphors, what are some inappropriate ones? Metaphors and stories that spark a wider range of imaginaries.

For example, we also share common ancestors with cephalopods, fungi and micro-organisms. We could broaden gender discussions with the 36,000 sexes of fungi, or hermaphroditic snails, or fish that can change sex. We could develop non-verbal communication inspired by octopuses, who can change the colour, shape and texture of their skin. Their distributed nervous system could become a metaphor for the human exo-nervous system, as it extends through networks of connected devices.

For resilience and anti-fragility in hostile environments, think of the Endoliths – organisms that can live inside rocks, crevices of animal shells or the pores between grains of minerals, filling ever more extreme niches. They can live many kilometres beneath the Earth's surface, surviving without water, feeding on iron, sulphur and other inorganic material. Alongside the superheroes from Wakanda, The Invisibles or The Anachronauts, could the Deinococcus radiodurans become an archetypal hero of our times? "*The world's toughest bacterium*" able to survive radiation, cold, dehydration, vacuum and acid. Imagine our bodies with such bacteria living on our skin.

What we consider our "selves" are already shared spaces, colonised by symbiotic bacteria. Our bodies survive on mutualism. Approximately 2% of the human body consists of micro-organisms. By weight, equivalent to the brain. We contain roughly the same amount of microbes as non-microbial cells. Our life depends on interspecies co-operation and yet we usually fail to engage with our symbionts as collaborators. What if IBS was treated as an unfortunate miscommunication between the nervous system and gut flora? Food becomes a communicative medium, modulated by embodied mindstates. Each meal a story to tell, with stress and fermentable sugars as its main protagonists.

There are beings that thrive in our bodies, while others thrive in our wake, in exclusion zones like Chernobyl or abandoned mines. There are now sparrows in the old mining towns of Broken Hill and Mount Isa that have evolved to avoid lead poisoning. There are plastic eating bacteria and extremophiles living on industrial waste. Evolution responds to a changing environment, accelerating in step with anthropogenic change.
The flip-side of mass extinction are the stories of contemporary speciation. New zlineages, new hybrids, new species and migrants better adapted to changing conditions on Earth. It's humbling and perhaps heartwarming to realise that whatever happens to humankind, life on Earth will continue, in yet unknown, unknowable forms. At the same time, it is eviscerating to contemplate the possibility of human extinction. It's hard to comprehend the loss of a single life, let alone the loss of entire species, the loss of everyone and everything you have ever known.

All macroscopic matter copes with some form of erosion, senescence or entropy. Mortal coils inevitably unwinding, over days, decades, millennia or aeons. Perhaps we'll become extinct, perhaps we'll continue our process of speciation. Or perhaps we'll thrive in technologically sustained human refugia. In secluded monastic habitats and libraries of human life on Earth. Places where the biomass of terrafiction accumulates, growing as its spills over into books and libraries and literatures, gradually becoming an ambient literacy of human co-existence with the planet.

Terraforming

And yet, how to resist the impulse to leave it all behind and start again, somewhere else in the universe? To leave the planetary cradle, to explore, to renew, to terraform.

We don't need to leave earth to see the effects of human terraforming. Think of the Dutch polders. Or Singapore. Or Stalin's Great Plan for the Transformation of Nature. Every road and dyke, every chocolate factory, every farm and piece of recycled aluminium. To get a sense of how much humans have shaped the Earth, the mass of the human technosphere is an order of magnitude larger than the mass of all plant life. The infrastructure that supports our contemporary lifestyles and the waste it produces is estimated at about 30 trillion tons of carbon, or 30,000 gigatonnes. In contrast, plants make up the largest percentage of earth's biomass, estimated at about 450 gigatonnes of carbon. For further comparison, the biomass of all living humans make up a mere 0.6 gigatonnes of carbon, roughly equivalent to about 6 million whales.

Terraformation. Shaping earth, or making of soil. Terraforming as composting and gardening rather than planet-wide engineering. In this sense humans have been terraforming Earth for millennia. Making the planet more hospitable to humankind, making soil to grow food. Terra preta in the Amazon Basin, for example, a fertile anthropogenic soil made over centuries by composting charcoal, bone and manure. Or the rice terraces of Bali that are kept productive by generations of priests and farmers, who encode their irrigation plans in calendars of ceremonial observances. A convoluted enfolding of culture and nature.

Terraforming. Making places habitable by humans. It's a process of cultivating somewhere to live. A shelter to keep the monsters at bay, to keep us safe in hostile environments. In improbable places on Earth and beyond. Terraformers are home-makers, the housewives of the stars.

Beyond Earth (diaspora, decolonisation...)

Before terraforming other planets, humans have to be able to leave Earth. How will we leave our ancestral home? Like rebellious teenagers, curious explorers or frightened refugees? How we leave matters as much as where we go. Why we travel to the stars matters. Our intentions, attitudes and habits matter. These are the seeds of the human diaspora.

Think of the deep scars that Earth-bound colonisation has left. If humans are capable of such inhumane treatment of humans, what will happen as we spread through the solar system? As we encounter beings that we can barely comprehend as alive...

Why wouldn't cosmonaut training include a crash-course in post-human animism and panpsychism? Wouldn't the new space travellers need to meditate on the nature of 'the void' to make it across the darkness between stars? Alongside technological and scientific skills, the pioneers could be drilled in mythic cultural imaginaries, ethically convoluted games, psychological endurance, and a wide spectrum of speculative literature.

There are many stories from many cultures about making other places habitable. They all point to different approaches to being human on and beyond Earth. They tell us about the speciation of humankind, shaped by their new environments. Desert cultures on Mars. Atmospheric cultures on Venus. The thalient inhabitants of Ventus. Living with our ancestors among the stars. Civilisations as stars. While humans might set out to terraform other planets, we will inevitably be shaped by them in return.

Terraforming internal landscapes

For now though, not just our technologies but also our cultural capacities are inadequate for the task of successfully terraforming another planet. Many aspects of our cultures are still tainted with anthropocentrism and xenophobia. So how do we imagine surviving in a place where the very ground under our feet is alien?

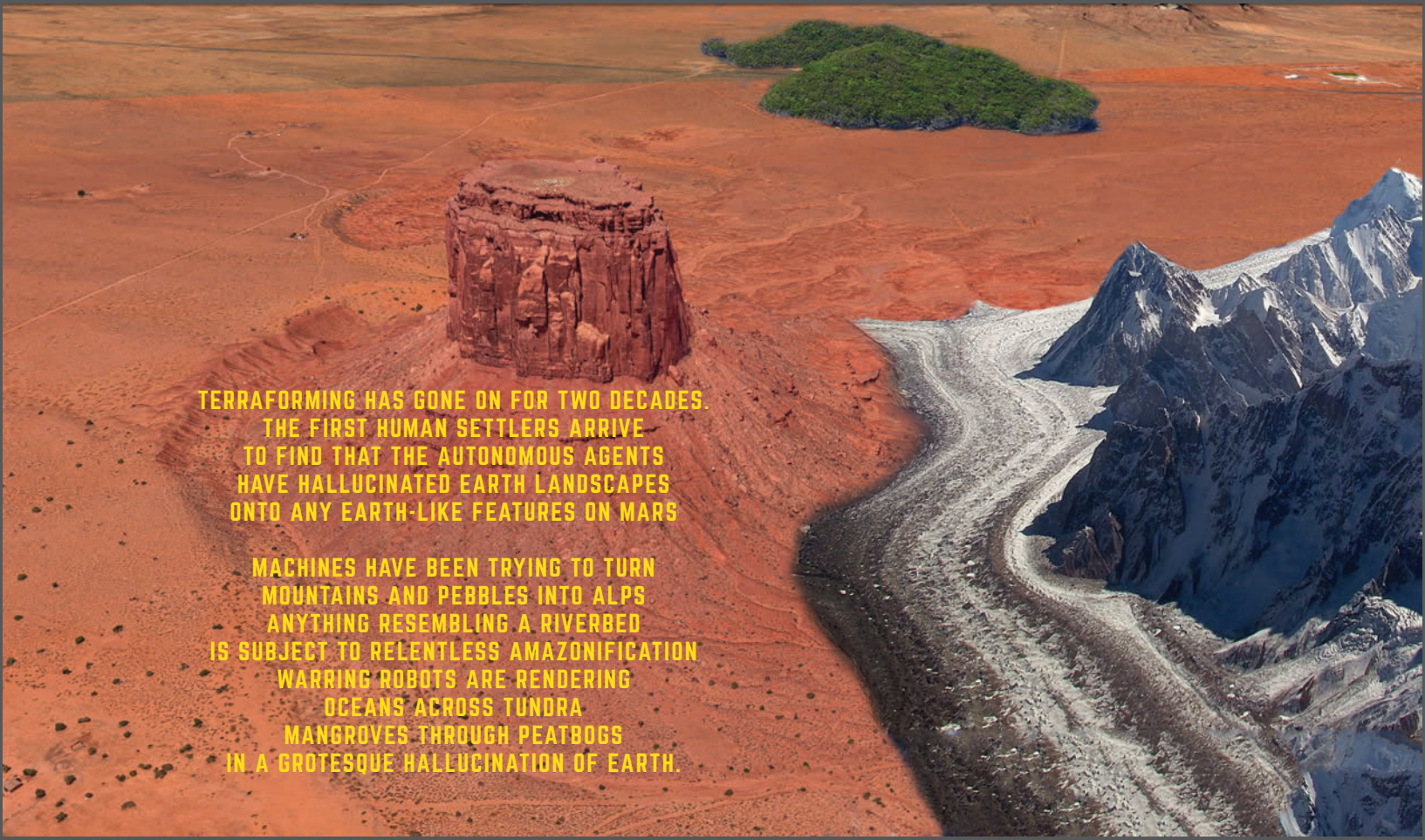
Perhaps the most urgent terraforming required is that of our internal landscapes. Widening the reach of the human sensorium. Channeling emotional storms and the inner weather. Cultivating the imagination. Tending to the larval formation of thoughts. Exploring the depths through introspection and meditation. Transforming reactions into responses. Activating the unknown with the help of psychedelics. Entangling our grey matter with seeing machines. Finding ways of embodying others' mindstates. Rewiring our neural pathways with cognitive therapies or biotech.

Until we stop taking ourselves so seriously (or not seriously enough). Until our individual identities are shattered and smeared and re-congealed innumerable times. Until we understand that we exist because of and despite relating to everything else. Until we understand that we are hydrogen ripped from its context, mixed with the dust of dead stars. That we are endlessly recycled water and crystalising cyclones. That we are teeming civilisational hosts. Most importantly, that we are capable of care. To care for humans and to care for the earth. To care for the earth without humans and for humans without the earth.

To take heed from the Overstory. *"Keep still. Wait. Something in the lone survivor knows that even the ironclad law of Now can be outlasted. There's work to do. Star-work, but earthbound all the same."*

Further reading

- Octavia Butler. The Xenogenesis Trilogy
- Italo Calvino. Cosmicomics
- Greg Egan. Diaspora
- Donna Haraway. Staying with the Trouble
- N.K. Jemisin. The Broken Earth Trilogy
- J. Stephen Lansing. Priests and Programmers
- Ursula K. Leguin. The Hainish Cycle
- Alphonso Lingis. The Imperative
- Cixin Liu. The Remembrance of Earth's Past Trilogy
- Tim Morton. Humankind
- Nnedi Okorafor. The Binti Series
- Richard Powers. The Overstory
- Martin Shaw. A Branch from the Lightning Tree
- Kim Stanley Robinson. The Mars Trilogy, 2312
- Karl Schroeder. Ventus
- Olaf Stapledon. Star Maker
- Isabelle Stengers. Reclaiming Animism
- Neal Stephenson. Anathem
- Anna Lowenhaupt Tsing. The Mushroom at the End of the World
- Gordon White. Star.Ships
- E.J. Michael Witzel. The Origins of the World's Mythologies
- Ed Yong. I Contain Multitudes
- Lidia Yuknavitch. The Book of Joan


TERRAFORMING HAS GONE ON FOR TWO DECADES.
THE FIRST HUMAN SETTLERS ARRIVE
TO FIND THAT THE AUTONOMOUS AGENTS
HAVE HALLUCINATED EARTH LANDSCAPES
ONTO ANY EARTH-LIKE FEATURES ON MARS
MACHINES HAVE BEEN TRYING TO TURN
MOUNTAINS AND PEBBLES INTO ALPS
ANYTHING RESEMBLING A RIVERBED
IS SUBJECT TO RELENTLESS AMAZONIFICATION
WARRING ROBOTS ARE RENDERING
OCEANS ACROSS TUNDRA
MANGROVES THROUGH PEATBOGS
IN A GROTESQUE HALLUCINATION OF EARTH.


OFF
WORLD

EQUINIX AM3 WALK

Random Forests walk @ Sciencepark
Amsterdam October 15/2018

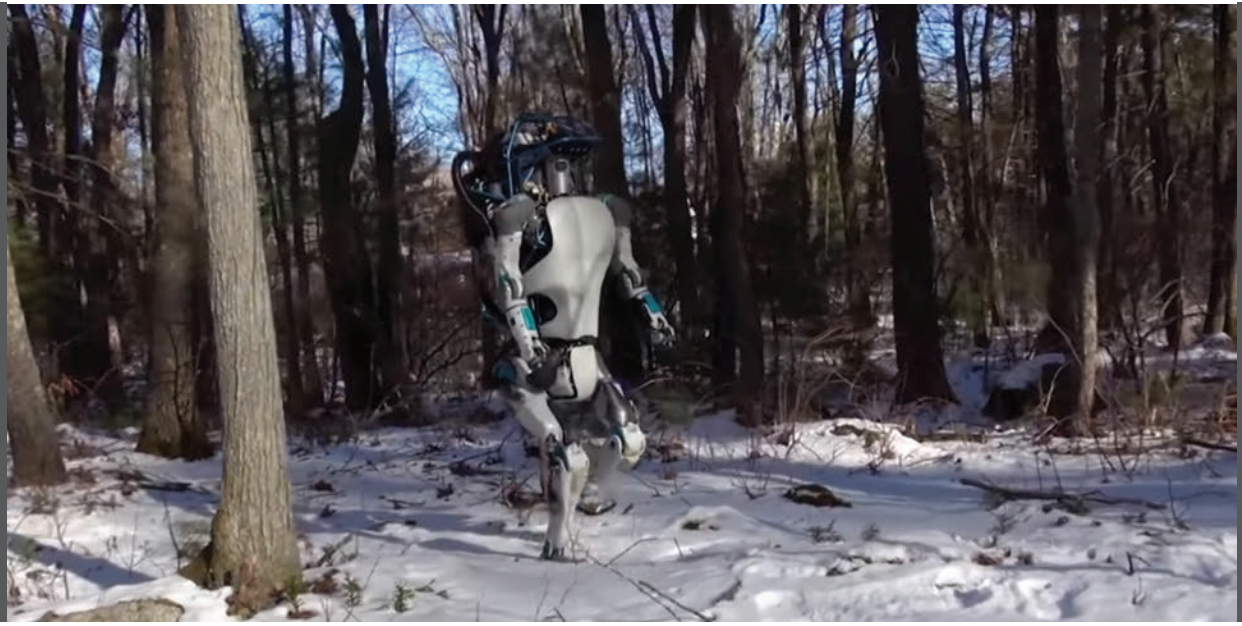
with: Arita Baaijens, Theun Karelse

Algorithms are an emerging physical force in the environment. In this nature walk we'll visit Amsterdam's newest data-centre the Equinox AM3. This architecture is not primarily for humans but for data transfer. It has been built at Sciencepark just next to the Institute for Biodiversity and Ecosystem Dynamics (IBED) department of the University of Amsterdam. In a way Sciencepark is a great metaphor for an area that now hosts these two institutes. This is a park that acts as an environment for data and facilitates the understanding of environmental data.

The Equinix AM3 walk is part of Paradijs in the Polder a programme by Arita Baaijens.

Sajji a Paniya tribal man who is part of the Green Phoenix programme at the Gurukula Botanical Sancturay in the last remnants of rainforest in Kerala India. He explains how he notices visitors to the forest - people from the city or abroad - don't know how to walk in the forest. This is not so much the way they place their feet, or keep their balance, but he says:

THEY WALK LIKE NOTHING IS AROUND THEM



The Boston Dynamics Atlas robot out for a stroll.

Interview with Semuel Sahureka about the indigenous environmental code of conduct called: SASI

Interview with Marinus van Dijke about environmental literacy and his decades long artistic study of a dune landscape.

COULD MACHINES LEARN FROM ANIMALS DIRECTLY

IAN INGRAM
AT ZONE2SOURCE

1769.
Year
elborne).

	Place. Soil.	Therm[r]	Barom[r]	Wind	Inches of Rain or Sn. Size of Hail-st.	Weather.	Trees first in leaf.—Fungi first appeared.	Plants first in flower: Mosses vegetate.	Birds and Insects first appear, or disappear.	Observations with regard to fish, and other animals.	Miscellaneous Observations, and Memorandums.
28.	Sunday 8 12 4 8	56.	29 3/10.	S.W.		Brisk air. clouds.					No chaffers appear at all.
29.	Monday. 8 12 4 8	56.	29 4/10.	W. S. W.		Showers. hail. vast clouds.					Began to tack the vines: much shews for bloom. Melons begin to set. Thunder at a distance.
30.	Tuesday. 8 12 4 8	55.	29 4/10	S.E. E.		Sup: clouds. rain.			Apis longicornis.		
31.	Wednes. 8 12 4 8	57.	29 3/10	W.		Showers.					
ne 1.	Thurs. 8 12 4 8	56½	29 4/10	S:		rain. brisk wind.					
2.	Friday. 8 12 4 8	55.	29½ 3/10	W.		Fine day.			Scarabæus auratus.		Showers about.
3.	Saturday. 8 12 4 8	58.	29½ 3/10.	S. W.		Great showers fine.					Saw the planet Venus enter the disk of the sun. Just as the sun was setting the spot was very visible to the naked eye. Nightingale sings; wood-owl hoots: fern-owl chatters.

The Habits of Vipers and the Love Interest Supplied by Frogs

Gilbert White and the origin of environmental literacy
by Wilfried Hou Je Bek

Stuffed deer and robotic owls with camera eyes stream their footage to an omniscient intelligence, abstract and unfathomable, with a mind of its own, psyched out on scorpion oil. Trackers are leaving cookies on the forest floor as if this is just another German fairy tale of chance and fear in the Hercynian woods. ID hashes and GPS coordinates are uploaded every second by anonymous wizards to unmarked data centers. The AI is the hunter and you are the prey. Why? To know at all times what ads and what conspiracy videos you might want to click on next with the highest probability. You are on the game theory bandwagon and the equilibrium is against you. Who talks about the lady in the lake when the lake is filled with aggregated data handily formatted in JSON? Who worries about the witch in the woods when the woods are just a bunch of randomly grown trees parseable with TenserFlow? Who needs serpents when there is Python? Who needs decisions when everything has already been decided? Don't be evil, we will do it for you. What is now missing is a Cambridge Analytica for the forest, a psychoherbaric analytic front, a Bayesian black op to make the rabbits align themselves with the interest of the foxes, soft persuasion through knowledge derived from data mining the practice of the wild.

Men like John Ray and Carl Linnaeus reformulated naturalism as a science by creating theoretical frameworks that created the need to collect data and a conceptual impetus for the orderly pursuit of it. Data is a modern word that only received its common meaning in the ninetysixties but it was in the eighteenth century that the ground-work for data science was laid. If we take the 126.694 GitHub results for 'machine learning' (October 2018) as the end of the story than Gilbert White and his social network is at the beginning. White (1720-1793) was in many ways typical for a breed of man of which Edward Casaubon is the most enlightening and Charles Darwin the most famous: the English clergyman whose quiet and regulated life gave him the leisure to pursue his scholarly interests. Richard Mabey describes White as petty gentry who preferred gardening to his religious duties but needed the job to make ends meet. After his rumperstumper years at Oxford he went back to Selborne, his native village in the South of England, to live a happy little life in perfect harmony with the rhythms of the seasons, observing the natural world with the same obsession as a punter at the bookies evaluates the racing papers.

The reputation of White is based on the 'The Natural History and Antiquities of Selborne' first published in 1789. It is a collection of letters, a few written especially for the book, in which he "shaped our everyday view of the relations between man and nature... because of the sense he gives of birds and animals as living things sharing a living situation with each other and with man" as the Penguin blurb has it. It has never been out of print and it remains the single point of origin for a specific kind of amateur naturalism. In all its droll but charming naivety White somehow managed to be pioneering the modern science of ecology. His correspondence is only the process, at the heart of the White project sits his lifelong dedication to the harvesting of data. Starting in 1751 he worked for almost 20 years on keeping his Garden-Kalender, an attempt to create a locally specific record of the flowering of (food) plants in the hope of gaining enough understanding to improve agriculture by making it, in the language of BI, data driven and data informed. From 1768 to the end of his life he would log over 70.000 observations in his Journal. In these efforts White had clear models. The idea of a Garden Kalendar was based on the well read work of Benjamin Stillingfleet who in turned based himself on the work of Alexander Berger, a Swedish who studies with Linnaeus. At home there was his brother-in-law Thomas Barker who meticulously collected records of the weather for over 70 years, data that is still used as a source for climatological study.

Two other important influences that spurred on White to compile his Selborne data into a book were the men he directed his letters to. The first was Thomas Pennant, a writer on zoology who send out

printed 'queries' to his network of human databases across the world to left join data on those topics his next, often bestselling, book happened to be about. The second of White's correspondents was Daines Barrington, a polymath barrister who in 1767 published The Naturalist's Journal, a printed ledger with a page for every week with ten columns for every day in which the naturalist could record weather conditions and observed events in a structured manner for future analytical ease. Paul G.M. Foster, who wrote a book on White's data, observed that people trained in law were perfectly suited to see the value of big data before many other disciplines did. In law one does not work from theory but by evaluating and corroborating eyewitness accounts. Only when done collecting all the facts can an impartial narrator, a judge, recreate the most likely unfolding of a past event and reach a verdict. Barrington's own words about the rationale of his Journal, a first step on the road to machine readability, sounds strikingly modern, like a man who has seen the potential for money-balling the secrets of nature:

"*...it may also be proper to take notice of the common prognostics of the weather from animals, plants, or hygroscopes, and compare them afterwards with the table of the weather, from which it may be perceived how far such prognostics can be relied upon... Many other particulars will daily offer themselves to the observer, when his attention to such points hath once become habitual, and from many such journals kept in different parts of the kingdom, perhaps the very best and accurate materials for a General Natural History of Great Britain may in time be expected, as well as many profitable improvements and discoveries in agriculture.*"

White's influence as a pioneer of nature studies is undisputed. Nature conservation, Birdwatching, data repositories like waarneming.nl, the literary genre of nature writing, when they look back, all end up with Gilbert White as a precursor. But while White has status he has little authority. There is a Midsomer Murderesque homeliness, a Woodehousian brio to his rambling prose that continues to inspire his readers to action. His one-liners ("The language of birds is very ancient, and, like other ancient modes of speech, very elliptical; little is said, but much is meant and understood") can be memorable, his anecdotes ("I forgot to mention in my last letter (and had not room to insert in the former) that the male moose, in rutting time, swims from island to island, in the lakes and rivers of North America, in pursuit of the females. My friend, the chaplain, saw one killed in the water as it was on that errand in the river St. Lawrence: it was a monstrous beast, he told me; but he did not take the dimensions") remain quotable. At other times his writing is nearly unreadable and written from such a distant perspective that it has become as alien to us as the fashion of the nineteenseventies. His focus on the unusual makes White's data pointless and the artificial intelligences trying to make sense of his data keep breaking down in tears.

One way of framing White's legacy has been by pointing out that, with his persistent allusions to writers like Shakespeare, Milton and Virgil, he brought his readers to the viewpoint that 1) everything that classic drama has to offer is reenacted on a daily basis in every forest and backyard across the world 2) no village is small enough to contribute to the knowledge of the world. Virginia Woolf, in 1939, read it slightly different and saw White as the village gossip, sharing the badly kept secrets of the habits and sexuality of frogs and the obesity of the church mouse: "nothing can exceed the minuteness of these observations, or the scrupulous care with which they are conducted". In White she saw foresaw a practice in which data becomes its own art form, a method of expression in which one loses self-consciousness and becomes a what? A machine? A conduit for the streams of consciousness that so define her own work? A recording device to power the AI? It is fitting for a novelist to see a story beneath a fact and the story of the scorpion and the frog comes to mind. The scorpion offers to carry the frog across the river. The frog knows the scorpion will sting it before they reach the other side, even though it goes against the scorpion's own interest. Yet the frog sits itself on the scorpion's back and they both drown. The narrative need of the story is stronger than the common sense of the frog, the logic of the story needs to be obeyed despite everything, and so the frog gives its life so we may benefit from the morale. Woolf notes something else about White: the nastiness of the conservativeness hidden behind the veneer of his farcical eccentricity. At the center of White's work sits a degenerate and entitled egotism that is blind to the injustices that do not concern himself personally.

SPOTTER #BIRDS AMSTELPARK

Erwin Driessens
& Maria Verstappen

When envisioning an artificial bird-spotter - which observes its environment from a fixed position and consequently forms an image based on its impressions - you could imagine all kinds of characteristics and behaviours that are involved or could be involved. You might think in terms of 'waiting', 'searching', 'recognising', 'looking', 'aiming', 'moving', 'predicting', 'remembering', 'imagining' et cetera. These are things we humans do routinely and without effort. Things we are not even aware of doing. Once you decide to create an artificial bird-spotter, none of this can be done routinely or effortlessly. The system must be able to deal with the reality of its environment and of course this environment turns out to be more complex and unpredictable than one might anticipate.

The lab environment where the robot was initially developed, is a rather monotonous and predictable context. The lighting conditions are uniform, there is not a lot that moves and certainly no birds! A potted plant moving in the wind of a ventilator was perhaps the most complex stimulus the robot encountered. All in all a rather poor setting for a bird-spotter... Leaving the studio was therefore an exiting and much needed step towards finding a richer territory. We've been able to set up the bird-spotter for a two month period at the Glazen Huis in the middle of Amstelpark to further develop the system. Artificial stimuli were no longer required. Entire trees were now moving in the wind before the camera-eye, the sun casted different shadows, reflections moved across the windows, joggers passed by, elderly citizens with rollators, dogs, cats, rabbits, magpies, raindrops slipping down the window... But very few blackbirds and that happened to be exactly the bird which the machine had been tuned to be the most susceptible to. The blackbird is the most common bird in the Netherlands so it seemed a practical practical choice as the target for the spotter to look out for. Its neural networks were trained with thousands of photographs of blackbirds, mostly harvested from the web and some made by us specifically. The apples that we occasionally put outside the Glazen Huis made crows and magpies pay regular visits. Because crows are somewhat similar to blackbirds, some became a target, so clearly the spotters reactions were triggered by more than just movement.

the neural networks dreaming

At first the robot showed primitive reactions to anything that moved: aiming the camera, trying to zoom in as quickly as possible and taking a photo. This resulted almost always in images where the target had already left the scene. Leaves moving in the wind would capture its attention and a large almost black shadow-patch on the lawn would periodically generate great enthusiasm in the neural networks. From day one the spotter took pictures of anything that moved in the park, usually between a thousand to two thousand pictures per day. After a while we started to realise this could actually be very useful data. There was all kinds of stuff. Magpies, crows, leaves, people, bikes, dogs, shadows, fallen leaves, reflections, lawnmowers, rollators, balls, habits, insects on the window, to much to list. The bigger the collection of images the more valuable they became: neural networks benefit from different angles of a subject to be able to model and classify them.

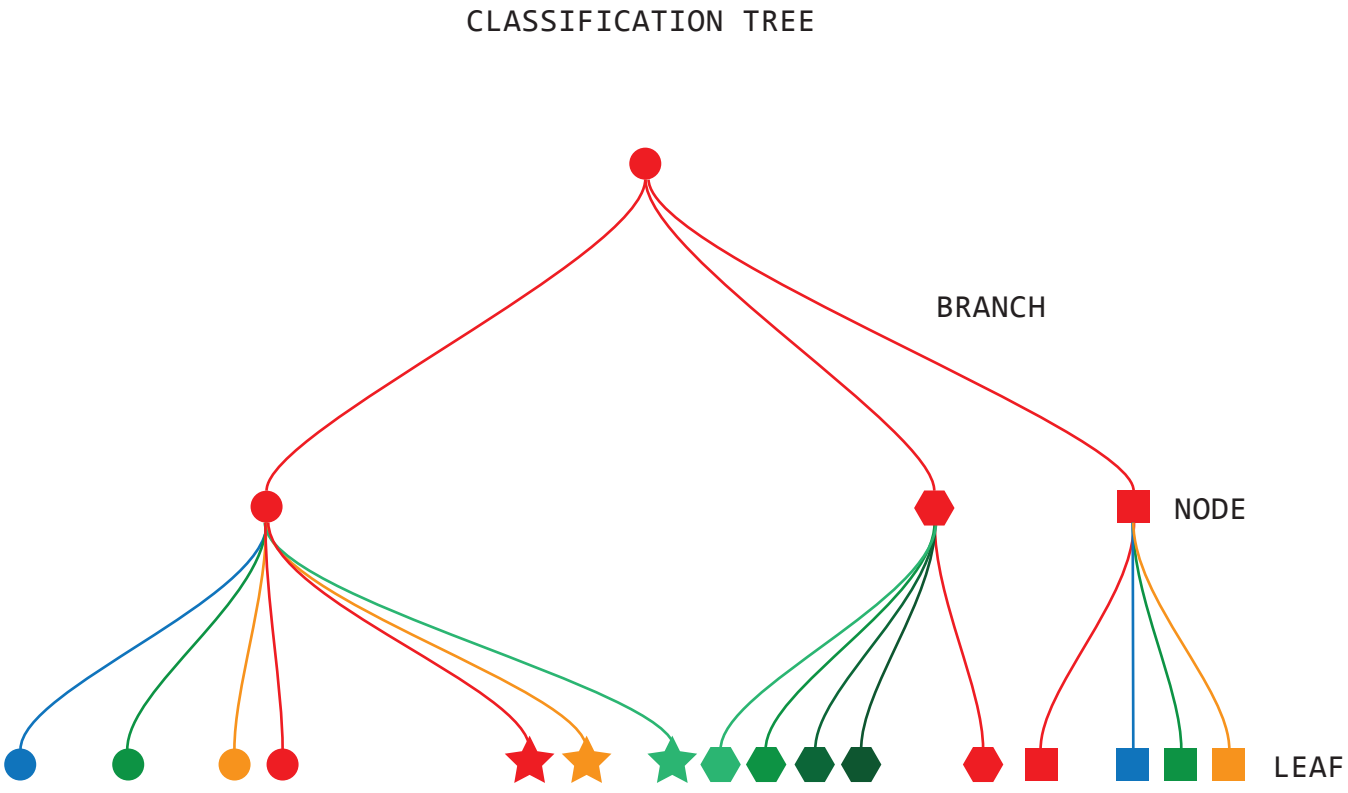
At some point we switched the blackbird/non-blackbird training process from the prepared set of images to a more differentiated training based on the set of photographs the spotter was making itself. This enabled to discern a wider variety of things: initially this included bird/human/leaves/other and later on bird was extended into crow/magpie/blackbird/pigeon/rabbit.

By then the manoeuvring of the camera had become more developed, to the extent that the robot would try to keep the found subject within the frame, slowly zoom in on it and take pictures regularly during the process. Feedback from the subject-recognition system gave the spotter a more selective curiosity. A moving leaf of dog on a leash would still be noticed but not photographed. Better to wait for a bird! With the increase of bird spottings the envisioning of what a bird might be also became more refined. The image-producing network was now being fed with more and more detailed input, learning about 'real' local birds in stead of generic examples from the web.

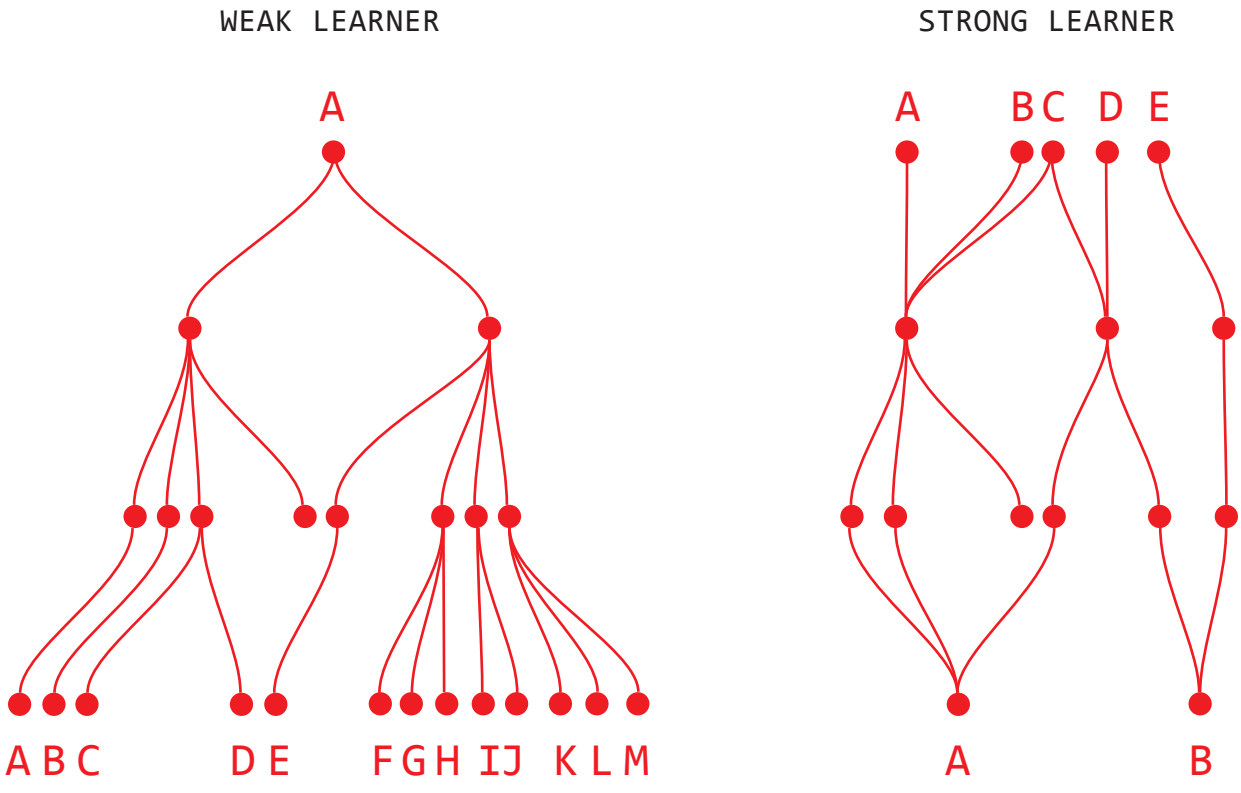
In a way the bird-spotter has become more and more autonomous during its development. It would be interesting to continue this direction, especially where it frees itself from the intentions of its human creators and decides on its own what it finds interesting or not.

the set-up at Zone2Source
in Amstelpark 2018

FOREST GUIDE


CLASSIFICATION TREE
BRANCH
NODE
LEAF


TRAINING DATA
OUTCOMES


WEAK LEARNER
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STRONG LEARNER
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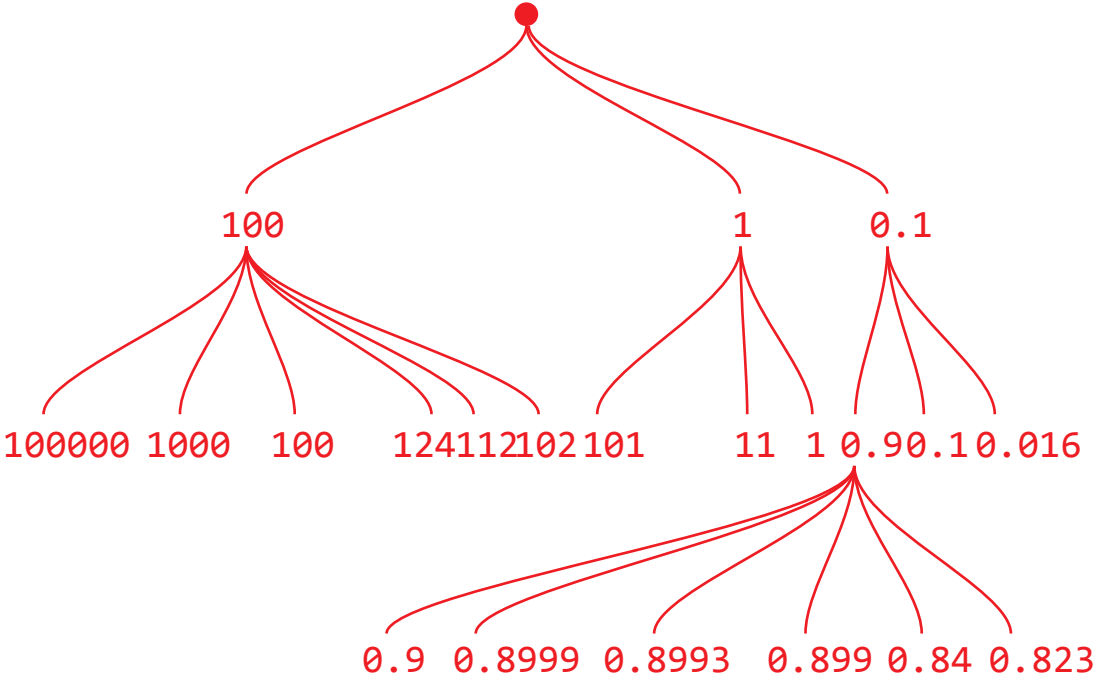
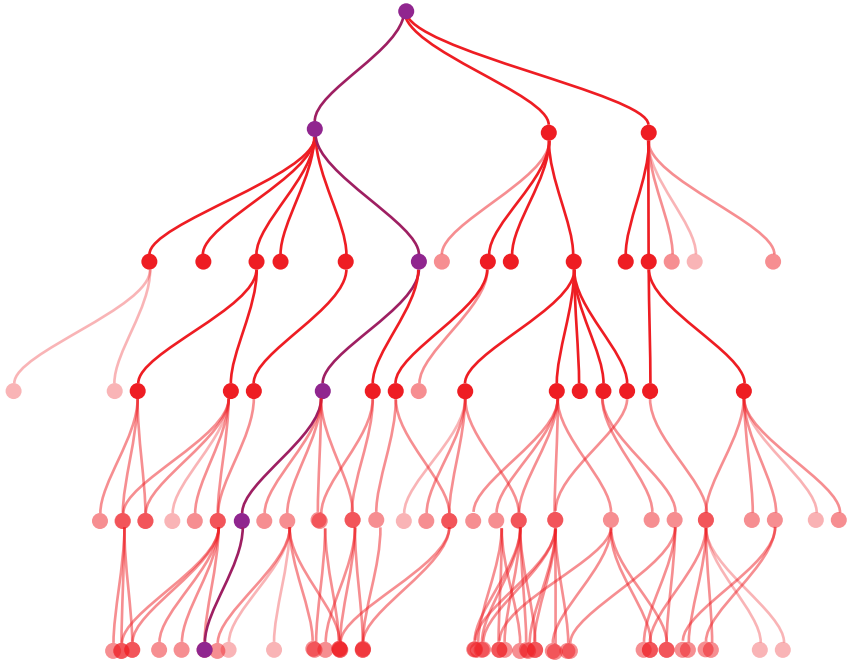
OVERFITTING



RANDOM FOREST



RANDOM FORESTS

a glossary of terms

AARE or ***autonomous agents for regenerative ecologies*** is the title of a public lab during Random Forests in collaboration with Klaas Kuitenbrouwer (het Nieuwe Instituut) and Sjef van Gaalen (Structure and Narrative) which explored if landscapes could engage in self-regeneration autonomously by forming alliances with technological systems as a means to find out what such systems might entail.

adaptation evolutionary response to a particular often new environment within a species or neural network architectures.

adaptive radiation occurs in nature where conditions appear to favour unusually high rates of speciation, like oceanic archipelagos in ecology, in synthetic agents favourable conditions may include long term research programmes, stable platforms and budgets.

age of loneliness or ***Eremozoic Era*** is a term proposed by E.O. Wilson for the emerging period of mass extinction. Based on this thinking our technological heritage since the Industrial Revolution has been dominated by technologies of loneliness.
see also: technologies of loneliness

agent architecture in computer science is a blueprint for software agents and intelligent control systems, depicting the arrangement of components, within Random Forests this includes how it senses and/or relates to its local environment, including populations of biologial organisms and semiosphere.

agent evolvability evolvability concerns the different rates of evolutionary change in any system - a ecosystem or culture - that has evolvable characteristics. For example: human tool-use evolves faster than human physiology. agent evolvability concerns autonomous agents which speciate and evolve even faster than tools developed exclusively by humans.

allometry size related differences in behaviour or life cycle events, for example battery size and weight are a well-known limiting factors to robotic behaviour.
see also: computational overhang

animal as platform the organism seen as a base for added functionalities.
for platform as animal see: algorithmic companion species

animal cultures the assertion that some animals have cultural frameworks within which they operate and can be lost; zoo-elephants are Serengeti-illiterate.

anthropocentric co-occurence where humans have transformed how plants and animals relate.

algology artificial neural architecture at a level of scale and sophistication that it becomes an ecology.

algorithmancy the derivation of meaning from the actions of an algorithm, the inner workings of which are in fact not legible to any human observer.

algorithmic accountability developers tend to think of algorithmic accountability as a technical project, while social critics challenge the underlying logic of applying algorithms to social situations and conditions and the hierarchies of wealth, power and attention that algorithms may be embedded in. **- Frank Pasquale**

algorithmic companion species a term coined by Sjef van Gaalen to introduce the idea of evaluating our algorithmic companions through a Harawayian lens. What might we encounter if we were to considering our evolving algorithmic neighbours as significant others? What would their behaviour, training and the breeding say about who or what they were?

artificial agent see: autonomous agent

artificial intelligence has become a container for a vast spectrum of artifical agents that mimics "cognitive" functions that humans associ-

ate with other human minds, such as "learning" and "problem solving".

artificial general intelligence perhaps the Holy Grail of AI, AGI is the intelligence of a machine that could successfully perform any intellectual task that a human being can.

artificial artificial intelligence when behind the scenes its actually humans who perform the tasks that are claimed to be done by an artificial agent.

assisted evolution genetic modification of species to be able to deal with climate change.

assisted migration transplanting species that cannot keep up with the shift of biomes due to climate change.

augmented ecology the study of how technologies are rooting in the wild, a research blog since 2010 run by Theun Karelse.

automation bias when a human decision maker favors recommendations made by an automated decision-making system over information from a human expert.

autonomous agent is used as an inclusive term to indicate technologies, artificial entities and systems that perform without direct human supervision, which includes artificial intelligences and DAOs.

behavioural signatures patterns in behaviour of animals in ecological studies collected through remote sensing technologies. The range of behaviours is strongly linked to what sensors and algorithms can quantify and process.
see also: libraries of signatures

bird avoidance model near real-time information and forecast on large scale bird mobility.

bionics also known as biomimetics, biognosis or biomimicry applies biological processes found in nature to develop sustainable systems for human use. Machine Wilderness states the need to set our goals much further, beyond biomimicry, towards environmental participation and co-existence.

biorobotics a study of how to make robots that emulate or simulate living biological organisms mechanically or chemically.

characteristic return time the rate at which a population returns after heavy predation, environmental catastrophy or rebooting.

computational overhang refers to any situation in which new algorithms can suddenly and dramatically exploit existing computational power far more efficiently than before.

conservation algorithm conservation of species and habitats through analysis of (live) data, which reduces costs in manhours and may assist in predicting poaching activity, but moves the power to direct conservation policy into the places where data is managed, where its analysis is understood, and the results can be debated among experts.

concept drift when the accuracy of an agent to make sense of its environment is impacted by unforseen types of change, kinds of change it therefore finds hard to model.

crash blossom a problem in natural language understanding: for example the headline Future of Oranutangs Hangs by a Thread is a crash blossom because an agent could interpret the headline literally

cryptic diversity latent diversity in DNA or software of a population.

cyberpoaching hunting endangered species through GPS data in online media (Flickr, Instagram) or by hacking GPS based trackers used in scientific research.

dark biodiversity a term coined by Nigel Pitman who observes that some landscapes are so vast and biodiverse that they are fundamentally unknowable, organisms live and die at densities below our capacity to research or even see.
see also: un-understanding nature

data poisoning when an artificial agent is given false data to corrupt the model or outcomes.

DAO decentralized autonomous organisation.

deep body refers to the embodiment of an artificial agent. Is it significant in this context that biological organisms species like humans have evolved with millions of nerve ends exposed to the environment in our skin, nose, eyes and ears, but robots generally have only a few? Would their environmental awareness be different if their bodies had trillions of pressure receptors, temperature receptors, etc? Does environmental literacy imply a need to have something at stake existentially in the interaction with an environment? Does it imply a level of somatosensory of hetero-perception?

deep learning is part of a broader family of machine learning methods based on learning data representations, as opposed to task-specific algorithms, learning can be supervised, semi-supervised or unsupervised.

deep naivety when the naivety of an artificial agent to a task exposes human bias, moves beyond human bias or shows hidden aspects of human-animal or human-plant relationships.

drive power the energy source or sources for an autonomous agent.

ecological niche describes how an organism, artificial agent or population responds to the distribution of resources and competitors (for example, by growing when resources are abundant, and when predators, parasites and pathogens are scarce) and how it in turn alters those same factors (for example, limiting access to resources by other organisms, acting as a food source for predators and a consumer of prey).

ecoveillance climate, vegetation cover and species distribution patterns are now monitored from regional to planetary level. This is undertaken in an academic, corporate and civil context through anything ranging from field observations and sensor networks to satellite systems or social media mining.

embodied agent or ***interface agent*** is an intelligent agent that interacts with the environment through a physical body within that environment.

emergent behaviour a complicated resultant behaviour that emerges from the repeated operation of simple underlying behaviours.

environmental code of conduct for artificial agents If the training environment remains exclusively corporate, do AI-s need training forests? Should they spend their weekends exploring national parks, mangroves, glaciers and tundra?

environmental literacy is used within the context of Machine Wilderness and Random Forests to describe the ability of organisms and artificial agents to make sense of their environment.

environmental machine learning the capacity for environmental literacy in artificial agents, also the training processes for an artificial agent to learn about the natural processes and species

environmental participation within the context of Machine Wilderness and Random Forests becomes looking for ways in which artificial agents and autonomous machines can strive towards environmental solidarity, intimacy, affinity, allegiance, reverence, commitment, mutualism and perhaps even kinship.

epizoic media refers to the rich sensor sets carried by animals that have evolved from basic GPS and data-loggers onwards.

ethogram a catalogue or inventory of behaviours or actions exhibited by an animal.

faraday forest a metaphor for wildness retained by technological means, data refugia.

farmerless landscape originally pointing towards automated agriculture, but seen here also as the ambition towards and intermediate state between wilderness and agriculture related to hunter/gatherer cultures which may include artificial agents.
see also: tending the wild / aare

feature in machine learning and pattern recognition, a feature is an individual measurable property or characteristic of a phenomenon being observed.

feature extraction if the environment is too complex (input data given to an agent is too large to be processed) it can be transformed into a reduced set of features which still holds enough information for the agent to conduct itself, within Random Forests feature extraction may include ethological, geographical, climatic, archeological or semiotic features.

fieldwork more than simply being outside, fieldwork is seen as a method of enquiry and in-situ prototyping, that starts from radical non-containment of the participants, their thoughts and their acts, aiming for full exposure to the complexities and subtleties of a given area which is being navigated in collaboration with local experts.

field observation:
- ***focal-animal sampling*** record all of the actions of one individual for a specified time period
- ***continuous group sampling*** record all of the behaviours that occur while the group is being watched, e.g. preening, feeding, flying, displaying, and the time & duration of the behaviour
- ***instantaneous sampling*** record the behaviour of an individual at predetermined time intervals
- ***scan sampling*** record the behaviour of all group members at predetermined time intervals
- ***sampling occurrences of a specific behaviour*** record each time a chosen behaviour is observed during a specified time period
- ***identification key*** a visual guide to identify species which points out the differences that make the difference
- ***jizzing*** instantaneous field-based identification of organisms using the entire spectrum of features, including movement and behaviour

fishonomics the illusion of abundance that emerges within industrial chains that have a consumer base, with fish being the classic example: even as fish become rare in the sea their presence in supermarkets remains stable.

forward chaining a process in which events or received data are considered by an entity to intelligently adapt its behaviour.

functional trait diversity a measure of biodiversity beyond just listing the amounts of species present, to form a picture of the impact of different species to ecosystem health, but some warn it is susceptible misuse for economic arguments in conservation, in effect putting a bounty on certain species in a community.
see also: phylogenetic diversity

general adversarial network or ***GAN*** a system to create new data in which a generator creates data and a discriminator determines whether that created data is valid or invalid.

green concrete or corpus vegetation, when none of the specialists remain but only very common species.

gridworld a virtual environment used to train a neural network before releasing it into the wild. In the context of environmental machine learning these may be regarded quite literally as training forests. Games can be gridworlds where humans and artificial intelligences train in a shared environment.
see also: training forest / staged nature

heuristic a practical and nonoptimal solution to a problem, which is sufficient for making progress or for learning from.

hysteresis when a system depends heavily on the history of its environment. Field-experiments during Random Forests indicate that for an artificial agent that is active in an ecoregion, some appreciation for historic contexts or a critical historic perspective are a vital ingredients to self-regulation and are in many ways mission critical. A hysteresic artificial agent would have this built in as a dependency.

in-situ prototyping creating physical sketches or prototypes during fieldwork as a way to exposing the prototype and its makers to the full extent of environmental complexity.

info-chemicals potential means of establishing contact between organisms and agents.

instrumental convergence is the hypothetical tendency for most sufficiently intelligent agents to pursue certain instrumental goals where the relentless pursuit of apparently harmless goals can result in collateral damage. It may be summarised as: having perfect goals in an imperfect world.
see also: objective function

IoO internet of organisms, also known as internet of animals, which aguably preceded the internet of things by some decades but only became recognised as such after IoT entered mainstream thought.

kinematics the study of motion, as applied to robots.

lack of model interpretability does the model give the quality of results that it was intended to produce or is it giving over-simplified, irrelevant or erroneous solutions.

land as platform described by Jay Springett: Land as platform grafts the organising logic of digital platforms back into living soil

library of signatures capturing a wide range of phenology of an organism through sensor technology to form a database of behavioural signatures which are then used to predict or manage behaviour. Aconcept first proposed at Yellowstone National Park concerning predator species, but was soon extended to prey species. In effect it became a programme to track all wildlife in the park -which raises the question what the meaning of wild becomes in this situation.
see also: ecoveillance

machine genotype the software of an artificial agent (programming language, behaviour, learning ability).

machine learning a program or system that builds (trains) a predictive model from input data.

machine phenotype the embodiment of an artificial agent (arms, legs, platform, battery life).
see also: phenotypic plasticity

Machine Wilderness a programme exploring the ingredients and methods for developing technologies that relate to environments in the way organisms do and may strive towards mutualism. It identifies our technological heritage since the Industrial Revolution as technologies of loneliness in an effort to push current technological narratives beyond capitalist realism. Machine Wilderness was also the theme given by curator Andrea Polli to the wonderful ISEA 2012 symposium, and originates from writings by cultural geographer Ron Horvath in the 1960s.

mass extinction examines the drop in the total number of individual organisms rather than the number of extinct species, because that ignores the enormous decline in individuals among common species.

maximum envelope (space), the volume of space encompassing the maximum designed movements of all robot parts including the end-effector, workpiece, and attachments. As a term coming from robotics it may be interesting to apply it to the maximum designed reach of an AI.

multi-agent system may offer opportunities to by-pass instrumental convergence to which single agents may be prone, by a tapestry of distributed artificial actors which become active/passive under changing conditions, in effect increasing phylo-algorithmic diversity.
see also: phylogenetic diversity

mutualism interspecific and/or interagent cooperation where all participants benefit.

niche is the fit of a species or agent living under specific environmental conditions.

not-in-front-of-the-bots Maxime Februari states that humans may have to be at their best behaviour in front of their algorithmic companions if they learn through pervasive monitoring.

objective function a function that defines the goals for an artificial agent, which can result in instrumental convergence when an intelligent agent persues apparently harmless goals so relentlessly that it runs rampant.
see also: instrumental convergence

optimal foraging theory in ecology a maximum caloric intake, with minimal energy expenditure, per unit of time.

overfitting occurs when your model learns the training data too well and incorporates details and noise specific to your dataset. You can tell a model is overfitting when it performs great on your training/validation set, but poorly on new data.

parataxonomy field-trained biodiversity collection and inventory specialist recruited from local areas.

phenotypic plasticity in ecology the ability of a genotype to diversify when exposed to different environments, some examples are emerging in autonomous systems such as differnet types of grabbers on submarinous robots developed to harvest different kinds of deep-sea specimens.

phylogenetic diversity level of species that have few or no close relatives locally and that are very different from other species, which may mean that they can contribute in very different ways to an ecoregion.
see also: functional trait diversity

population enrichment a population is studied before and after addition of individuals or within Machine Wilderness and Random Forests addition of artificial agents.

radical non-containment asserts that environmentally sustainable practice implies an absence of human control. In this approach technology deemed safe to be applied in wild systems only if the technology doesn't need any human oversight, safety instructions, safety procedures or special treatment and if it is safe even when the system breaks down. In design terms: design for open systems and no human control.

Random Forests a programme exploring environmental literacy in biological and artificial intelligences. In machine learning random forests are a type of analysis in which a large number of simpler operations called 'Decision Trees' are examined to find the optimum tree. The "random" part of the term refers to building each of the decision trees from a random selection of features; the "forest" refers to the set of decision trees.

reporting bias for example: the word laughed is more prevalent than breathed. An artificial agent who estimates the relative frequency of laughing and breathing from literature may determine that laughing is more common than breathing.

restoration ecology aims to reeastablish natural cycles, rather than attempting to bring back pre-existing ecosystems exactly, because that often often fails anyway.

robochory the dispersal of plant seeds by machines, both externally or internally by digestion, adapted from zoochory which relates to dispersal by animals.

robot darwinism a term coined by battling robot pioneer Pete Abrahamson, has left the field with only three major robot archetypes:
1. lifters which had wedged sides and could use forklift-like prongs to flip pure wedges.
2. spinners which were smooth, circular wedges with blades on their bottom side for disabling and breaking lifters.
3. pure wedges which could still flip spinners.

R.O.N.R a Brand goose whose journey - traveling from Terschelling to Bolshevik Island in Eastern Syberia and back- played a central role in the Terschelling session of Random Forests in collaboration with IMRAMA.

rubber banding an automatic change in parameters, scenarios, and behaviors in a video game in real-time, based on the player's ability, with the aim of avoiding player boredom or frustration. In the context of Random Forests the real-time adaptation of parameters, models and behaviours of an artificial agent to environmental dynamics.

semiotics construction of meaning through communication incl alarm calls and chemical reception.

semiosphere the full spectrum of signalling included in the construction of meaning between all biological beings.

sequential social dilemmas in real life, both cooperating and defecting may require complex behaviours, involving difficult sequences of actions that agents need to learn to execute. SSDs are gridworlds to study artificial agents beyond traditional game theorists models that present social dilemmas in terms of a simple binary choice between cooperate and defect for each agent. SSDs aim for deep multi-agent reinforcement learning.

smart collar next generation GPS trackers for pets, farm animals or wild animals.
see also: behavioural signatures

slow speed control a mode of robot motion control where the velocity of the robot is limited to allow organisms sufficient time either to withdraw the hazardous motion or stop the robot.

species:
- ***casual species / agent*** unable to form self-replacing population but relying on continual reintroduction
- ***flagship species / agent*** acts as an ambassador, icon or symbol for a defined habitat
- ***foundation species / agent*** has a strong role in structuring population dynamics in an ecoregion
- ***indicator species / agent*** their function, abundance, or health can reveal the qualitative status of the environment
- ***keystone species / agent*** has a high impact on its habitat relative to its abundance, acts as a regulator
- ***sentinel species*** used to detect risks to humans by providing advance warning of a danger

solutionism the tendency to approach a situation through the lense of a single problem that may obscure many other features from view or create additional problems due to oversimplification. This is particularly relevant in the development of artificial agents, because historically they were made almost exlusively to perform tasks with very specific and onedimentional goals. Within Machine Wilderness it became clear how hard it is infact to think of machines from anything else but their goals. The goal of some wilderness machines eventually becomes something broader than a single problem to solve, towards general environmental participation.

species banking a segment of biodiversity markets where algorithmic entities help manage biodiversity offsetting, compensation and banking.

staged nature the staging of naturalistic behaviour to create an impression of authenticity, originating from staged authenticity as described by Dean MacCannell in relation to tourism. Staged nature was explored by artist Antti Tenetz during Random Forests by hunting deer in FarCry5 (game).

subsumption architecture a robot architecture that uses a modular, bottom-up design beginning with the least complex behavioural tasks

superintelligence a hypothetical agent that possesses intelligence far surpassing that of the brightest and most gifted human minds. University of Oxford philosopher Nick Bostrom defines superintelligence as "any intellect that greatly exceeds the cognitive performance of humans in virtually all domains of interest".

swarm robotics is to robotics what population ecology is to animals

symbiogenesis the merging of two organisms resulting in new features (much faster than classic genetic mutation).

tarzanisation when a biological organism or artificial agent in isolation becomes imprinted with the culture from another species or platform.

technologies of loneliness acknowledges the collateral damage of our infrastructures and technologies that have been deployed in the environment.
see also: age of loneliness

Tending the Wild indigenous landmanagement methods and ethnobotany that represent an intermediate state between wilderness and agriculture, where the land is subtly tended to increase the

occurence of species used by humans as described by M. Kat Anderson in the book by the same title.

tensorflow is an open-source symbolic math library also used for machine learning applications such as neural networks.

thalience is an attempt to give nature a voice without that voice being ours in disguise. It is the only way for an artificial intelligence to be grounded in a self-identity that is truly independent of its creator's. “We don't want machine copies of our own minds, we want to give the natural world itself a voice”. **- Karl Schroeder**

training forest a term that originates in Orang-utan conservation where young animals are first released in a semi-wild context to learn basic skills and environmental literacy as a preparation to be released in the wild. Within the context of Random Forests the term may be quite literally applicable to artificial agents that are intended to operate in the wild.
see also: gridworld

training set inference signifies the way an artificial agent deals with sensitive, confidential or private data when a model is public.

transplantation ecology a method of regenerative ecology in which the topsoil of a functioning ecosystem is inserted into the site to be regenerated as a way to transfer microbes, fungi and seeds which significantly speeds up the regeneration and increases the resulting biodiversity.

un-understanding nature how do we research or protect nature if it is fundamentally unknowable, as described by ecologist Theunis Piersma and biologist Thomas Oudman.
see also: dark biodiversity

undesirable model bias the biases a model inherits from the training data that lead to incorrect or undesirable results, specifically ones that users didn’t realise were there and didn’t compensate for.

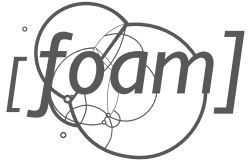
undomestication of machines after domesticating animals to industry there are early signs in society of machines being developed to exit the wild.

unified modelling language is a general-purpose, developmental, modelling language in the field of software engineering, that is intended to provide a standard way to visualize the design of a system.

unmanned conservation biodiversity conservation informed or performed by autonomous agents.

Wild Bits the title of a residency at MAAJAAM in Estonia as part of the Random Forests programme.

This glossary was made with a few adaptations from Google’s machine learning glossary and anonymous contributions added online.



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