16. Weihenstephaner Forum

Cyborg Landscapes

The Optimised Nature of Nature

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Cyborg Landscapes. The Optimised Nature of Nature

16th Weihenstephan Forum

Udo Weilacher

Welcome speech by the curator of the symposium Udo Weilacher in the Schafhof – European Art Forum Upper Bavaria in Freising

"A cyborg is a cybernetic organism", the biologist and philosopher Donna Haraway explained in 1985, "a hybrid of machine and organism, a creature of social reality as well as a creature of fiction."[1] Such hybrids have long since populated more than just science fiction. In human medicine, increasingly sophisticated implants are being developed that not only ensure a person's survival, but also improve the quality of life of many people. The spectrum of today's implants ranges from pacemakers, first implanted around four decades ago, to current "body modifications" that serve the purpose of "enhancement", that is the technical optimisation of the human body. This technological progress is fuelling the social question of how far the fusion of nature and technology can go. What opportunities and risks does increasing hybridisation harbour? Cyborg landscapes, hybrids of machine and landscape, are also not a new phenomenon and are shaping today's human living environment much more than most people realise.

Increasing digitalisation is driving hybridisation processes in the landscape. The call for technical optimisation of nature and landscape is becoming louder, especially in the wake of the ever-increasing challenges to environmental development, primarily due to global climate change. The variety of propagated environmental enhancements ranges from large-scale geo-engineering and the generation of hybrid energy landscapes to the local implantation of artificial trees, smart biotech fine dust filters such as the "Citytree"[2] with integrated moss modules, for climate adaptation in urban areas. Should current landscape architecture increasingly promote the development and application of such technical innovations and devote itself to the creation of new cyborg landscape types? Or do these efforts to optimise the environment through technology resemble the pursuit of a phantom that distracts from relevant, essential tasks in landscape architecture? Significant changes in the living environment were already clearly recognisable more than three decades ago.

Despite enormous technological progress, the impression at the time was that the global environmental crisis was not being alleviated – quite the opposite. Even before the catastrophic accident at the Chernobyl nuclear power plant in April 1986, high-tech solution strategies for more sustainable energy generation, industrial production, mobility, construction, and settlement activities had repeatedly proven to be prone to failure. At the end of the 1980s, landscape architecture students at the Technical University of Munich therefore no longer wanted to devote themselves to the topics of nature, landscape, and the environment exclusively from an engineering or scientific perspective, as prescribed by the curriculum. The academic and rational approach to nature and landscape at the university also lacked something crucial: an inspiring appeal that would touch people emotionally and inspire them to rethink their social value system and resource consuming lifestyle.

The students therefore independently founded the *Zeichen + Landschaft* (Sign + Landscape) initiative[3] and invited artists such as Hannsjörg Voth from Germany (1991), Andy Goldsworthy from Great Britain (1993), Martha Schwartz (1993), Christo and Jeanne-Claude from the USA (1993), Dani Karavan from Israel (1996), and others to Weihenstephan for inspiring lectures. Workshops were also organised with the artists in former mining areas and on post-industrial wastelands to find out what different, direct access to the landscape art can facilitate. Initial findings from *Zeichen + Landschaft* were discussed in 1992 in a diploma thesis entitled “Von der Landschaftsarchitektur zur Land Art”[4], which was later published as the book “Between Landscape Architecture and Land Art”[5]. The introduction states: “One of the main issues of our age is the disturbed relationship of man to nature and the ensuing world-wide threat to the ecological balance.

Participants in the panel discussion: Ilkka Halso, Natalie Gulsrud, Steven Velegrinis, Essam Heggy, Daixin Dai, Paul Roncken, and their host Udo Weilacher

More than 100 participants, including many landscape architecture students, followed the presentations of the international speakers live at the Schafhof Freising

Our society is still seeking a technological solution to a crisis generated by this same technology. The realisation that the crisis facing the environment is being caused by man, who is not just a 'factor' to be predicted by rational means and researched by science, but is also a being perceiving through his senses and often acting intuitively, is only very gradually gaining acceptance. [...] Ultimately, the question as to whether we can overcome ecological and social crises is primarily a question of human behaviour."[6] This finding from 1991 has not fundamentally changed to this day, but the context is more problematic than it was three decades ago. Technical progress has accelerated enormously since the Internet was opened for commercial use in 1990 at the latest. Today, a thoroughly digitalised society is looking for high-tech ways out of the technologically induced environmental crisis, which has worsened to a catastrophic extent as a result of the almost total economisation of all areas of life. According to the World Ecomomic Forum's Global Risks Report 2023, six of the ten most serious global risks in the coming decade are to be found in the area of the environment.

The report lists the top four risks as: "1. failure to mitigate climate change, 2. failure of climate-change adaptation, 3. natural disasters and extreme weather events, 4. biodiversity loss and ecosystem collapse."[7] In the fight against the consequences of the global environmental crisis, political and planning circles are currently focussing on improving the usefulness and efficiency of nature and the landscape. This is signalled not only by normative buzzwords such as "ecosystem services" (ESS), "nature-based solutions" (NBS), or "green infrastructure" (GI)[8], but also by intensive research into new technologies for environmental control and a dwindling inhibition against ever more extensive technological interventions in the Earth's complex climate system, for example with "geoengineering"[9]. Farreaching interventions in global ecological processes are intended to counteract climate change. These range from the use of genetically modified plants in agriculture and the wrapping of melting glaciers in reflective tarpaulins to the underground injection of the greenhouse gas carbon dioxide using the Carbon Capture and Storage CCS process or the installation of solar sails in Earth's orbit. This environmental

technology on a planetary scale is labelled "nature-based", but here too it is primarily about functionalism, the use of nature's ecosystem services, their technical control and optimisation. The social consequences of these interventions are usually not really taken into account. Landscape architect Martha Schwartz, who began her career as a visual artist in the USA and was a guest at *Zeichen + Landschaft* at TUM in Freising in 1993, is giving a lecture today on "Climate Change and Why We Will Need Geoengineering"[10]. She hopes that the use of this cutting-edge technology will save time in the race against global climate collapse and wants to use the opportunity to recalibrate our relationship with nature. Perhaps she is right, but there is now a real fear that this will once again encourage the procrastination that has persisted for decades, in line with the realisation from 1991: "Our society is still seeking a technological solution to a crisis generated by this same technology." It is obvious that an increasingly technology-orientated approach will change landscape architecture significantly in the future. Landscape is already a complex living superorganism that often reacts unpredictably to planning interventions. Like all complex systems, landscape is characterised by non-linearity, emergence, and surprise. In cyborg landscapes, increasingly interspersed with geoengineering implants, the complexity is increased, and this leads not least to the uncertainties with which we will be confronted – Environmental Impact Assessment or Social Impact Assessment will become almost impossible. As with the humanoid cyborg, the cyborg landscape also raises crucial questions. What intensity and severity of technological interventions are acceptable for the landscape and the ecosystem, and do they still exist in a sensible relationship to the expected ecological and social benefits for humanity?

How far can we push the hybridisation of man and machine, of nature and technology, without risking the organism as a whole becoming too susceptible to disruption and possibly collapsing completely one day?

Key questions such as these can only be discussed successfully in open interdisciplinary debates. Natalie Gulsrud from Denmark, Daixin Dai from China, Ilkka Halso from Finland, Essam Heggy from the USA and Egypt, Paul Roncknen from the Netherlands, and Steven Velegrinis from the USA have accepted the invitation to take part in such a round table discussion at TUM and, in their contributions published here, they offer trend-setting suggestions for dealing with the cyborg landscapes of the future.

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2 c.f.: https://greencitysolutions.de/en/city-tree/ (downloaded January 2, 2024)
3 c.f.: Ernst, Annika: „Land Art in Freising". Drei Vorträge der Initiative „Zeichen + Landschaft" in: Süddeutsche Zeitung 1992
4 Weilacher, Udo: Von der Land Art zur Landschaftsarchitektur. Diplomarbeit am Lehrstuhl für Landschaftsarchitektur und Planung an der Technischen Universität München-Weihenstephan. Freising 1992
5 vgl. Weilacher, Udo: Between Landscape Architecture and Land Art. Basel Berlin Boston 1996
6 Ibid. p. 9
7 World Economic Forum (eds): The Global Riska Report 2013. 18th Edition. Cologny/Geneva 2023; p. 6
8 c.f. COM(2013) 249 final Green infrastructure (GI): enhancing Europe's natural capital, Brussels 2013, p. 2/3
9 c.f.: https://www.umweltbundesamt.de/themen/nachhaltigkeit-strategien-internationales/umweltrecht/umweltvoelkerrecht/geoengineering-governance#was-ist-geoengineering (downloaded January 3, 2024)
10 https://www.arch.rpi.edu/2021/02/s21-lecture-schwartz/ (downloaded January 3, 2024)

Museum of Nature

Misbelief turns into anger or relief or enthusiasm

Ilkka Halso

Excavations 1998. A geometric rectangular opening is created in the ground. The terrestrial living present meets the historical. Organic meets geometric.

Since graduating from the University of Art and Design in Helsinki in 1992, my work has been tightly dealing with representation of nature and practices of science illustration. Works have been little investigations of the visual world of science. I have been interested especially in the traces and imprints that scientists leave of themselves in scientific records and documents. As physicists have noticed on the smaller atomic scale, observation always affects observed objects. What do scientific images tell about the scientist and their values and cultures? The same problematics have been in the background in my later works. Mediums have turned towards landscape photography and architectural installations. But what is meaningful, is what works tell about me and my culture. They show how, in our culture, nature is observed through the looking glass of science, rationalism, and consumerism. Nowadays I deal more and more with problematics of artificial and virtual nature. Projects and pictures I am planning are becoming impossible to carry out in real life. Parts of the images are created with help of a computer.

I will shortly describe my artistic path to where I am today. De Pterygotis (1990) is one of my earliest works is, also called Manual for Insect Construction. It is a portfolio of twelve prints. During the working period, I was fascinated by old science. This portfolio box has been made in the spirit of 17th century books of science. In those times, science was still at its very beginning, as we know it today. Illustrations of those books were, to say the least, strange, populated with odd figures, dragons, and little devils. Imagination and ancient stories and myths were still essential parts of observation.
I have taken similar kinds of liberties in ordering my insect collection. The portfolio contains photographs of single parts of dried insects ordered in nine squares in a strict order. Each part is a separate sample, but within a geometrical matrix they refer to the wholeness of a winged insect. The viewer can continue to compose insects by reordering pieces in their mind. The next work, which was also my graduate work from the university, continued in the same attitude of sampling nature into geometrical order.

The series Evolution from the year 1992 was a straightforward, simplified interpretation of the evolution theory by Charles Darwin. This series consisted of eight large black and white photo-composites in old looking vitrine boxes. Eight different animals, eight steps in the evolution tree. All animals are composed of the same origin: one skeleton of a cat. The cat was found dead by the side of a road. I took it to the forest and one year later collected the bones. I photographed the bones and assembled and enlarged them depending on proportions of each animal type. The pictures are two-dimensional projections of animals. Animal structure is forced into a geometrical matrix. Evolution starts from the dragonfly and ends in homo sapiens.
The sieries Excavations (1998) is an exhibition about an archeological study process. It focuses primarily on human behavior and the practices of scientific research. The exhibition has two types of photographs: the first are site photographs showing excavation in connection to nature and its surroundings, and the second refer to the study and documentation process as well as to the reconstruction of findings. The surface of soil is the present day. The deeper you dig, the older sediments and objects you can find. Juxtaposing present day with ancient is one point in this series. It also makes visible how, in a geometrical way, scientists are exploring the unknown. Sites depicted are fictional, and most of the found objects are self-made.
Anatomiche Kabinet (1997): Since my cabinets had been filled with skeletons self-made or found, I decided to do something with them. This work is an installation that looks like a museum but on closer look reveals something strange and unsettling. There is something not exactly right about the anatomical pieces of skeletons, and parts of their anatomy are missing or replaced with something else. “Cabinet” is a personal view on museums and anatomy, a friendly bow to old museological science and the spirit of old museums.

Ceratosaurus from my collection an assembled six-meter tall skeleton exhibited in the Anatomical Cabinet in Helsinki 1997

© Ilkka Halso: Untitled (2), 2000

Restoration

"This project is a series of photographs about man's attempt to repair nature with the means of technology and science. The basic idea was crystallized when I was repairing an old wooden summer cottage on an island close to Helsinki. The island Vartiosaari is well preserved in a natural state because its only connection to the city is by boat. In order to fix the wooden walls and roof, I had to get scaffolding and surround the house with it. So, in the middle of old trees and an untouched nature area, renovating an old house, an idea came to my head: What if nature and objects of nature would be repaired in the same manner as houses and other man-made objects? In order to explore this idea, in the summer of 1999 I built eight fictive restoration sites in nature, some of them on Vartiosaari island and others in my home place, Orimattila. Scaffolding and plastic foils and nets cover objects of nature. Trees, boulders, rock faces, and fields are under repair. Sites are empty, no people, no action. What is broken? What could be made to fix that? This is not exactly clear. Restoration as depicted here is an ironic comment and hopefully a question mark.

What would be the right way to restore nature, if it were possible?
These sites work as self-assuring gestures that we care, because we take so much effort to fix things! Photographs show these sites in the evening when artificial light conquers natural light. Scaffolding and light settings highlight and frame natural objects and detach them from everyday life's context. The object of nature and the construction site that surrounds it together form a large installation. I was and am still fascinated with scaffolding systems. It is like Lego building blocks on steroids. They can be assembled without extra help, which is good since I like to work alone. There is again a geometrical matrix, which this time is taken into nature. In the middle of chaotic nature, it is an indication of man's will and power to control."
– Ilkka Halso

"Restoration" still goes on. After the exhibition in 2000, it has shifted towards manipulation and recreation of nature.

Adaptive Landscape Architecture in Desert Megacities

Essam Heggy

NASA scientist Essam Heggy explains why geoengineering on Earth is a highly complex undertaking. “We can landscape a site, but we can’t geoengineer a planet.”

Green loans in the middle of the desert, waterways across dune fields, and green hills in salt lakes; the need for blue-green infrastructure in several newly built urban areas in arid environments is rapidly growing and profoundly changing the visual attributes and public perceptions of several cities, most notably in Gulf countries.[1] While landscape architecture in these new large urban areas, such as Doha, Dubai, Abu-Dhabi, and Riyadh, made them more scenic and livable, their resilience to increased climate extremes is subject to a growing debate.[2] In the vast deserts of North Africa and the Arabian Peninsula, an area about the same size as the US and Canada, the impacts of changing climatic conditions on landscape design and urban management practices are widely overlooked, let alone understood. For instance, extended droughts, dust storms, flash floods, coastal erosion, and poor water quality pose increased challenges for landscaped areas such as public gardens, seafronts, resorts, and waterways. Furthermore, the blue-green visual attributes of these expansive man-made landscapes can often act as a delusive factor for inhabitants to understand the risks associated with desert climate extremes.[3] The above vulnerability is aggravated by the largest portion of the population in these newly built megacities in the Gulf region being primarily made of expats from more temperate climates such as Europe, North America, and Southeast Asia. For instance, Qatar and UAE’s native populations are less than approximately 10% of the national census, while around 90% are born and raised outside these harsh desert environments. As such, the population is often unaware of the climate risks of living in these deserts, and the expansive blue-green infrastructures implemented across these cities often dilute the sense of these threats.[4] For instance, many believe that the primary risk to human health in these harsh deserts would be heat.

However, official records show that the primary threat to human life observed in these hyper-arid areas originates from floodings caused by sparse occasional rains referred to as flash floods. To illustrate the above, in late 2023, the flood in the coastal city of Derna in Libya took the lives of more than 11.000 inhabitants overnight, although Libya is one of the driest nations on Earth, with an average precipitation below 200 millimeters per year.[5] Derna was hit by a rare type of Mediterranean storm called “medicanes”. These storms have increased in strength and frequency in the Eastern Mediterranean basin over the last two decades due to global warming. As such, the two catchment dams, protecting the city from minor rains, gave way under these increased storm impacts, unleashing floodwaters that swept away entire neighbourhoods. This unprecedented disaster has put tens of thousands of residents in danger in a region already grappling with conflicts. To what extent did the intense landscape design in Derna play a role in reducing the public awareness of flooding risks remains to be investigated. However, most of the inhabitants impacted by this tragedy expressed they were not aware of their houses being constructed in a dry riverbed prone to rare floods due to heavy landscape design in the area that erased the visual attribute of such topographic features. Recent assessment reports suggest that poor landscape design, inefficient urban transformation along waterways, and poor maintenance have amplified the impacts of the upstream dam’s collapse that generated the Derna floods following Storm Daniel’s landing on Libya. Preventing dam failure and improving waterways efficiency in managing overflows requires proper planning, maintenance, and adherence to safety measures, but most importantly, it requires reducing littering and degradation in these infrastructures by inhabitants. Recent research shows that innovative landscape architecture is crucial to achieving this objective. From the above, an important question emerges: Are blue-green infrastructures exogenic to desert landscapes? The global public perception of desert landscapes in the Gulf countries such as Qatar, the United Arab Emirates, and Saudi Arabia is mostly associated with vast and harsh areas of sand with poor visual attributes.[6] Several might be surprised that rapid urbanizations in the growing megacities are adopting landscape designs for their cities that include vast blue-green spaces. In some cases, the portion of these blue-green spaces would out-pass western cities in more temperate climates. To understand the need to create blue-green spaces in urban areas in arid regions, one has to understand that desert inhabitants historically lived in oases, river deltas, and coastal areas with localized freshwater resources. While these fertile blue-green environments represent a small fraction of desert surfaces, they were the areas where the populations are mostly concentrated. Historically, desert inhabitants will only encounter the harsh desert landscape when traveling from town to town, and not in their daily life activities. Hence, the feeling of geographical belonging was always associated with the blue-green spaces. In today’s modern times, the need for rapid urbanization to expand far beyond the geographical limits of the small oases that formed the original historical settlements of many cities like Dubai, Doha, or Riyadh brought the need to replicate blue-green spaces proportionate in size to the population growth. As such, creating large green-blue spaces in the deserts should not be conceived as exogenic to the inhabitant’s visual heritage. However, the type of blue-green spaces created is often imported from Western English gardens rather than replicating the attributes of the native ecological environments of oases.[7]

The uncertainties on climate change patterns are currently one of the most difficult challenges, affecting ecosystems, weather patterns, and landscape transformation worldwide. While climate change challenges are acknowledged globally, they are met with skepticism among desert inhabitants. The public perception is that there is nothing to change in deserts in the first place. This wrong perspective underscores the immediate need for adaptive landscape design and management practices capable of responding to the evolving climate in these areas. Moreover, the consequences of this rapid urbanization, the limitations of artificial landscape architecture, and the critical need for landscape resilience to the growing occurrence of hydroclimatic extremes need to be further studied. In today’s urban growth, where suitable land for construction diminishes daily,

the urgency of transforming unfavourable lands into favourable ones becomes apparent in desert environments. This involves protecting developed landscapes from overloading and promoting sustainable development while preserving ecological balance. One of the most tangible consequences of a changing planet that can be observed in arid areas is coastal erosion, exacerbated by rampant urbanization. Our research[1] delves into the critical issue of coastal landscapes succumbing to the relentless advance of the sea. Urban developments, including resorts and hotels, have replaced natural soils with cemented ones, disrupting the delicate balance of inland sediment transports that preserved the coastline dynamic in healthy conditions. Coastal erosion is not solely a result of rising sea levels; human infrastructure, desertification processes, and groundwater depletion significantly intensify it. Mitigating coastal erosion in arid areas often necessitates costly interventions such as sand replenishment and seafront landscaping to counteract the observed shoreline retreat. Today, the debate persists between global and local aspirations in landscape architectural projects in these arid areas that account for approximately 40% of fossil fuel energy production. Modernism, introduced to major cities in the Gulf countries, has led to design approaches detached from the local context, some influenced by Western models with limited adaptation. Ambitious designers seeking to celebrate local values through context-based designs face dilemmas between client-driven global aspirations and local contextual particularities. Ongoing projects in Abu Dhabi, Dubai, Doha, Riyadh, and Muscat illustrate various current trends in landscape practices, emphasizing the importance of considering cultural meanings, ecological processes, and the profound connections between culture and ecology in future design strategies. Landscape, when poorly designed, can often mask underlying environmental challenges, creating an illusion of reduced vulnerability to climatic extremes. For instance, Doha's landscape, adorned with lush greenery and waterfalls amidst a desert backdrop, exemplifies this phenomenon.[8] However, such landscapes lack resilience and fail to withstand natural disasters, emphasizing the need for sustainable landscape architectural practices. The vulnerability of these areas underscores the urgency of re-evaluating landscape design and management practices to address climate-induced natural hazards. In conclusion, climate change in arid areas represents a major challenge for the rapid development of megacities in the Gulf. Adaptive landscape design approaches to mitigate coastal erosion, desertification, and water scarcity are crucial. As we confront the consequences of climate change that increase flash floods and dust storms in North Africa and the Arabian Peninsula, developing resilient landscapes becomes crucial.[9] Lessons from the adaptative landscape architectural approach in growing urban areas in deserts, witnessing climate fluctuations, can guide the development of sustainable and adaptive landscape design and management practices in other parts during extended droughts or extreme aridity conditions as recently observed in southern Europe, Australia, and the southwest of the United States.

Satellite images of the Palm Trees Island in the middle of Doha Bay in Qatar showing the lush green but unsustainable landscape design in 2015 and its complete destruction in 2016 by a storm.

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9 Hzami, A., Heggy, E., Amrouni, O., Mahé, G., Maanan, M., & Abdeljaouad, S. (2021). Alarming coastal vulnerability of the deltaic and sandy beaches of North Africa. Scientific reports, 11(1), 2320.

One of the largest public parks in Doha is located in Katara Cultural Village, designed with abundant green lawns and rushing waterfalls on manmade hills.

Doha’s skyline viewed from the manmade Katara Hills with modern luxury hotels, designed in a European style, overlooking the Bay of Doha.

Tree Works

"Under this title objects of nature are reshaped in the restoration process. New trees are rebuilt from leftovers of logging or a tree trunk gets a new sophisticated shape. Usually, my installations are made only to be photographed, partly because they look best during nighttime in artificial lights, but nowadays I also do more permanent works."
– Ilkka Halso


© Ilkka Halso: Tree revolution 1, 2007

Killing Your Darlings
A Journey Towards the Emergent Cyborg Landscape

Steven Velegrinis

Conventional architecture and urbanism continues to reinforce the modernist paradigm in which nature and culture are perceived as separate and architecture and urbanism exist outside of the natural world. We continue to conceive of cities as existing outside of "nature" or "landscape" and regard nature as a resource for urbanism and the cleaning up of the mess we collectively create as a profession. The climate crisis and its need for urgent and immediate action has drawn this flawed approach into sharp focus. The IPCC consensus and the overwhelming majority of practitioners understand the urgency of that situation[1]. However, we tend to see it as a problem that is to be solved outside of the subject of our work. We want to explore the ways in which we can conceive of a landscape or urbanism that is understood through the lens of ecology and the creation of highly functioning synthetic ecologies. By doing so, we can foresee the ways that we may be able to address the wicked problem of climate change through our work. Using the literary tradition of "Killing Your Darlings"[2], we as a profession need to let go of the long-held beliefs that have led architecture to contribute significantly to the climate change wicked problem. In doing so, we can "kill the darling" of the objectified and ecologically detached understanding of architecture and write a new narrative around cities and architecture as component parts of a new ecological landscape. This trajectory has been evolving over the last two decades, particularly through the landscape urbanism, ecological urbanism, and metabolic building discourses that have dominated landscape architectural thinking. It is also a strong theme in the arts as expressed through the work of Donna Haraway, Ilkka Halso, and Patricia Puccini. That work highlights the role of hybridized "cyborg" cities as metabolic systems. Finally, we explore through a series of urban project case-studies the ways in which we can give expression to those ideas at several scales to realize cities as new natures.

Framing the Theoretical Weakness of Urbanism's Response to the Climate Crisis

The idea of landscape or ecological urbanism has, throughout the last 20 years, dominated the discourse of landscape architecture in particular, and it offers a convincing conceptual model through which to understand urbanism as a performative landscape that has the utility to respond to climate change. Paradoxically, the common definition of landscape architecture often represents the discipline as: "the development and decorative planting of gardens, yards, grounds, parks, and other planned green outdoor spaces. Landscape gardening is used to enhance nature and to create a natural setting for buildings, towns, and cities. It is one of the decorative arts and is allied to architecture, city planning, and horticulture."[3] This definition reflects common misconceptions of urbanism and landscape architecture as purely decorative arts with no utility or ecological function. It is precisely this common understanding that I aim to address here. Ecology as a discipline has also been guilty of separating a "pristine nature" from urban development. However, as Boivin and colleagues point out, a truly "pristine" nature hasn't existed for at least 10.000 years[4]. We, as urbanists and architects, continue to conceive cities as if they exist outside of big N "nature", and nature is there as a resource for urbanism and to clean up the mess we collectively create as a profession. As the Geographer Stephen Read outlined: "The city is no longer something we can understand as architecture; as a mass of formed material that we can distinguish from a non-material void which can be characterized as countryside or periphery – or as in any event 'not-city'."[5] That world view has held back the evolution of an ecological architecture, landscape architecture, and urbanism. In the simplest of ways, ecologies do not respect "city" or "not city", but rather they transcend the places we create.

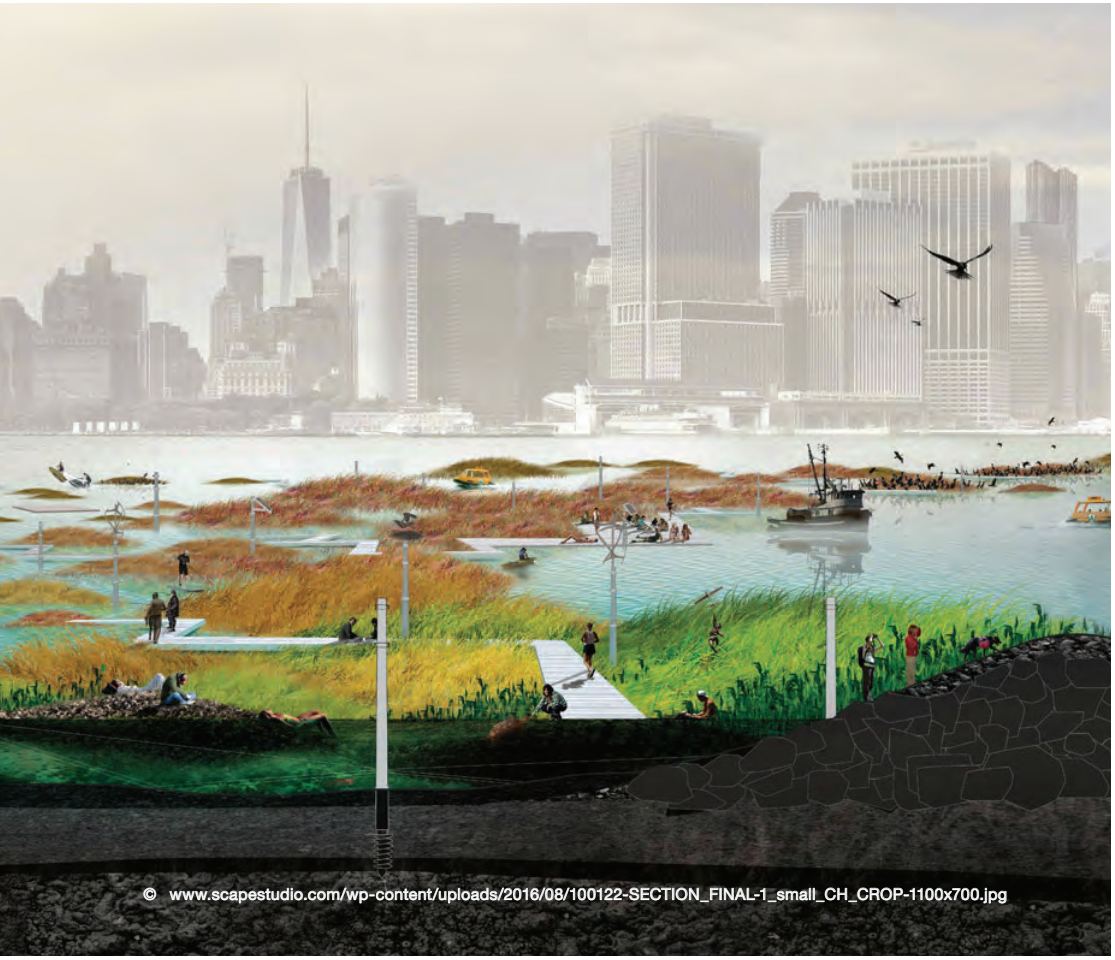
We would be well served to harness the potential of ecology as formative to cities. This necessitates the willingness to see ourselves as the creators of urbanism as Hybrid Ecologies. It has been suggested that "we need to explore how we can design, build and live in the nature caused by people".[6] Geographers like Donna Haraway have eloquently outlined, through the discourse of feminism and space, the idea that we need to reconceive of our relationship with the duality of nature and culture. In her Cyborg Manifesto, she suggests: "Nature and culture are reworked; the one can no longer be the resource for appropriation or incorporation by the other. The relationships for forming wholes from parts, including those of polarity and hierarchical domination, are at issue in the cyborg world. Unlike the hopes of Frankenstein's monster, the cyborg does not expect its father to save it through a restoration of the garden; that is, through the fabrication of a heterosexual mate, through its completion in a finished whole, a city and cosmos."[7] Artists like Ilka Halso and Patricia Piccini have also challenged the convention of the

The Probiotic Tower by Design & More in Cairo. Indivisibility of Ecology and the City

Oystertecture by SCAPE Studio, presented in the Museum of Modern Art New York, exhibition “Rising Currents: Porjects for New York’s Waterfront” 2010

pristine garden through the hybridisation of technology and nature, often creating uncomfortable and disturbing images of the world we may be creating. But in the praxis of recent architecture and urbanism, several projects provide real examples of what that hybridisation may look like for architecture, landscape architecture, and urbanism. A number of urban masterplans and infrastructural urban landscapes begin to highlight the potential for cyborg landscapes that use the utility of natural systems to deliver infrastructural outcomes that shape cities.
Several recent examples of such hybridised ecological and technological landscapes include projects like:

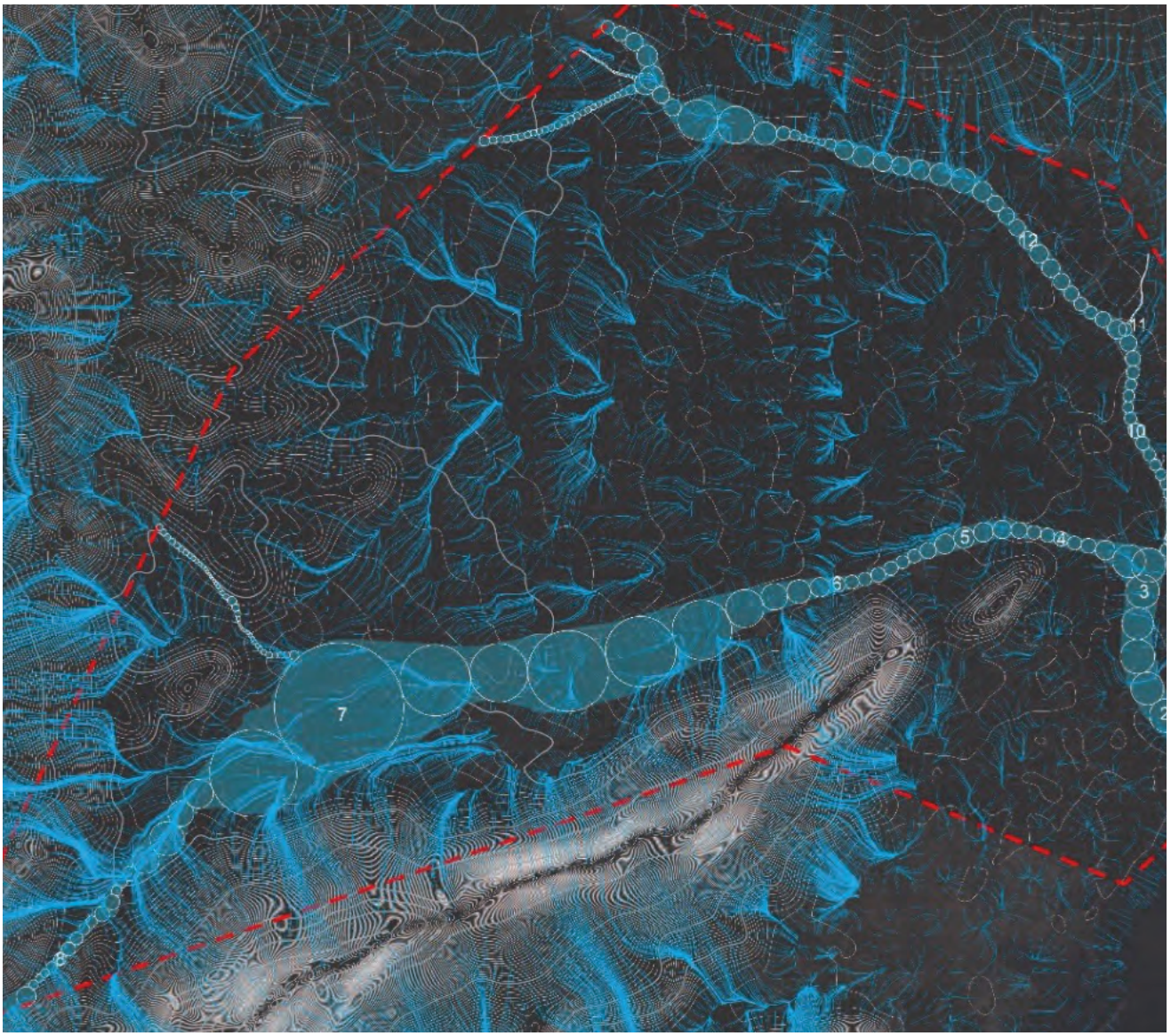
- The Big U in New York, by BIG, which aims to create a grand public park along Lower Manhattan shores that also serves to protect all of Lower Manhattan from Storm Surges like Superstorm Sandy;
- Qianhai Water City, China, by JCFO, which uses several constructed wetland fingers and marine structures to form the basis of the entire masterplan and create a system that significantly cleanses the entire bay upon which it sits;
- Self Sufficient City in Jakarta by WoHa[8], which conceived of a new town in northern Jakarta to house 210.000 people on a 730 hectare secondary forest. The use of a three dimensional master planning approach was adopted to create a tropical “eco-town-in-a-forest”, retaining over half of the existing green landscape and achieving self-sufficiency in energy, food, and water; and
- Oystertecture in New York by Scape Studios, which deploys artificial oyster reefs to regenerate and clean the heavily polluted New York Harbour and eventually provide a previously native source of food.



To a degree, this approach has been elaborated through a rubric of "Hedonistic Sustainability" by the Bjarke Ingels Group, which challenges the idea that utilitarian infrastructure can't be an important part of architecture and urbanism.
Many of these examples highlight the connectedness of urbanism and natural systems in which buildings are conceived of and shaped by new urban ecologies that are purposely infrastructural and productive. Using the loose organisational dynamics of ecology allows for a more emergent and adaptable kind of urbanism that is particularly important for a warming world. In recent years, this potential for adaptive systems has been made significantly more attractive by the possibility of funding through sustainable finance structures such as carbon credits and Payment for Ecosystem Services (PES) systems. Coupled with approaches such as Natural Capital Accounting (NCA), we are seeing the emergence of a potential new standard of performance that compels urbanists to think ecologically and provides an economic value and funding of ecosystem services.

Methodology: Applied Research on Case Study Projects

The conceptual drivers outlined in the preceding sections have been interpreted by the author in a series of projects spanning over the last 15 years, some of which were realised and others not. Included in these are the following summarised projects, which explore a number of aspects of ecological urbanism: In the Active, Beautiful, Clean Waters (ABC Waters) Programme, a masterplan initiated in Singapore 2006[9],the restoration of all waterways in terrestrial Singapore was conceived to deliver a strong ecological and hydrological function while providing



Watershed flow simulation of the Bogacay basin and parametric order of operations diagram. Research led by the author while at Perkins+Will

potable water systems, open spaces, and ecosystem services as well as to create development opportunities for the city state. By expanding the conceptual scope of urban waterways to be both ecological and urban, the project redefined the potential of ecological thinking in the city. Much of this has been realised in pursuit of a water self-sufficiency strategy for Singapore.

Similarly, in the masterplan 2013 for the Abu Dhabi Airport Business Park in the United Arab Emirates, the connections between distinctly urban areas, open areas of the airport, and the surrounding areas were cast as a solution to urban and landscape problems inherent in business park typologies. Where an extensive landscape structure shaped four business districts around the airport and connected them through a landscape that delivered biofuels for planes, water cleansing through constructed wetlands provided food through aquaculture and terrestrial ecology and supported a biodiversity network. In the masterplan for the Qatar Science & Technology Park (QSTP) inaugurated in Doha 2009, the landscape systems on the site shaped the urban development and provided significant biomass, food, wastewater processing, building materials, and energy harvesting. In Southern Turkey, the environmental systems of the city became the basis

of the city planning framework and created the armature of experiential loops in the city. The 2016 Bogaçay Creek Masterplan for Antalya in Turkey featured a hydrological framework which provided the basis for an urban plan addressing all of the environmental and infrastructural needs of the city and its future expansion. In 2019, the Plus Urbanism masterplan project explored the evolution of that system in a very large regional scale that could deliver more energy, water, food, building materials, carbon sequestration, and employment opportunities than was required for the development. Using regional acupuncture approaches, the developments of this future city were embedded within regional ecologies and worked symbiotically with enhanced ecosystem services to realise a fully self-sufficient city that went beyond net zero. At the same site in 2021, the system was extended into the realms of a digital twin NCA framework in GIS, delivering a landscape strategy and guidelines that resulted in an engineered and quantified net zero approach for the Plus Urbanism site and demonstrated its achievement through a digital twin, which was also linked to securing sustainable finance mechanisms. In doing so, it demonstrated a link between ecological urbanism and climate change adaptation and mitigation that can move beyond developer or national interests.

The Journey Towards the Cyborg Landscape

The findings of these methodological explorations and case studies do indicate a trajectory towards the achievement of cyborg landscapes that can address climate change. These were made possible and achievable by employing methods that may be described as ecological urbanism combined with the potential agency of climate Finance. Whilst they do so, the proof of the concept of many of these schemes is yet to be delivered as a developed place and generally exists as a series of digital models. Therefore, the greatest challenge is yet to be met – that of turning the vision of the research into a built form that delivers on a negative emissions scenario.

1 IPCC (2018), Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

2 c.f. King, Stephen: On Writing, A Memoir of the Craft. New York 2000, p. 222

3 https://www.britannica.com/art/landscape-architecture (download Feb. 17, 2024)

4 Boivin, N. L., et. al.: “Ecological consequences of human niche construction: Examining long-term anthropogenic shaping of global species distributions” in: Proceedings of the National Academy of Sciences in the United States, June 7, 2016, 113 (23), pp. 6388-6396. https://www.pnas.org/content/113/23/6388 (download Jan.10, 2022).

5 Read, Stephen: “Thickening the surface – or, what is an ‘ecological landscape’ exactly?” in: Kerb Journal, 15 (2007), pp.197-200.

6 Van Mensvoort, K; Grievink, H.-J. (eds.): Next Nature: Nature Changes Along with Us. Barcelona 2012

7 Haraway, D. J.: “A Cyborg Manifesto”. New York 1991. Pp. 149-181 https://www.faculty.umb.edu/gary_zabel/Courses/Art%20and%20Philosophy%20in%20SL%20and%20Other%20Virtual%20Worlds/Texts/cyborg_manifesto.pdf (Download Feb. 17, 2024)

8 c.f.: Bingham-Hall, P.; WOHA Architects: Garden City Mega City: Rethinking Cities for the Age of Global Warming. Balmain Australia 2016

9 https://info.pub.gov.sg/abcwaters/about (download Feb. 17, 2024)

Museum of Nature

"This series is the next step in a continuum of imaginative nature restoration projects.
The 'Restoration' series was about restoring single objects of nature by means of technology and building skills. The museum project takes this one step further. Restoring nature is not enough. Nature as it is needs to be protected and musealized with all resources available.
In my project I visualize shelters, massive buildings where big ecosystems could be stored as they are found today. These massive buildings protect forests, lakes, and rivers from pollution, climate change and, more importantly, they protect nature from the consumption of man himself. The project is based on a pessimistic vision of what is happening on earth. I am looking into the future, and it does not make me very happy.

Works are visualized building plans, plans I would rather not see realized. When putting nature into a museum, you have to take into consideration that museum guests are consumers. In order to protect nature from consumption and erosion, the audience must be separated from actual nature and experience must be based on visuals and simulations. With a little help from architects and engineers, a beautiful natural place, waterfall, or old tree turns into a meditative theatre show. Attention and appreciation of the audience is heightened through collective experience.
As in the work 'Rollercoaster' the nature path could be combined with amusement park equipment, and a trip to nature becomes a head shaking joyride. Nature stays intact, except maybe for some noise problems."
– Ilkka Halso

© Ilkka Halso: Rollercoaster, 2004

© Jonas Papenborg & Remco van der Togt, 2012

Landscape Machines. A Future-Native Design Attitude

Three discussion topics to help improve human-nature-technology relationships

Paul A. Roncken

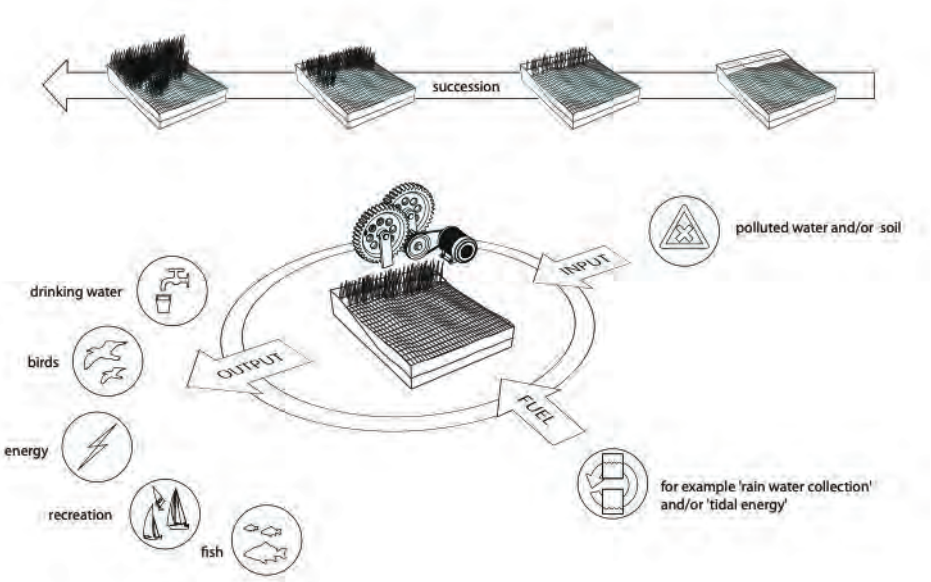
Cyborg Landscape = blend of native + advanced technology = future-native

"The optimized nature of nature" is a powerful statement to question ideas about technology and landscape architecture. As Udo Weilacher articulated during the Cyborg Landscape conference at TUM in October 2023, he is afraid that "what has gotten us into this mess, cannot be the solution to get us out"[1]. This "mess" is our human contorted and oftentimes devastating relationship with nature. I agree with Weilacher that we must indeed be very careful with technology, particularly if it becomes so complex and automated that we are no longer its puppeteers but are enslaved by it. And is artificial intelligence not a further enhancement of a fundamental displacement with nature? On the other hand, technology is a unique component of our human nature, and it ought to be as life confirming as other types of nature can be. What type of technology improves our human nature to benefit the whole of nature? That is the central question when exploring Cyborg Landscapes.

The right technology ought to be different from the just-in-time delivery of most of today's technologies. For example, a supermarket with daily refreshments of goods will falter within two days if no new supply has arrived. But natural systems are not so easily toppled. There may be plant communities that will collapse if flooded for ten days in a row, yet there are also systems that can cope with stress for up to decennia and longer. Natural systems can deal with stress and disturbance much better than any technology we currently have available: just-in-time smart storm water engineering, micro dozed fertilizers to improve poor soils around the globe, and automated atmospheric sprays to reflect sunlight in cities with heath stress. Such Cyborg landscapes must operate within sharp boundaries that need vigilant control by either human or artificial supervision.

What design attitude?

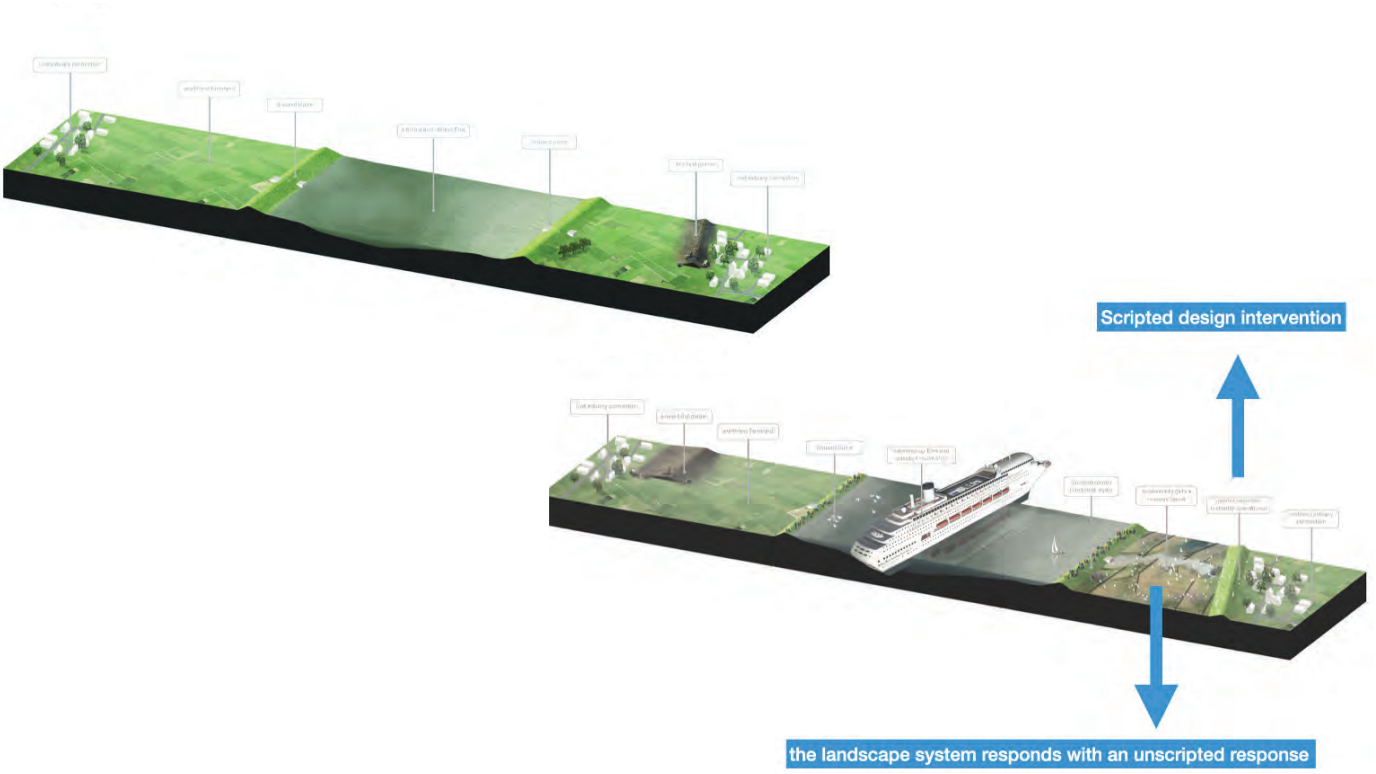
Landscape architects and designers have long been altering riverbeds and the growing conditions for plants, and they have made the most remote and unexpected environments accessible. For



Schematic display of the process-related organization within a Landscape Machine

a long time, the designerly purpose has been to provoke a sense of beauty and enthusiasm for the wonders of nature, "that kind of beauty which is agreeable in a picture."[2] Yet today, due to a more urgent environmental agenda, a well-designed and performative landscape in terms of climate responsiveness could very well be "a little ugly on the side". Once central, an artistic liberalism in landscape design is now exchanged by more pressing needs to navigate humanity through the challenges of the Anthropocene. The design of Landscape Machines focusses not on the pictorial effects of landscapes on human perception, but on humans as the biggest stress-inducing actor in natural systems. Any landscape design intention is aimed at incorporating a certain level of stress into an ecological system which is simultaneously strengthened in its regenerative capacity to deal with such stress. The scale of "the machine" is as large as a natural landscape that is "operated" by large-scale natural system interactions and ecologically driven succession. Landscape Machines need only to be designed in the initial phase and will then continue with an open-ended development over a period of at least 20 years. Seeds take root and become vegetation, animal species discover new habitats and help to shape them, humans discover interactions and yield that will help to regenerate the whole system. Described in terms of technology, it is smart and intelligent, similar to what is referred to as "general (super) intelligence" and to the existence of a generic protocol algorithm that is able to machine-learn itself into unforeseen directions. However, the algorithm for a Landscape Machine is not what needs to be designed, because that algorithm is already included in the life-giving properties of natural interaction, succession, growth, decay, and circularity.[3]

The general idea of the Landscape Machine is to develop a new kind of semi-wilderness, a marriage between human intervention and natural response. The area must therefore be made suitable to accommodate both agricultural yields and ecosystem regeneration. The physical



Crossection of the Ems delta and the introduction of a new dike and a tidal polder (left) Schematic image of the dynamic development of a "resetting" polder every time a ship passes (right)

performance is mechanized by natural processes such as evaporation, tidal fluctuation, and groundwater seepage. The harvest consists of crops and animal populations and of resilient systems to cope with a new climate regime. The most resilient systems can, in the end, even act as cleansing facilities for polluted soil, water, and air.
There are four rather simple requirements to permit the development of a wide variety of Landscape Machines.[4]

Design of the Scripted, Response by the Unscripted.
A Landscape Machine consists both of a series of scripted design interventions and one of unscripted system responses. After an initial script, the way the landscape system reacts is the unscripted response affecting the initial script.
The development over time of scripted interventions and unscripted response is what constitutes the whole of the Landscape Machine: slowly colonized by minerals, microbiomes, plants, and animals in reaction to a series of shifting landscape performances. Every Landscape Machine is initially a "young landscape" passing quickly into juvenile phases.

Critical Fremdkörper Stress
A Landscape Machine is a performing landscape in which a host landscape is provoked into new system responses; it is regenerative. The source of the provocation is best described by the German word *Fremdkörper*. *Fremdkörper* are either technological, chemical, or geo engineered elements within the landscape that are non-endemic and thereby stimulate systemic responses. The artificially introduced *Fremdkörper* are designed to cause a critical level of system stress. The main design effort lies in the determination of critical levels of response through which a landscape will start to adapt, but not to cross over system boundaries or tipping points and topple the whole system into a new dynamic interaction. The "aroused landscape" is regenerative through a variety and amount of food, chemicals, offspring, resources, energy, et cetera.

Metabolism Rhythm Bookkeeping
The development of the Landscape Machine will initially increase in complexity as there are continuous interactions affecting the shape, scale, and position of components within the

landscape. Typically, change occurs according to a seasonal or climate change related rhythm. Any harvesting of crops, fresh water, cleaned soil, or animal stock is an additional disturbance to the system. The introduced conditions need to be quantified and qualified to describe the material interactions, the metabolism of the system. A bookkeeping model is needed to account for all the inputs and outputs throughout the system. The functionality of the design is thereby expressed in the form of input/output ratios for both the quantitative and qualitative aspects of the system, providing a means for evaluating performance. The quantitative aspects include amounts of water retention and waste decomposition. The qualitative aspects include chemical composition, species capacity development, and physical and mental well-being. Such a bookkeeping could co-evolve with the use of certain artificial intelligences, digital twins, and various monitoring measurement systems.

The Meaning of Nature is to Grow in Abundance.

The overall development process of a Landscape Machine can be simplified by breaking it down into four stages: an initial stage, a growth stage, a yield stage, and a steady state stage.

During the initial stage, an intervention is made in the host-landscape, as well as the introduction of one or more Fremdkörper. The growth stage, under the influence of

Development of sustainable nautilism on the basis of century-old sailing tradition and the introduction of new-native elements (Fremdkörper): recycled from oil rigs in a 300 kilometres range from the coast that allow animals, plants, and minerals to increase biodiversity as part of a regenerative recycling. Resulting in a new-native underwater biotope with attention to a ‘larger audience’, a post-humanistic design attitude to design for the well-being of other than human life forms.

various interacting parallel successions, is transitional. During the yield stage, the Landscape Machine will provide a substantial amount of harvest that can be regarded as ecosystem services and goods, as long as the system is regenerating more “life” than in the initial stage. The final steady state stage is the ideal state of the Landscape Machine, because the continuous harvesting of products coincides with continuous shifts within the landscape adapting to changing (micro) climate conditions, while an abundance of biodiversity is maintained. Ilya Prigogine, Russian-born French chemist and Nobel Prize winner in 1977, formulated the concept of dissipative structures to define systems characterized by their ability to organize themselves into coherent forms or structures and maintain them over time, for example in a steady state. Dissipative structures are thermodynamic systems, open to energy and matter, that self-organize towards higher degrees of complexity and organization.[5] Mangrove forests, wetland systems, and highland peatlands are all examples of dynamic steady state systems. A simpler version of such a steady state is agriculture according to permaculture principles such as food forests.

Discussion

There are some implications for the “optimized nature of nature” by means of technology included in landscape architecture.

1. A return of the native

It is not a surprise that due to the increasing presence of (artificial) technology and the magnitude of the impact on planetary climate stability, there is an equally strong response of a “return of the native”.[6] This describes the preference for a simple life, away from busy and stressful urbanity, but also a recognition of the rights of Gaia and nature. In ecological or biological terms, the word “native” indicates those plant and animal species that have co-evolved with environments well enough to withstand many of the challenges as climate regions change. The question of what is native and what is not is a dynamic one. It is very probably a wicked problem without any

Thijs de Zeeuw is diving into his park for the Eel in the Amsterdam Harbour stating ‘we have a new relationship with the Eel’. Introducing unfamiliar, performance-related landscape conditions that allow both the designer and spectators to experience new levels of intervention and gradually evolve and change their habitual aptitudes and interpretations. Photograph by Maartje Geels, 2020.

final resolution. Designers have remarkably often taken the lead in cultivating a new kind of native culture, a future native, a more direct involvement with the land and a circular economy; better for soil and water and material flows, better for equal distribution of resources in a regional economy. The challenge of defining a fitting Cyborg Landscape in terms of a return of the native is to keep focussing on that type of technology that allows a co-evolvement with the landscape itself.

2. Designing for and tuning in with a larger audience

Landscape Machines can be regarded as environments in which all audiences, including humans, minerals, microbiomes, animals, and plants are deliberately estranged and teased into new performances, not in order to optimize nature according to what we know about it as a dynamic system, but rather to regenerate the unknown unknowns. This introduces unfamiliar, performance-related landscape conditions that allow "a larger audience" to experience new levels of intervention and gradually evolve and change their habitual aptitudes and interpretations. It will be relevant to invest in those types of technology that allow an increase of our human interaction within a larger audience.[7]

3. Sustainable is not enough, regenerative

is probably better, but still better is ... (?)

In his article "What do we mean by 'sustainable landscape'?", Paul Selman discusses that "on occasion, it [ed. sustainable landscape] may involve recreation and rewilding to promote a 'future nature' across extensive areas and habitat networks, resulting in landscape systems sufficiently large and intact to be autopoietic, self-sustaining, and adaptable to climate change."[8]

Yet I am inclined to follow the famous statement by philosopher Bruno Latour: "There is no Earth corresponding to the Globe".[9] Our ideas about the benefits of globalization in trade and political treaties and climate control are ideas that will be needing more than one planet. In other words, one planet for a successful rewilding programming and three planets for our human needs. Sustainability as a frame for better technology is not good enough. Regeneration is better because it at least aims at reviving a life-giving capacity that has been damaged. Still better would be something for which we have no words or technology yet; it must, however, fit that one earth.

1 Weilacher, Udo: Introduction to 16th Weihenstephan Forum 2023: https://www.youtube.com/watch?v=hxis9Brl4r4 (February 3rd 2024)
2 Gilpin, William: An Essay on Prints. London 1768, p.2
3 c.f.: James Corner: "Terra Fluxus" in: Waldheim, Charles: Landscape Urbanism Reader. by New York 2006, p. 21-34
4 Examples of various Landscape Machines: https://paulroncken.com/landscape-machines/ (February 3rd 2024)
5 c.f.: Prigogine, Ilya; Stengers, Isabelle: Order Out of Chaos: Man's New Dialogue with Nature. London 1984
6 Hardy, Thomas: The Return of the Native. London 1878
7 see: Bridle, James. Ways of Being. Animals, Plants, Machines: The Search for a Planetary Intelligence. New York 2022
8 Selman, Paul: "What do we mean by 'sustainable landscape'?" In: Sustainability: Science, Practice and Policy, Volume 4, 2008 – Issue 2; p. 27
9 Gertenbach, Lars; Opitz, Sven; Tellmann, Ute: "There is no Earth corresponding to the Globe": An Interview with Bruno Latour. In: Soziale Welt, 67. Jahrg., H. 3, Themenheft: Bruno Latours neue politische Soziologie (2016), pp. 353-363

Naturale

“This series shows an even more dystopic view on nature. What is happening? Has nature been evacuated to await better times, or has it been chopped and simplified into transportable merchandises and items of decorative tableaux? Whole ecosystems have been harvested and collected in a gigantic warehouse. Elements of nature are arranged in city-like blocks in strict order. Objects of nature have been rethought and have, for logistical purposes, been packed into modules that are easier to handle and transport. Different items of nature from soil to vegetation can be easily collected, transported, and assembled into new working ecosystems. Just like in IKEA: collect it from shelves and assemble at home.”
– Ilkka Halso

© Ilkka Halso: Boulder corridor, 2011

The Living Landscape in Anthropocene

Regeneration, Information and Resilience

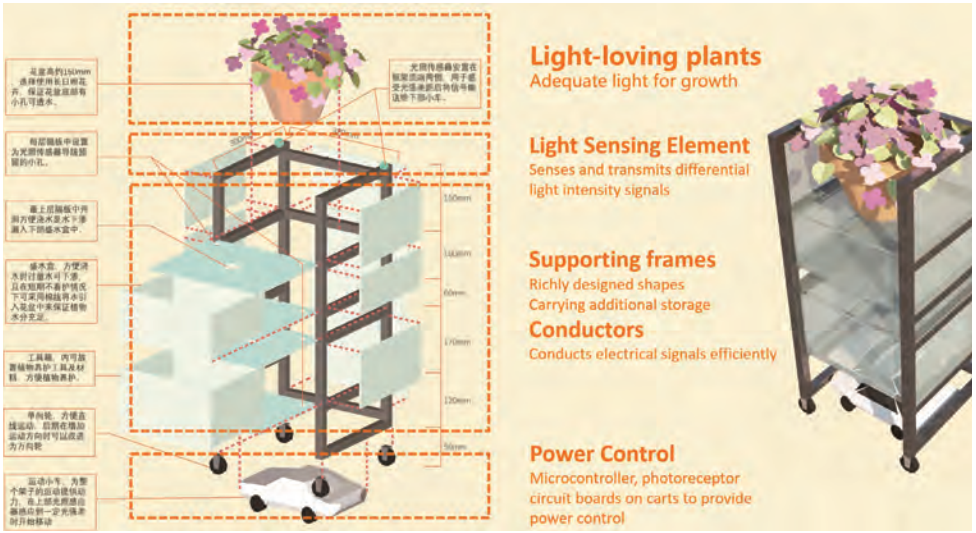
Dai Daixin
Jialing Zhang

In 1960, Manfred E. Clynes and Nathan Kline introduced the concept of the Cyborg – an abbreviation for cybernetic organism. According to their definition, "The Cyborg deliberately incorporates exogenous components extending the self-regulatory control function of the organism in order to adapt it to new environments."[1]
Cyborg appears to amalgamate two seemingly contradictory notions. However, upon delving into the definitions of "cybernetics" and "organisms", one can discern the semantic overlap between these two terms. Cybernetics pertains to the study of automatic control and communication functions found in both living organisms and mechanical or electronic systems.[2] This means that cybernetics exist inherently within organisms. While the cyborg concludes semantic repetition, it may appear nonsensical. However, its function extends beyond that. According to Elisabeth K. Meyer, the concept of the cyborg disrupts entrenched dualistic thinking. Examples include the dichotomies between culture and nature, art and ecology, and humanity and nature.[3] At its core, the cyborg embodies the fusion of technology within the inner workings of natural processes. It encompasses not only natural occurrences as a foundation, but also technological tools that derive from human ingenuity.
Regarding the definition of a cyborg landscape, a clear and unified explanation has yet to emerge. If we understand the cyborg to be a cybernetic creation, a hybrid of machine and organism, then urban infrastructures can be conceptualized as a series of interconnecting life-support systems.[4] From the perspective of systemic thinking, conceptualizing the cyborg could be a landscape-making practice that promotes feedback loops and agency, whereby humans, animals, plants, inorganic matter, and biosphere processes create a network of actors and relationships that are mutually dependent and constantly changing.[5] In general, The landscape cyborg represents a blend of human and non-human natural processes, of the mechanical and the organic[6].

Three lexicons

In the discourse surrounding the cyborg landscape debate, the focal point revolves around the relationships between humans, nature, and technology. These elements coexist symbiotically, and within the realm of landscape architecture, we can discern the following three distinct lexicons.

The Landscape Heritage Conservation Framework was developed by the LandscapeInLab team of Tongji University to support the protection of Chinese historical sites.



Self-reliant small potted plants, capable of independent movement

Natural and human: Infrastructure

The word "landscape" originates from the Middle Dutch "landscap", consisting of two parts: "land" and "scap", where "scap" represents "-ship" with the meaning of condition.[7] Originally, "landscap" referred to a "painting representing an extensive view of natural scenery".[8] In the first lexicon, humans integrate constructed spaces into nature, and this combination of nature and human intervention constitutes the landscape. According to J. B. Jackson, "[...] we will eventually formulate a new definition of landscape: a composition of man-made or man-modified spaces to serve as infrastructure or background for our collective existence".[9] Human technology should be involved in specific cycles within nature, ensuring its assistance is endogenously derived to increase the organisms' abilities to acclimate to new environments.

Nature and Technology: Responsive Landscape

The relationships between humans, technology, and nature are complex and nested. Humans originate from nature, and technology arises from humans. In the second lexicon, namely the responsive landscape, technology's role is amplified, while the human role becomes more closely intertwined with nature. "Responsive" denotes that an object engages in a process of feedback, a conversation between two actors[10]; hence, the responsive/interactive landscape aims to optimize technological outcomes for interaction with natural processes. In a project at Tongji University in China, students developed "self-reliant small potted plants" which were capable of independent movement. A pot containing a light-loving plant sits atop a supporting frame equipped with light-sensing elements on its sides. The movement relies on these sensors detecting varying light intensities and relaying these signals to a toy car positioned at the base of the support frame. Upon receiving these intensity differences, the car initiates movement.

Nature, Human, and Technology: Cyborg Landscape

In recent decades, many scholars have advocated for a "living" interpretation of technology, suggesting that it embodies life processes.[11] Life, definable by characteristics including the capacity for growth, reproduction, functional activity, and continual change preceding death, distinguishes animals and plants from inorganic matter.[12] According to Brian Arthur, technology is also a life entity capable of reproduction; all technologies stem from others which already exist, implying that combinations of current technologies pave the way for new advancements.[13]

Our exploration of life's meaning aims to deepen our understanding of technology. With the continuous evolution of technology, including the currently popular AI technology, the identity of technology is quietly shifting. In other words, technology and life are intertwined and mutually embedded. Technology assemblages, mediated through human inventors, construct themselves much like coral reefs do through tiny organisms.[14] Therefore, within the third lexicon, the Cyborg Landscape is a living landscape.

Intelligent Technology and Landscape Regeneration

Through the analysis of the above three lexicons, we can clearly see that today's technology is no longer just cold machinery; it fulfills the autopoiesis cycle within living forms. Therefore, today's designers first need to uphold a regenerative worldview. Regenerative design means replacing the present linear system of throughput flows with cyclical flows at sources, consumption centers, and sinks.[15] According to the American landscape architect John Tillman Lyle, regenerative design strategies advocate for a natural leading role, viewing design from a systems perspective. Designers integrate nature into design decisions rather than isolating it, and at the same time, nature serves as a model and as context. This implies that designers should have a comprehensive understanding of the internal cyclical patterns in design and incorporate technology when necessary. Additionally, using information to substitute for energy can provide more diversified directions for design development. Designers consider the system, utilizing storage as a key to guide the constantly changing flows and processes within it, rather than focusing merely on a frozen moment in nature. The following three programs of "LandscapeInLab" at Tongji University demonstrate the integration of human, nature, and technology.

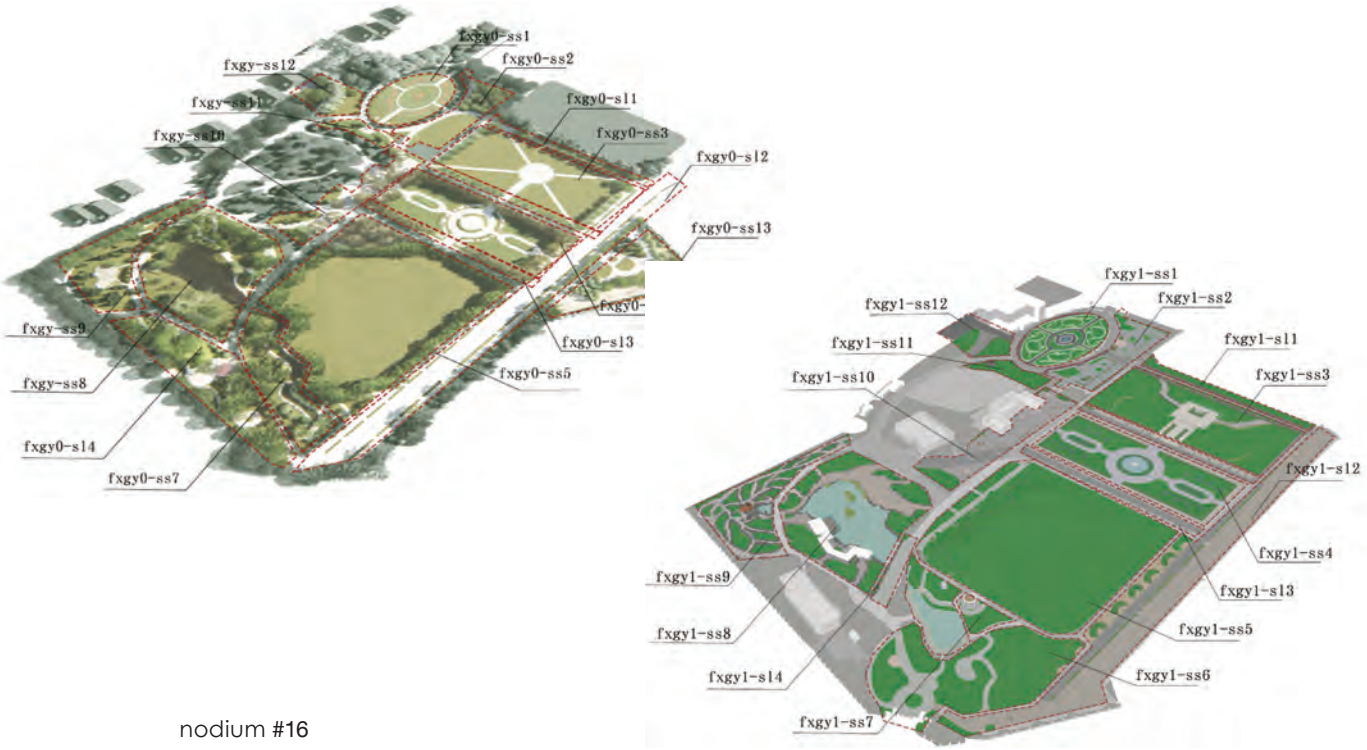
Zero waste design

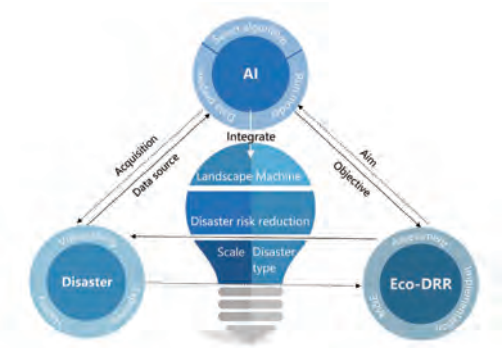
Zero-waste design theory, including prototype and industry chain, was obtained through qualitative text analysis. The team has also developed the zero-waste design intelligent auxiliary system. This contains rapid status assessment, the intelligent decision of the zero-waste scheme, comparison and optimization of the zero-waste scheme, and zero-waste performance evaluation.

Theory & Practice of Landscape Heritage Conservation

In the realm of regenerative design, technology indubitably plays a crucial role. Environmental issues can be effectively addressed through technological means, such as water, energy, and waste management. However, regenerative design methods are not solely confined to these aspects. The LandscapeInLab team put forward a "Landscape Heritage Conservation Framework" to protect many Chinese historical sites. Combining the central ideas of regenerative design, the flow of information serves as the foundational logic within the framework, while public participation completes the actual implementation. A representative example here is Fuxing Park in the Huangpu District of Shanghai. To conserve it, the first task was the digital reconstruction of the park, followed by the information model.

Restoration model of Shanghai Fuxing Park 1925-1935 (left)
Shanghai Fuxing Park 2008 Status Model (right)





The framework of AI technology in Eco disaster risk reduction (Eco-DRR)

By modeling relevant survey information from the site and importing the model into different software (Autodesk Revit) based on management intensity, the team obtained precise information about Fuxing Park, such as landmarks and botanical records; the information will be applied to the Shanghai historical parks information platform.

Eco-DRR Procedure
(Eco disaster risk reduction)

In another project by the LandscapeInLab team called Eco-DRR, AI technology integrates landscape with machines for disaster risk reduction. Through Eco-DRR procedure, the aim of AI can be determined so that it can learn from the disasters. In turn, AI can achieve the goal of Eco-DRR.

Conclusion

Cyborg Landscape promotes a more systematic and dynamic approach for designers to integrate nature and design. At a time when technology is evolving so rapidly, the point is not whether we should possess technology, but whether we should accept a cold, will-less technology or embrace an organic, life-sustaining one. The first two lexicons integrate technology more into people or nature, while the third lexicon, more in tune with the present, singles out technology as a separate entity. Next, technology should be a means to help people better adapt to nature. Understanding the endogenous laws of nature and matching them with appropriate technologies is crucial. Of course, in the future, nature and technology will only become more similar. The more natural the technology, the more the landscape becomes “unnatural”, realizing the cyborg landscape.[16]

1 Manfred E. Clynes and Nathan S. Kline: “Cyborgs and space” in: Astronautics. Issue 13/1960; p. 27
2 https://www.dictionary.com/browse/cybernetic (14.10.2023)
3 cf. Elisabeth K. Meyer: “THE EXPANDED FIELD OF LANDSCAPE ARCHITECTURE” in: GEORGE THOMPSON / FREDERICK R. STEINER (ed.): ECOLOGICAL DESIGN AND PLANNING. New York 1997; pp. 45-79
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© Ilkka Halso: Kitka river, 2004

“When I started to work with the Museum of Nature series, the work ‘Kitka River’ was one of the first clear ideas I wanted to realize. It took about three years to finish the final picture. That time included lots of planning and learning to use 3D-modeling programs and two trips to Kuusamo to photograph the place. Two to three months of working with computer. One month when my computer was rendering pictures of constructions itself. The basic idea was to cover some large forest or entire ecosystem with a roof to protect it from pollution. When I was trying to find a suitable nature setting for that idea, I saw a postcard of Kitka River and I was sold.”

Ilkka Halso

Smart Nature

Will AI support or hinder social and ecological resilience?

Natalie Marie Gulsrud

The cyborg Supertrees in Singapore are highly popular among tourists but have led to the replacement of indigenous forests.

Before starting a discussion regarding smart nature and the extent to which technological advances in AI will support or hinder social and ecological resilience, we first need to know what smart nature is and who governs it. Additionally, which visions of the future are presented in smart nature? Whose sustainability gets prioritized in these visions? And ultimately how do we balance the drive for resource optimization with the imperative of realizing justice and equity? Cities have taken on a critical role in the global political agenda due to factors like urbanization and climate resilience challenges. International initiatives, such as the UN sustainable development goals[1] and Habitat III new urban agenda[2], emphasize cities as not just environmental challenges but also as places for environmental solutions. Along these lines, policy makers are calling for landscape planners and managers to develop nature-based solutions for urban climate resilience, focusing on an integrated approach that balances ecological, social, and digital methods. Urban nature, including trees, parks, and green spaces, is recognized for its multifunctional benefits, such as improving air and water quality, managing stormwater, enhancing social cohesion, and promoting human health and well-being. Additionally, policymakers are increasingly interested in "smart" urban nature that uses digital solutions to deliver

enhanced ecological and social benefits. In parallel, professionals and the public are actively employing digital innovations. Examples include autonomous lawnmowers, urban forest inventories in which tagged trees communicate data to smartphone apps, biodiversity assessments gamified for user engagement, and the use of hashtags to map citizen preferences. These technologies aim to enhance productivity, profitability, creativity, and innovation, offering intelligent solutions to critical environmental challenges. Collectively, these swift technological advancements have the potential to significantly transform landscape planning and management, potentially causing disruption in this field.
In light of the rapid advances made in AI technology, the vision of the smart city has taken on a new dimension and speed – the conversation today is not only how to make cities smart and in turn urban nature smart – but additionally, how to harness the enormous computational power of AI for urban climate adaptation. This discussion pipes into spaces of opportunity for current and future generations by calling for better and stronger decision-making tools given the massive challenges of climate change and the accompanying uncertainty. AI provides an opportunity to synthesize and analyse massive amounts of open-source data on urban natures to provide certainty in an age of uncertainty. What is promised in these initiatives such as the Climate IQ project, an AI climate risk tool for cities to advance adaptation and resilience funded by Google.org's Impact Challenge on Climate Innovation[3] , and lead by urban ecology scientists, is the opportunity to combine massive data, speed, scale, and experimentation in order to achieve technological advances. The smart city 2.0 is about data optimization and acceleration of solutions for climate resilience. In an era marked by a climate and a biodiversity crisis, these technological advancements hold promise and are spreading quickly. However, they also give rise to new types of data and social and political consequences that require further investigation. Key questions to consider are: what kind of work is being performed by smart nature? What new relational and contingent spaces are opened or closed? What are the potential implications moving forward? The advances of AI are providing novel opportunities to know more and ask more about our natural environment by synthesizing massive data from drones, sensors, and our own phones. For example, "smart forests"[4] represent a growing trend where various technologies, including drones, sensors, artificial intelligence, and robots, are increasingly employed for data collection, processing, and analysis within forest environments. These digital tools are strategically placed on tree trunks and integrated into forest soil. Forest technology includes the use of drones for tasks like tree planting and fire monitoring, sensor networks that create an "Internet of Trees" to monitor forest processes, LIDAR scanning to assess changes in forest structure, machine learning to automate responses to forest events such as wildfires, remote sensing for real-time detection of deforestation, and civic apps and platforms designed for monitoring forest conditions and contributing to reforestation efforts.
In Singapore, a different approach to "cyborg trees" has emerged through the development of "supertrees". These supertrees are essentially treelike cement structures covered with a "living skin" composed of over 200 native plant species, all controlled by photovoltaic technology. While these supertrees do not contain digital sensors, they have become iconic and highly Instagrammable landmarks in Singapore. They also exist within the realm of the Internet of Things, serving as online memories and virtual representations of real trees. In an age of rapid deforestation and urbanization, there are huge benefits associated with the technological tracking, mapping, sensing, and generation of nature, from trees to plants, soils, and water. Digitally monitored trees can more easily be given a quantitative value potentially elevating their visibility and status in the urban landscape. Digitally archived data about trees and people's perceptions of them could serve as a lasting ecological memory of biocultural preferences and knowledge. However, there are significant risks associated with assigning a higher utilitarian or economic value to certain biophysical materials over others.

For example, in Singapore, the introduction of cyborg supertrees has led to the replacement of indigenous forests, illustrating the risk that ecosystems with lower economic value might be supplanted by landscapes with a direct economic benefit.[5] Additionally, critical questions should be asked about who owns and has access to smart forest data. Ultimately, questions emerge regarding the ownership and distribution of benefits stemming from "smart nature" and the potential conflicts of interest between technology proprietors, citizens, and the public sector.

The concept of "smart" nature encompasses a fusion of the computational fabric and computational performance within the digital landscapes discussed above.[6] It reveals a profound and complex interconnectedness between machines, humans, and more-than-humans. In this context, various aspects of nature and human interaction with it are redefined and reimagined. Computational technology blurs the boundaries between sentient and non-sentient entities in landscape planning and management. It enables a reconfiguration of the landscape in a way that aligns with a post-humanist perspective, where all actors, whether they are natural elements like rivers and trees or human-made components like pipes and wires, are recognized as having equal potential agency. "Smart" nature represents a techno-ecological assemblage of code and space that profoundly alters the conditions under which social and economic relationships unfold. It invites businesses, communities, individuals, and the more-than-human world to reconsider and reorganize their operations in response to these new dynamics. However, at the boundaries of this techno-ecological assemblage, there remain unanswered questions about how the software and technology in "smart" nature impact social and material dynamics. It is essential to critically examine how these technologies determine, discipline, and, in some cases, may even discriminate in the context of urban nature planning and management. The potential consequences and ethical considerations associated with this transformation require careful consideration as we navigate the evolving landscape of "smart" nature. So, can advances in AI support social and ecological resilience and ultimately a more just and equitable future? As we move forward, it becomes increasingly vital to not only recognize the opportunities but also confront the challenges that come with profound changes, particularly with regard to the

Sculpture "Fruition" (2013) by the artist Matthew Harding in the Royal Park in Melbourne, Australia. Two giant Corten "pods" are metaphorically promising a regenerative future.

transparency, fairness, and technical control of smart nature. Smart nature is on the rise due to political demands and the push for collaborative and participatory urban development, alongside the anticipated productivity gains associated with automated resource management. However, key question remains: what can technology offer us, and who stands to benefit from it? We must critically examine technology's role in shaping the future and consider for whose benefit these advancements are intended.

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2 https://www.habitat3.org/the-new-urban-agenda (download Feb. 17, 2024) (
3 https://impactchallenge.withgoogle.com/climate2022?lang=de (download Feb. 17, 2024)
4 Gabrys, Jennifer: "Smart forests and data practices: From the Internet of Trees to planetary governance" in: Big data & society7.1 (2020): 2053951720904871; Pauleit, S., Gulsrud, N., Raum, S., et. al.: "Smart Urban Forestry: Is It the Future?" in: Chokhachian, A., Hensel M. U., Perini, K. (eds): Informed Urban Environments. Data-Integrated Design for Human and Ecology-Centred Perspectives, Berlin 2022; pp. 161-182. https://doi.org/10.1007/978-3-031-03803-7_10
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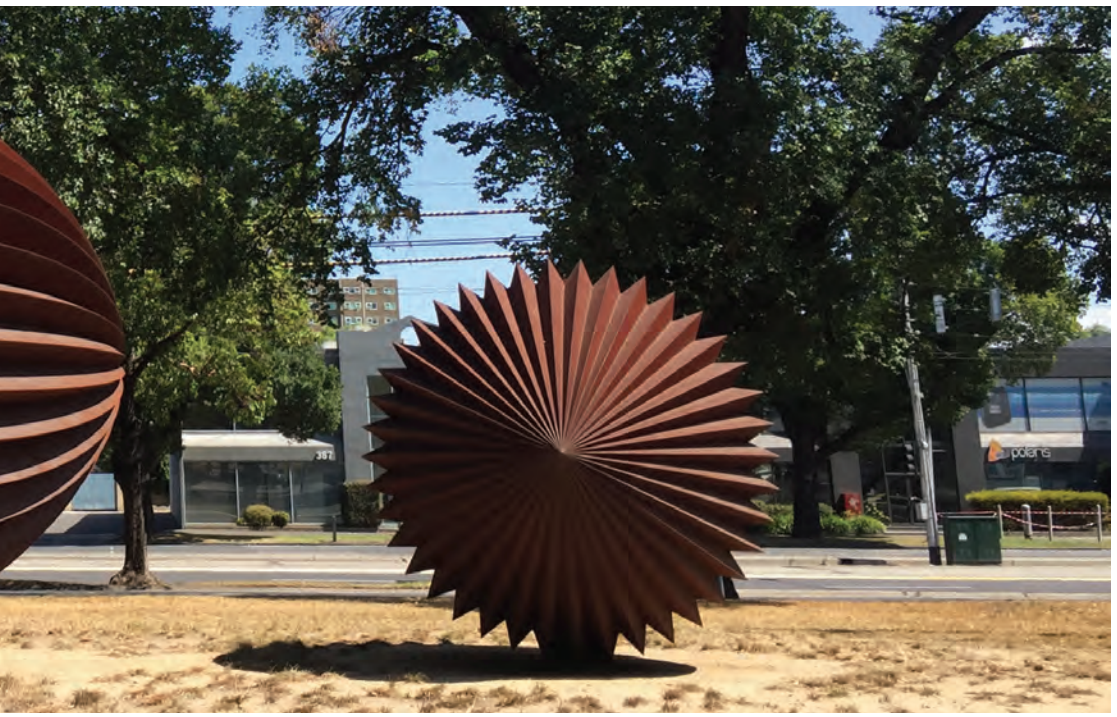

“Making nature easier to approach is not a new phenomenon. Platforms to observe nature and motorized nature trips have been part of nature tourism for a long time. In my project, I try to exaggerate the collision with nature and human consumption to an extent that reveals something profound about our relation to nature. I do aim to mimic reality as well as I can. But I think that pictures will reveal their artificial nature soon after. I think that this moment of recognition is key. Misbelief turns into anger or relief or enthusiasm.”

Ilkka Halso

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