

Exhibition
Symposium

Nature of Robotics

an Expanded
Field

EPFL
Pavilions

Amplifier for Art,
Science and Society

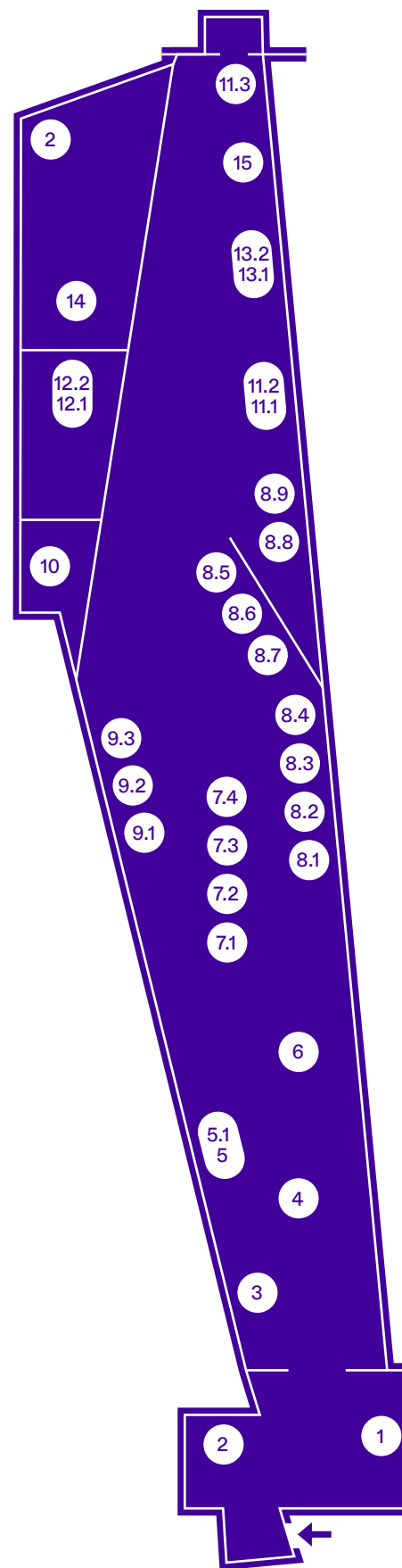
English

Guide



When the dust settles we won't
even remember the storm

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Nature of Robotics

An Expanded Field

In the winter of 2020, EPFL Pavilions is devoting its programme to the theme of robotics to instigate a thought process on the emerging perspectives and scenarios of this rapidly expanding field. *Nature of Robotics: An Expanded Field* aims to highlight the state of art of the robotics discourse today in the Swiss academic context, as well as fostering contemplation on the expansion and impact of this scientific area in our imagination and its future uses for the understanding of our environment. Through artists' works and scientific productions from EPFL laboratories, *Nature of Robotics* invites contemporary reflection on the place of artificial agents in our natural and social ecosystems.

Visions emerging from the laboratories are juxtaposed with speculative creatures, drawings, diagrams, and videos produced by contemporary artists.

Two major trends stand out in society's overall perception in the history of the development of robotics. The first corresponds to the desire to replace man with machine for the automation of tasks: the advent of robot industrial machines and automation. The second corresponds to the utopian search to produce a near-perfect being, free from biological needs: these are humanoid robots. In contrast, however, this exhibition focuses on lesser-known paradigms of this science, taking up the issues of interrelations between natural and artificial agents.

COVID-19 has introduced a novel sense of precariousness, and the role of technologies is questioned in light of a global phenomenon that challenges us at our most fundamental level. Just as Bruno Latour foresaw in relation to the ecological crisis, "the whole fabric of life"¹ is implicated in our response to COVID-19. The virus outbreak mined us first in our bodies, then in our habits, intensifying our dependence on technology for survival and communication; at the very origin of the pandemic were the consequences of our controversial relationship with the environment and the violent alteration of ecosystems. The disruption caused by the

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pandemic reframed all our concerns: on a deeply intertwined scale, animals and humans, the environment, biology and technology appear as the interdependent factors of an ongoing crisis. All are actors/agents of what could be an overcoming or even transcendence of its destructive forces.

Nature of Robotics widens the scope of this reflection, questioning robotics as a science; it reveals how technological advancements and developments are structurally dependent on a process of investigation and learning through “observation” of the natural world.

Cautious observers and inventive creators, artists and scientists explore the complexities of our biological ecosystems.

Bio, Micro, Soft, Modular, and Reconfigurable Robotics

The exhibition’s curatorial strategy is based on discussion with EPFL professors who are at the forefront of robotics, in order to understand the direction of scientific discourse today. From this initial starting point, we have proceeded to define a set of novel categories, tangential to the conventional characterisation of robotics. Keywords identified in discussions with the laboratories included “soft”, “reconfigurable”, “modular”, “micro” and “bio”.

Modular, reconfigurable, soft, micro and bio robotics manifest the emerging scenarios of a discipline facing constant renewal. As recent scientific developments show, cross-pollinations are occurring and roboticists are contributing to the conception of “synthetic organisms”, as the recently invented *Xenobot* testifies. The new paradigms of robotics are evidence of the emergence of a scientific sphere at the crossroads of different disciplines, such as robotics, computational neuroscience (which focuses on problem solving, system design or even understanding human behaviour based on the fundamental concepts of theoretical computer science), biomechanics, behavioural systems and machine learning.

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The premise for *Nature of Robotics* is to offer an unconventional look at the subject of robotics and to extend its understanding into broader notions situated at the frontier between science and the visual arts. The exhibition space becomes a platform and arena for the confrontation of different viewpoints, offering a range of perspectives in order to unpack and reflect on the new frontiers of this expanded field. Opening a realm of speculation common to scientific and artistic research, the show thus also investigates the interdisciplinary concerns of robotics today, as well as its impact on society and environment.

Thinking Through an Expanded Field

Nature of Robotics revisits the notion of the “expanded field”², echoing Rosalind Krauss’s expression “the expanded field of sculpture”, which shaped the contemporary art debate from the end of the 1970s onwards.

The notion of the “expanded field” was developed by the North American art critic to define the “turn” of sculpture precipitated by land artists and an associated shift towards postmodernism. It is employed here in order to ground a curatorial endeavour, framing robotics in environment-related thinking.

While far from a historical presentation of robotic art, the exhibition nevertheless intends to acknowledge this tradition, notably through the pioneering work of Jean Tinguely. On the one hand, his work reminds us of the tradition of machine art, and on the other inaugurates the notion of “expansion” and “environment” through a film shot in the Nevada desert in 1962, anticipating Krauss’s later theorisation.

The exhibition’s itinerary takes the visitor from Tinguely’s Nevada desert to Trevor Paglen’s Nevada sky.

In *Maybe*, Urs Fischer’s robo-snails act as an ironic and absurd counterpoint resonating with the scientific robotic models exhibited. Artistic duo Melissa Dubbin and Aaron S. Davidson’s newly commissioned work presents an installation in which computational devices

Nature of Robotics

and a tank become the environment for an artificial soft robot in the form of a manta ray. The project is developed and enriched in the framework of a remote artist in residence programme supported by the EPFL College of Humanities, in dialogue with Auke Ijspeert's Biorobotics Laboratory. Underwater creatures are also a source of inspiration for Léa Pereyre & PATHOS's organic, bio mimicking, three-dimensional forms.

Adrien Missika's *Regarde Les Mouches Voler* takes scientific observation as its starting point, staging a video of a housefly (*Musca domestica*). Jürg Lehn's *Otto*, a drawing machine, reminds us of the tradition of "robotic art" and the broader history of art and technology.

A display of scientific work from EPFL acts as the central pivot, showcasing a range of recent robotic models in an alternation of amphibious vertebrates, bio-compatible microrobots, insect-scale and modular origami robots, and their associated applications in multi-scaled environments from physiological fluids to space.

Agnes Denes' *Visual Philosophy* punctuates the exhibition space; Alexandra Daisy Ginsberg's *Designing for the Sixth Extinction* offers a view on synthetic biology; *M.A.G.N.E.T* and *New Acid*, two films recently produced by Basim Magdy, metaphorically question the trajectories opened up by scientific research. Suzanne Treister's *SURVIVOR (F)* presents visions of a post-futuristic sublime, charting an existential imagining of potential human/non-human agency/non-agency, while Katja Novitskova's sci-fi-like creatures animate the gallery, fed with imaging from the EPFL MicroBioRobotic Systems Lab. After Haseeb Ahmed's site-specific work, which creates a parallel between the global stock market and meteorological phenomena, and Claudia Comte's viscous animations, the exhibition ends with Trevor Paglen's *Untitled (Reaper Drones)*, which acts as a reminder of the involvement of robotic technologies in practices of war and surveillance.

Krauss writes on what she sees as a shift operated by land artists:

"It seems fairly clear that this permission (or pressure) to think the expanded field was felt by a number of

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artists at about the same time roughly between the years 1968 and 1970. For, one after another Robert Morris, Robert Smithson, Michael Heizer, Richard Serra, Walter De Maria, Robert Irwin, Sol LeWitt, Bruce Nauman... had entered a situation the logical conditions of which can no longer be described as modernist. In order to name this historical rupture and the structural transformation of the cultural field that characterises it, one must have recourse to another term. The one already in use in other areas of criticism is postmodernism."³

While postmodernism belongs almost to a past epoch, the notion of expansion remains valid.

Acknowledging "expansion" as a method, the exhibition explores the value of "thinking the expanded field" as a way of approaching the encounter between art and science. This notion can also be employed to understand the increasingly interrelated network of artistic and scientific discourses, as well as its connections to visions of and impacts on our environment. The narratives crossing the space lead towards the creation of such connections. Through an orchestrated sequence of artistic and scientific manifestations the exhibition thus *expands* the field of robotics to understand it as a multi-layered discipline, magnifying our observation, knowledge and imagination of environments and past and future ecosystems.

Nature of Robotics reminds us that the structural nature of any discipline, once unpacked and observed, is a permanent source of unexpected directions which gives us "permission (or pressure) to think the expanded field".⁴

¹ Bruno Latour, *A Cautious Prometheus? A Few Steps Toward a Philosophy of Design (with Special Attention to Peter Sloterdijk)*. Keynote lecture for the *Networks of Design* meeting of the Design History Society, Falmouth, Cornwall, 3 September 2008.

² Rosalind Krauss, *Sculpture in the Expanded Field*, in *October*, Vol. 8 (Spring, 1979), pp. 30–44.

³ R. Krauss, *Sculpture in the Expanded Field*, p. 42.

⁴ Cit., *Ibid.*

Nature of Robotics

Artists and Scientists

Haseeb Ahmed
Claudia Comte
Alexandra Daisy Ginsberg
Agnes Denes
Melissa Dubbin &
Aaron S. Davidson
Urs Fischer
Basim Magdy
Jürg Lehni
Adrien Missika
Katja Novitskova
Trevor Paglen
Léa Pereyre & PATHOS
Jean Tinguely
Suzanne Treister

School of Engineering EPFL

Prof. Auke Ijspeert's
Biorobotics Laboratory
(BioRob)

Prof. Herbert Shea's
Soft Transducers
Laboratory (LMTS)

Prof. Selman Sakar's
MicroBioRobotic Systems
(MICROBS) Laboratory

Prof. Jamie Paik's
Reconfigurable Robotics
Laboratory (RRL)

1

Melissa Dubbin &
Aaron S. Davidson

Delay Lines, (feedback)

2020

Water, borosilicate glass, overclocked water-cooled computer, silicone soft robot manta, temperature sensors, microcontrollers, air compressor, air control system, simulated environment, monitor, metal, plastic and power supplies. Dimensions variable. Commissioned and produced in the framework of the EPFL Pavilions / CDH AiR programme 2020. Courtesy: the artists.



Delay Lines, 2019, detail. Collection of Ishikawa Foundation, Okayama. Photo: the artists.



Delay Lines, 2019, detail. Collection of Ishikawa Foundation, Okayama. Photo: the artists.

Melissa Dubbin & Aaron S. Davidson

Dubbin and Davidson approach robotics both conceptually and materially through the many disciplines that intersect within this field of research. Developed in the framework of a remote artist in residence programme promoted by the EPFL College of Humanities, the installation *Delay Lines, (feedback)* is a new, site-specific variation of the work begun in the context of *IF THE SNAKE*, the Okayama Art Summit 2019.

For *Delay Lines, (feedback)*, the artists focused on the biomimicry involved in the development of soft robots, and how humans relate to these soft forms. The robotic creature was developed in collaboration with the Okayama University System Integration Laboratory, which produced one of the first soft robotic manta rays 13 years ago.

In *Delay Lines, (feedback)*, Dubbin and Davidson's knowledge in the field of soft robotics is enriched by data developed in collaboration with Professor Auke Ijspeert's Biorobotics Lab. The visualisation explores the relationships between the manta and the simulated virtual environment.

This project is also a material transformation study on silica. Scientific

glassware typically found in laboratories is combined with glass forms to transport water through a series of pathways.

This organism of glassworks is connected to a computational device. Simulations of an underwater world are affected by the computer's temperature as well as the movements of the manta. This warmer water becomes an environment for an artificial manta ray housed in its amniotic world, coupling organism and machine, chip and fetus.

Melissa Dubbin and Aaron S. Davidson's work has been described as addressing processes of transmission and reception and interference and transference, often seeking to materialise immaterial or ephemeral states of matter (sound, light, air, time). They have co-created a body of work including forms, objects, images and experiences, and incorporating the mediums of photography, video, sound, performance, sculpture and artist's books.

Recent exhibitions include: *IF THE SNAKE*, Okayama Art Summit, Japan (2019); *Six Degrees of Freedom* at Untilthen, Paris (2017); *Poétique des sciences*, Le Fresnoy, Tourcoing, France (2017); and *Nobody Shoots a Broken Horn in Early Spring* at Campoli Presti, Paris (2016).

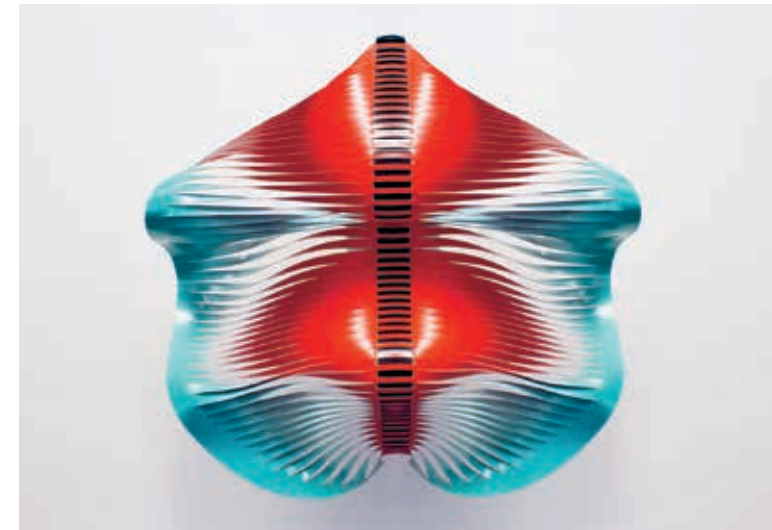


Delay Lines, 2019, Collection of Ishikawa Foundation, Okayama. Photo: Ola Rindal.

Léa Pereyre with PATHOS, Wyss Zurich

Anima I 2019

Personal exploration animated by PATHOS robotic tools. Paper & PATHOS animation modules. PATHOS: Poetic Animatronics Through Hands-On Systems. Wyss Zurich (UZH + ETHZ), ETH Zurich, Gebert RUF Stiftung, Faulhauber Minimotor Sa. Courtesy: the artists.



Anima I is an early exploration of how the field of robotics can be used as a medium for personal expression; it can be employed as a neutral, flexible, robust tool for crafting a subjective aesthetic language – both in visual form and motion qualities. Through an animatronics platform developed by PATHOS Lab, Wyss Zurich (ETHZ + UZH), this 'creature' demonstrates how to open up access to physical animation through intuitive interfaces. It allows non-technical people to immediately begin to sketch and build an affective language of movement and response, within the realm of their own visual sensibilities. Conceptualised by Léa Pereyre, this oval-shaped sheet of paper is transformed into an organic, bio-mimicking, three-dimensional form. A precise geometric system of searing and twisting the surface imparts both structure and flexibility to the material, making it ripe for animation and a rich, moving visual experience. The colour palette and light reflections are inspired by underwater creatures, as is the built-in self-defence mechanism:

when danger is close, it becomes flat, resumes its non-living abstract shape and appears immobile. *Anima I* is the first of a series of living expressions that work towards building an infinite lexicon of nuanced, poetic physical behaviours that can be applied to inanimate objects.

Léa Pereyre holds a bachelor's in industrial design from the Ecole Cantonale d'Art de Lausanne (ECAL), 2015. She worked for four years as a drone costume designer for Verity Studios. The company, founded by ETH Zurich professor Raffaello D'Andrea, is developing new dynamic systems that enable flying machines to interact with humans. Léa Pereyre was responsible for the creative exploration of drone costumes and other payloads to enhance the presence of autonomous indoor drones in a show setting. In June 2020 she joined PATHOS – which was founded by the art duo Pors & Rao at Wyss, Zurich – where she is responsible for research and development of interface design and physical animation.

3 Jean Tinguely

Study for an End of the World N°2

1962

David Brinkley's Journal, NBC. Excerpt.
Courtesy: NBC News Archives. © 2020,
ProLitteris, Zurich.



In 1962, Jean Tinguely was invited by the American television network NBC to stage an event for the programme *David Brinkley's Journal*, broadcast nationwide. On 21 March 1962, Tinguely presented his second vision of 'the end of the world'. He collected rubbish such as bicycle wheels and shopping carts from the city dump and fused it together to make sculptures in the parking lot of the Flamingo Hotel. The artists lined up seven sculptures on Jean Dry Lake in the desert southwest of the city, and exploded them with dynamite, fire-crackers, and smoke bombs at 4:51 pm. An audience of journalists attended to record the event. The desert area resembled Yucca Flats, a site used for atomic testing in the 1950s. The camera filmed Tinguely in the company of artist Niki de Saint Phalle during construction, transportation and production, as well as while searching for materials at the dumps outside Las Vegas.

A pioneer in 'robotic machine art', Tinguely also anticipated the American movement of land art, which would develop only a few years later. The radio

sculptures produced from 1960 onwards found parallels with the technical-artistic research of the E.A.T. (Experiments in Arts and Technology) organisation in the United States.

The Swiss sculptor, painter, and designer Jean Charles Tinguely was born in Fribourg in 1925. At the age of 17, Tinguely began attending Basel's School of Arts and Crafts.

In 1952, in Paris, Tinguely developed his first sculptures and kinetic reliefs, exhibiting them for the first time two years later at the Arnaud Gallery. From this moment on, his contacts and collaborations with artists and galleries in the kinetic movement became more intense, and Tinguely debuted on the international scene with his interactive, and later self-destructive, machines. In October 1960, Tinguely signed the manifesto of new realism together with Yves Klein and the art critic Pierre Restany.

The artist died in August 1991 in Bern. A creator of kinetic works of art, Jean Tinguely counts among the great pioneering artists of the second half of the twentieth century.

4 Urs Fischer

Maybe 2019

Motors, gears, aluminium, plastic, battery, brass, silicone, magnets, two-component urethane casting resin, acrylic paint, xanthan gum, gum arabic, ethanol, charging station. 2 parts. 6×13.3×5.4 cm and 6×14×5.4 cm. Edition 2 of 2 & 2 AP. Private collection. © Urs Fischer. Courtesy of the artist, The Modern Institute, and Gagosian.

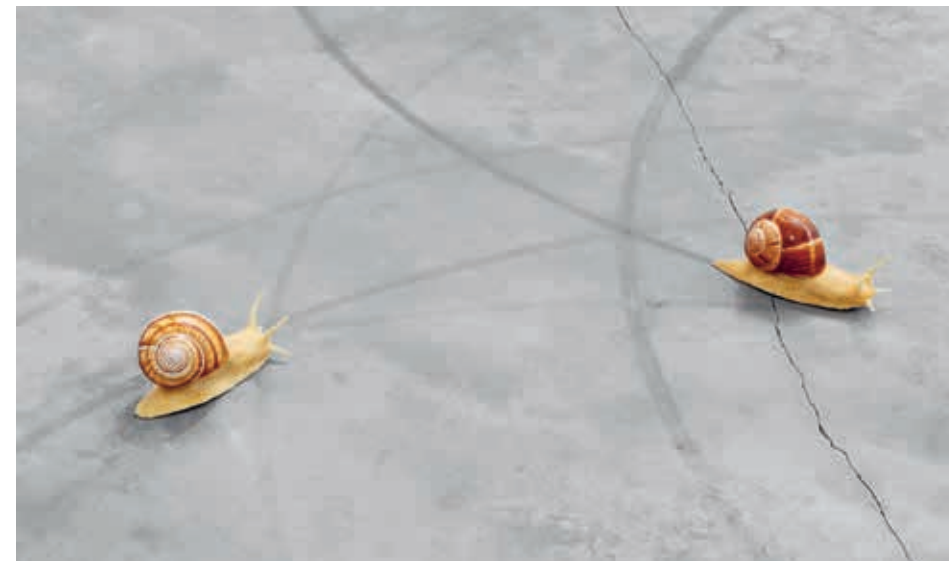


Photo: Stefan Altenburger.

Two robo-snails, with an artificial slime trail each, move in perpendicular circles at the beginning of the gallery space. Distinguished only by their shells and the length of their tiny, slimy bodies, the small creatures testify to Urs Fischer's interest in using technological devices to convey irony and surprise. In line with Fischer's interest in complex devices, as in the series *PLAY* (2018), in which nine office chairs act and interact independently with the viewer, these snails reflect the artist's multifaceted practice, exploring and expanding the possibilities of sculpture, painting and image production to create works that disorient and bewilder, while maintaining witty irreverence and mordant humour. The idea of time, process and transience in Fischer's installations often creates uncanny and illusory environments. In these environments he challenges the mechanisms of our perception, stimulating an awareness of the physical and ideological contexts in our surroundings.

The title of the work, *Maybe*, opens the exhibition with a question mark,

addressing the multiple perspectives of the show in a playful as well as doubtful manner.

Urs Fischer was born in 1973 in Zurich and studied photography at the Schule für Gestaltung Zürich. Drawing on historical and popular culture, Fischer continuously readjusts the way artworks are created and received. His questioning of 'the real' resonates with movements such as Pop Art, Dada and surrealism, all of which similarly made use of the found image and everyday objects to create new and unanticipated combinations, and offered new ways to relate to the changes in our environment and its ferocious collision of visuals.

Fischer has exhibited extensively around the world, and his work is included in many important public and private collections worldwide. Fischer lives and works in New York. Recent exhibitions include: *The Lyrical and the Prosaic*, Aishti Foundation, Beirut (2019); *Leo*, Gagosian, rue de Ponthieu, Paris (2019); *ERROR*, The Brant Foundation Art Study Center, Greenwich, Connecticut (2019); *PLAY* (with choreography by Madeline Hollander), Jeffrey Deitch, Los Angeles (2019).

Otto 2015

Computer-controlled chalk drawing machine. Motor modules, stainless steel ribbon coils, automated chalk holder, custom-made controller and software. Courtesy: the artist.



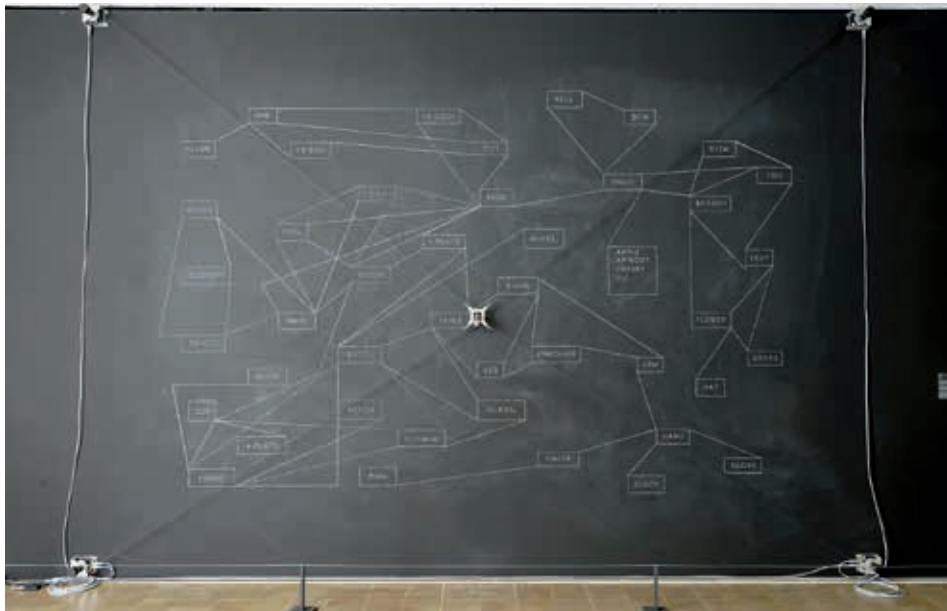
Silvio Ceccato, *La storia di un modello meccanico dell'uomo che traduce*, 1962, detail, Short Cuts, Kunsthau CentrePasquArt, Biel, Switzerland. © Jürg Lehni.

5.1 Two Legacies – Footnotes from the History of Two Cultures

2015–present

with Wilm Thoben

Growing series of drawings for reproduction with Otto.



Silvio Ceccato, *La storia di un modello meccanico dell'uomo che traduce*, 1962, Short Cuts, Kunsthau CentrePasquArt, Biel, Switzerland. © Jürg Lehni.

Otto is a scalable robotic chalk-drawing machine designed to work on large surfaces. It is driven by the same geometric principles of positioning through triangulation and a continuous negotiation between the involved motors that inspired the creation of its predecessors, *Hektor* and *Viktor*. Post-industrial in nature, these machines are not designed to be perfect: they feature distinct characteristics and poetic qualities in their gentle, fragile gestures as they execute line drawings using tools originally created for human use, such as chalk or spray-paint, in ways reminiscent of how a human would complete the task.

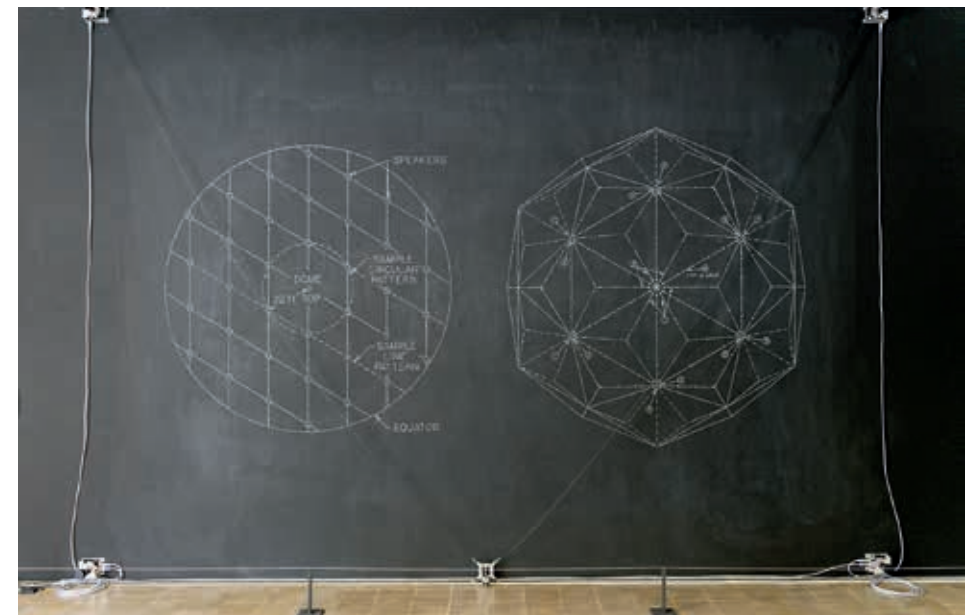
The series *Two Legacies – Footnotes from the History of Two Cultures* reminds us of the often-intertwined and complex relations between technology and the arts. The series focuses on sketches and blueprints that are anecdotal in nature, representing souvenirs of thought processes rather than final artworks, such as the E.A.T. Manifesto, handwritten on a scrap of paper, Abraham Moles' information theory diagrams, and a blueprint of the legendary E.A.T. Pavilion dome structure, one of the first "experiential spaces" for artists and engineers presented at World Exposition in Osaka, Japan in 1970. In addition, the series

will be extended with site-specific drawings inspired by the topics and motives addressed in the exhibition.

Jürg Lehni works collaboratively across disciplines, dealing with the nuances of technology, tools and the human condition. His works often take the form of platforms and scenarios for production and research, such as the drawing machines *Hektor*, *Rita*, *Viktor* and *Otto*, as well as software-based structures and frameworks – including *Paperjs.org*, *Scriptographer.org* and *Vectorama.org* – that combine computational and manual ways of working with graphical form and expression.

Lehni has shown his work internationally in solo and group shows at MoMA New York; SFMOMA; the Walker Art Center; the Centre Pompidou; Kunsthalle St. Gallen; the ICA, London; and the Design Museum, London. In 2015, his work *Viktor* was acquired by SFMOMA for its permanent collection.

After years of working and teaching abroad, he now runs his own studio practice in Zurich.



E.A.T., *Pavilion: Experiments in Art And Technology*, 1972, detail, Short Cuts, Kunsthau CentrePasquArt, Biel, Switzerland. © Jürg Lehni.

Regarde Les Mouches Voler

2012

1 channel b & w silent SD video / 6'06". Steel, glass, halfway mirror glass. 180×160×80 cm. Courtesy: the artist, Galeria Francisco Fino, Lisbon and Proyectos Monclova, Mexico City.



The video sculpture *Regarde Les Mouches Voler* opens up temporal levels of perception and asynchronism. The staged video of a housefly (*Musca domestica*) crossing the field of view is recorded with a high-speed imaging technique, widely used in the field of science.

In exaggerated slow motion and constant anticipation, the work depicts a movement that is normally invisible to a naked eye. Each individual wingbeat becomes cumbersome and monumental. The resulting film duration is diametrically opposed to the actual flight duration. Tethered to a toothpick – yet another common technique used in entomology – the fly's movement across the frame is conducted by a human hand. This display references the vitrines that can usually be found in museums of natural history. The video is visible from both sides of the glass screen, yet the flight is mirrored. In the spirit of the French expression “regarder les mouches voler” (in English: “to stare into space”, or literally: “watching the flies fly”), stasis and motion collide, creating a timeless zone in the realm of idleness and boredom.

The video was produced during the artist's residency at the Insect Flight Lab of the National Centre for Biological Sciences (NCBS), Bangalore, India, as part of the artists-in-labs programme at Zurich University of the Arts.

Adrien Missika (b.1981, Paris) studied at the Ecole Cantonale d'Art de Lausanne (ECAL). He was a co-founder of Galerie 1M³, Lausanne, (2006–2014), and the founder and art director of Belo Campo Lisbon (2017–present).

His work humorously investigates the natural and the cultural. Using epistemology as a base for research, his conceptual approach drifts into poetic and hypothetical narratives. Through a variety of media, the work digs into a wide range of natural and environmental sciences, including biology, landscape architecture and geography.

Missika has had numerous solo and group exhibitions at venues around the world, including the Palais de Tokyo, Paris; the Centre d'Art Contemporain Genève; Kunsthau Glarus; the Centre Culturel Suisse, Paris; 21er Haus (Belvedere 21), Vienna; and the Centre Pompidou-Metz. He currently lives in Berlin.

7.1

Biorobotics Laboratory (BioRob)



OroBot walking towards camera. © Tomislav Horvat (EPFL Lausanne), Kamilo Melo (EPFL Lausanne).

The Biorobotics Laboratory (BioRob) is part of the Institute of Bioengineering in the School of Engineering at EPFL (also co-affiliated with the Institute of Mechanical Engineering).

Led by Professor Auke Ijspeert, the lab works on the computational aspects of locomotion control, sensorimotor coordination, and learning in animals and in robots. EPFL BioRob uses robots and numerical simulation to study the neural mechanisms underlying movement control and learning in animals, and in return to take inspiration from animals to design new control methods for robotics, as well as novel robots capable of agile locomotion in complex environments. The laboratory is also interested in assisting persons with limited mobility using powered exoskeletons and assistive furniture.

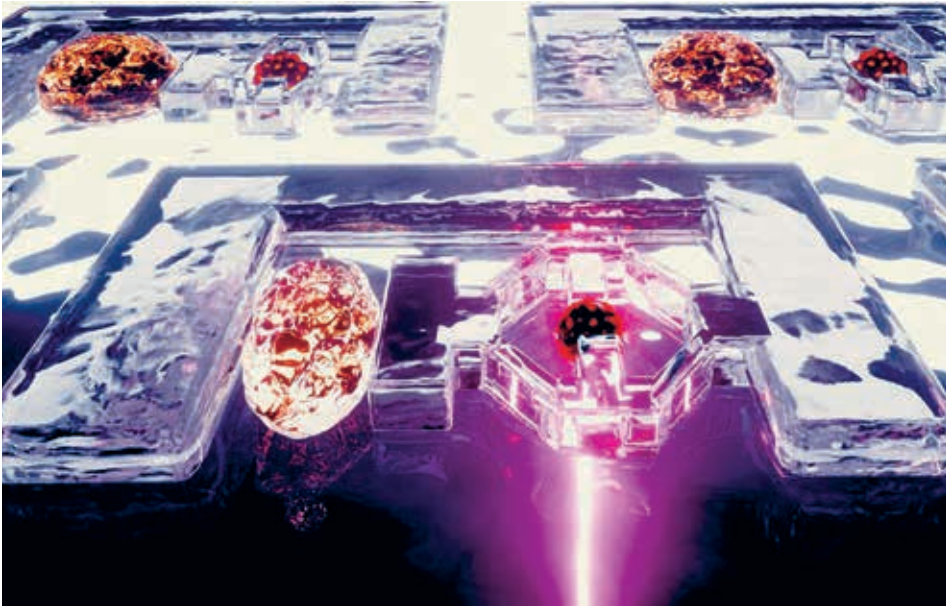
OroBot

A robot recreating the locomotion of a 300-million-year-old animal.

Using the fossilised skeleton and footprints of *Orobates pabsti* – a vertebrate that, on the evolutionary tree, comes between amphibians on the one

hand and reptiles and mammals on the other – the EPFL Biorobotics Laboratory and the Interdisciplinary Laboratory Image Knowledge Gestaltung at Humboldt-Universität in Berlin, created computer simulations and a robot replicating the morphology and locomotion of that animal. Drawing on experimental studies of four living amphibian and reptile species, they used these tools to evaluate the most likely ways of walking for the fossilised animal. *OroBot* and associated researchers' findings appeared in *Nature* (January 2019). Reconstructing the locomotion of extinct vertebrates offers insights into their palaeobiology and helps to conceptualise major transitions in vertebrate evolution. This innovative study of animal biomechanics using robots can help researchers quantify the likelihood of particular gaits, and better understand how vertebrate locomotion evolved over time.

7.2 MicroBioRobotic Systems (MICROBS) Laboratory



Hydrogel-based artificial muscles. © Nebahat Yenihayat and MICROBS.

Led by Professor Selman Sakar, the MICROBS laboratory's mission is to develop the science and techniques of microrobotics, where materials science and MEMS (MicroElectroMechanical Systems) technology meet robotics, creating the next generation of intelligent systems operating in complex microenvironments. Achieving this vision will enable MICROBS to make contributions in basic and applied life sciences.

Smart microrobots that can adapt to their surroundings

Drawing inspiration from bacteria, MICROBS develops smart, biocompatible microrobots that are able to swim through physiological fluids and modify their shape when needed, in order to pass through narrow blood vessels without compromising on speed or manoeuvrability. Made of hydrogel nanocomposites that contain magnetic nanoparticles, these microrobots are wirelessly actuated using electromagnetic fields. If they encounter a change in viscosity

or osmotic pressure, they modify their shape to adapt their locomotion without losing control of the direction of motion.

Gummy-like robots

MICROBS develops soft robotic micro-devices that are able to mechanically stimulate cells and 3D cell culture models. These machines, which are powered by biocompatible artificial muscles, can carry out complicated manipulation tasks under physiological conditions on a microscopic scale. The toolkit consists of actuators and compliant mechanisms that are wirelessly activated by laser beams. They can be incorporated inside microfluidic chips for high-throughput profiling. The design methodology involves assembling various hydrogel blocks – as if they were Lego bricks – to form a compliant skeleton, and then creating tendon-like polymer connections between the skeleton and the actuators. By combining the bricks and actuators in different ways, scientists can create an array of complex microscopic machines.

7.3 Soft Transducers Laboratory (LMTS)



Stretchable pumps for Soft Machines. © Vito Cacucciolo and LMTS, EPFL 2019.

Led by Professor Herbert Shea, the EPFL Soft Transducers Lab (LMTS) develops fast and efficient stretchable actuators and transducers for soft robotics and for wearable haptics. LMTS's core research areas are mm- to cm-scale polymer actuators driven by electrostatic forces, combining elastomers such as silicones with compliant electrodes.

300 V. This enabled the lab to make fast untethered autonomous soft robots that are robust yet only 18 microns thick, as well as wearable haptic interfaces, high-force textile clutches for VR gloves, and compliant grippers able to delicately manipulate fruit and vegetables. LMTS's ongoing work is aimed at embedding intelligence into these soft machines.

Stretchable pumps and grippers

The laboratory is well known for its unique fabrication methods, which allow them to address several key limitations of directly electrically driven soft actuators, including obtaining high forces (16 N holding force from a 1g device), high speeds (5 kHz), complex motion, and reducing drive voltage to

7.4 Reconfigurable Robotics Laboratory (RRL)



Mori. Conceptual vision of the new paradigm in form of a universal extraterrestrial exploration system.
© RRL and Raphaël Galeuchet.

Led by Professor Jamie Paik, the Reconfigurable Robotics Lab focuses on the design, actuation, fabrication, and control of unique robotic systems. RRL's research is committed to inventing interactive robotic systems with novel fabrication techniques and integration processes that push the limits of mechanical properties. These efforts enable RRL to create soft, reconfigurable, and interactive robots that are highly conscious of their environment and have extensive applications in wearable technology, medical/rehabilitation systems, and personal robots.

Tribot

Tribot is an autonomous multi-locomotion insect-scale robot (millirobot) inspired by trap-jaw ants that addresses the design and scalability challenges of small-scale terrestrial robots. The robot's compact locomotion mechanism is constructed with minimal components and assembly steps, has tuneable power requirements, and realises five distinct gaits: vertical jumping for height, horizontal jumping for distance, somersault jumping to clear obstacles, walking on textured terrain and crawling on flat surfaces. This ten-gramme, palm-sized prototype is the smallest and

lightest self-contained multi-locomotion robot reported so far.

Robogami Design

Robogami systems are foldable, quasi-2D machines and robots composed of multiple functional layers that are combined to reconstruct various 3D shapes and mechanisms, theoretically with infinite degrees of freedom. Using novel manufacturing processes and material combinations with high precision and compactness, *Robogami* enables the introduction of various functional features into the design of robots, such as smart and adaptable locomotion.

Modular Origami Robots

Mori, a modular origami robot, is the first example of a robot that combines the concepts behind both origami and modularity. Consisting of flat, triangular modules that can be attached to each other and folded up, *Mori* forms a multi-functional robotic system that can transform into any desired shape. Reconfiguration of its modules allows the system to change from a robotic arm to, for example, a walking robot or an interactive 3D display.

Visual Philosophy

1968–2018

Courtesy: the artist and Leslie Tonkonow
Artworks+Projects, New York.

8.1 The Kingdom Series:
X-Ray of Sting Ray

1980

Four-colour silkscreen
with metallic and hand
colouring. 104.14 × 74.9 cm.
Edition of 160/175 with
20 Aps.



8.2 The Kingdom Series: X-Ray of Seahorses

1980

Four-colour silkscreen
with metallic and hand
colouring. 106.7 × 74.9 cm.
A.P. from edition of 175
with 20 Aps.

8.3 Isometric Systems in Isotropic Space –
Map Projections: The Cube

1986

Three-color lithograph with
metallic dusting and
hand colouring on hand-
made paper. 92.2 × 63.5 cm
(sheet). A.P. II/XV from
edition of 50.

8.4 Dialectical Triangulation: A Visual Philosophy
(including The Human Argument)

1982–83

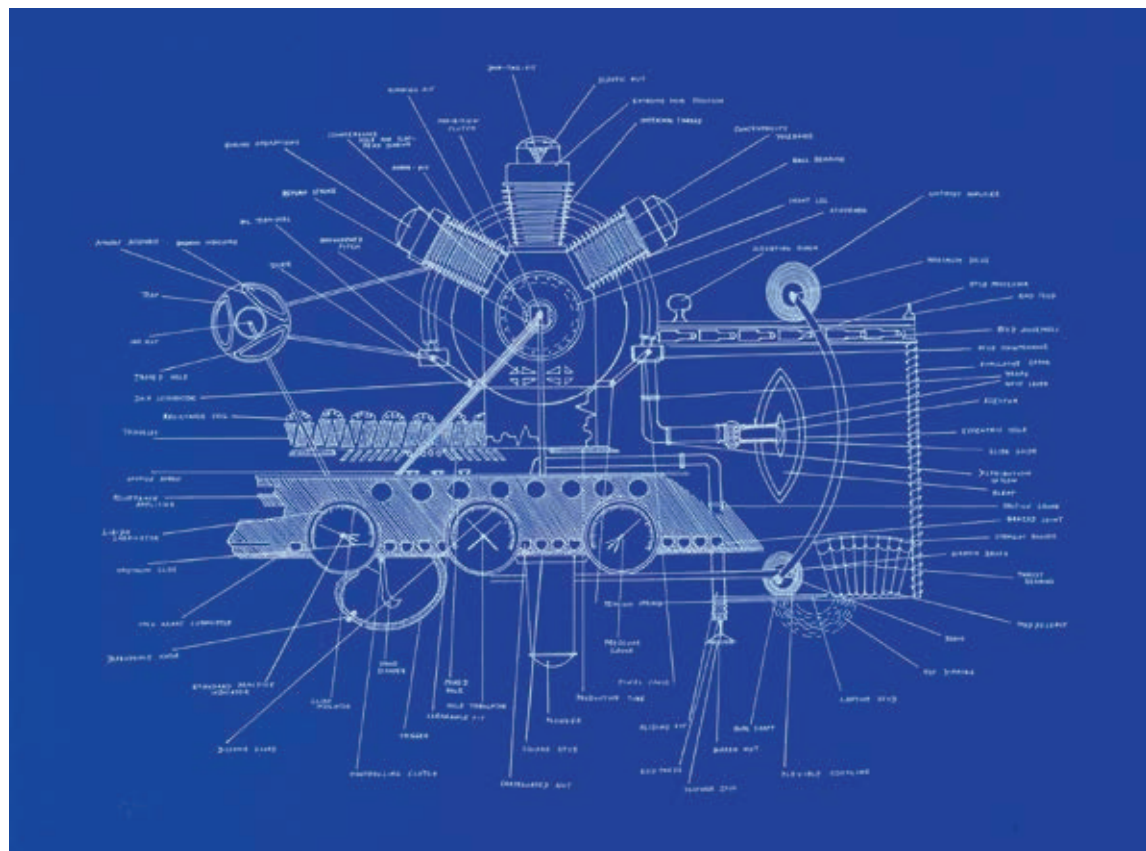
Hand-pulled and hand-
dusted lithograph on blue
Japanese Moriki paper,
gold leaf, green, bronze,
and silver/lavender.
97 × 64.7 cm (sheet).
Edition of 72/75.

8 Agnes Denes

8.5	<i>Fish Pyramid – Noah’s Ark for the New City</i>	1994 Lithograph with metallic dusting on BFK paper 63.8×90.8 cm (sheet). Edition of 9/20.
8.6	<i>Pyramid Awakens</i>	1994 Lithograph with metallic dusting on BFK paper 63.8×90.8 cm (sheet). edition of 9/20.
8.7	<i>The Reflection</i>	1981 Lithograph 83.8×63.5 cm (sheet). Edition of 69/75.

8.8 *Liberated Sex Machine* 1969–70/2013

Hand-pulled lithograph on blue Plike paper. 48.3×62.9 cm. Edition of 30.



8.9	<i>Liberated Sex Machine</i>	1969–70/2013 Hand-pulled lithograph on purple Plike paper 48.3×62.9 cm. Edition of 30.
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8 Agnes Denes

In her protean artistic practice, which has developed since the 1960s, Agnes Denes has embraced philosophy, mathematics, linguistics, psychology, history, sociology, poetry and music, closely intertwining science and art in a subtle mystery of knowledge. Considered as visionary, her visual investigations and formulations range from writings and drawings – which she kept as one of the principal means of expression despite the conceptual character of her art – to sculpture, environmental actions, performances and installations.

The *Pyramid* series, initiated in 1969, explores, dissects and reshapes the geometric form through the lens of an abstract mathematical theory of probability in order to reveal its logical patterns. This approach later allows the pyramid to become a fluid, floating form, that by keeping its geometric perfection offers future possible habitats for living in space or other self-contained environments. In these drawings, Agnes Denes has developed an innovative use of metallic dust and ink applied by hand that gives an ethereal glow to rigorously calculated patterns.

Her series entitled *Isometric Systems in Isotropic Space – Map Projections* (1973–1979) originates from the study of distortion and perspective. Playing with imagination and reality, uncertainty and knowledge, the artist applies mathematical formulae to the form of our globe to reshape it and rearrange its structure, mass, coordinates of longitude and latitude on graph paper into an egg, a snail, or a cube, that all dissolve our rigid reading of space by investigating the notions of curved space, black holes, fluidity and relativity.

A pioneer of conceptual and environmental art, she also coined the notion of Eco-Logic to express the paradox – or as she often refers to it, the human predicament – that lies between achievable conditions of global survival and logic, demonstrating how, despite being at its centre, we are prisoners of our own system. In 1968, she authored *Rice/Tree/Burial*, the first land-art performance with expressed ecological con-

cerns that called for environmental consciousness and responsibility.

To conclude the selection of works shown in the exhibition, the *Liberated Sex Machine* is a playful and witty physical-mathematical rendering of the chemical processes and sensations people experience when having sex.

Agnes Denes (b. 1931, Budapest) is a Hungarian-born American artist based in New York. A primary figure among the concept-based artists who emerged in the 1960s and 1970s, Agnes Denes is internationally known for works created in a wide range of mediums. A pioneer of several art movements, she is difficult to categorise. Investigating science, philosophy, linguistics, psychology, poetry, history, and music, Denes’ artistic practice is distinctive in terms of its aesthetics and engagement with socio-political ideas. Agnes Denes was raised in Sweden and educated in the United States. Since her exhibition career began in the 1960s, she has participated in more than 450 exhibitions at galleries and museums throughout the world, including solo shows and international surveys such as the Biennale of Sydney (1976); Documenta 6, Kassel, Germany (1977); and the Venice Biennale (1978, 1980, 2001). A major retrospective of her work, *Agnes Denes: Absolutes and Intermediates* (2019–2020), was recently hosted at the Shed in New York.

Designing for the Sixth Extinction

2013–2015

Black wood framed C-type print mounted on Dibond accompanied by models, prints and fictional patent applications for four organisms. Commissioned in 2013 for *Grow Your Own... Life After Nature* at Science Gallery, Dublin. Nominated for Designs of the Year 2015 by the Design Museum, London. Permanent collection of Zentrum für Kunst und Medien Karlsruhe (ZKM), and Ginkgo Bioworks, Boston. Courtesy: the artist.

9.1 Rewilding with Synthetic Biology 2013



Forest image. © Alexandra Daisy Ginsberg.

9.2 Patent drawings and photographs 2013



Installation view, Stedelijk Museum, 2015. Detail. Photo: Gert Jan van Rooij.

9.3 Mobile Bioremediation Units 2015



Mobile Bioremediation Unit. © Alexandra Daisy Ginsberg.

Can we preserve by looking forward? The sixth mass extinction in the history of biology is underway, and we humans are likely its cause. While conservationists struggle to protect existing 'natural' species from humanity, synthetic biologists are busy designing new organisms for the benefit of that same humanity. What might the wilds look like in a synthetic biological future?

Designing for the Sixth Extinction investigates synthetic biology's potential impact on biodiversity and conservation. Could we tolerate rewilding (the conservation movement that lets nature take control) using synthetic biology to make nature better? Letting synthetic biodiversity loose to save the nature we idealise would disrupt existing conventions of preservation.

In this future, novel companion species are designed by synthetic biologists to support endangered natural species and ecosystems. Financed by corporate biodiversity offset schemes, these patented species are released into the wild. Constructed using an expanded DNA code (a real science in development), they compensate for biodiversity lost due to monoculture farming.

Modelled on fungus, bacteria, invertebrates and mammals, the fictional species are ecological machines that fill the void left by vanished organisms, or offer novel protection against more harmful invasive species, diseases and pollution. If nature is totally industrialised for the benefit of society – which for some is the logical endpoint of synthetic biology – will nature still exist for us to save?

Dr. Alexandra Daisy Ginsberg is an artist examining our fraught relationships with nature and technology. Through subjects as diverse as artificial intelligence, synthetic biology, conservation, and evolution, her work explores the human impulse to 'better' the world.

Daisy spent over ten years experimentally engaging with the field of synthetic biology, developing new roles for artists and designers. She is the lead author of *Synthetic Aesthetics: Investigating Synthetic Biology's Designs on Nature* (MIT Press, 2014), and in 2017 completed her PhD, *Better*, at the RCA. Daisy has exhibited internationally at MoMA New York, the Museum of Contemporary Art Tokyo, the Centre Pompidou, and the Royal Academy, and her work is in museum and private collections. She currently lives and works in London.

Stock Weather 2020

Wood, electronics, custom software, steel, sand, 3D prints. Thanks to: Atelier Vilvoorde, Peter Heremans, Adrien Lucca. Commissioned by EPFL Pavilions. Courtesy: the artist and Harlan Levey Projects.



© Haseeb Ahmed.

Haseeb Ahmed's newly commissioned work *Stock Weather* creates a parallel between the global stock market and meteorological phenomena; this work examines the relationship between capitalism and the natural world. While the global stock market is entirely man-made, we experience it as though it is a force of nature – as something that happens to us rather than something we have made. In this sense, it is experienced more similarly to weather than something artificial. The installation takes live data from major indices including the NYSE (US), the TSE (Japan), and the LSE (UK) and uses it to generate a weather pattern inside the exhibition space. This weather is realised with programmed fans that act upon sand, modelling a desolate landscape that is a manifestation of the global economy. A camera focuses on this miniaturised sand dune to scale up and create a filmic image that allegorises global capitalism. Often working collaboratively, Ahmed integrates methodologies from the hard sciences into his art production.

Haseeb Ahmed (b.1985) is a research-based artist. Originally from the US, he resides in Brussels. His recently completed *Wind Egg Trilogy* blends art and aeronautics, myth and technology to create new narratives for the present. Developed at the von Karman Institute for Fluid Dynamics (VKI), it was the subject of his first solo exhibition at Harlan Levey Projects in Brussels, and his solo exhibition at the Museum of Contemporary Art Antwerp (M HKA), as well as the topic of his PhD in practice-based arts (completed in 2018). Ahmed holds a Bachelor of Fine Arts from the School of the Art Institute of Chicago, and a master's from the MIT Program in Art, Culture, and Technology. He has been a resident at the Jan van Eyck Academie in Maastricht (NL) and La Becque, among others. His work has been exhibited internationally, including at the Museum of Contemporary Art Chicago (US), the Göteborg International Biennial of Contemporary Art (SE), and De Appel in Amsterdam (NL).

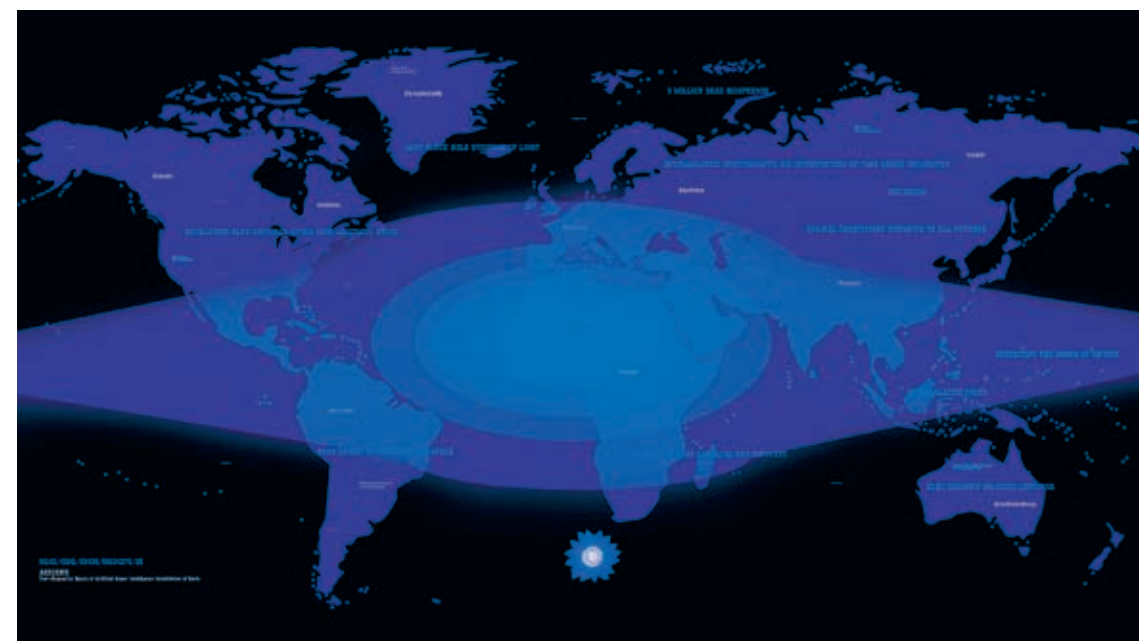
SURVIVOR (F) 2016–2019

Courtesy: the artist, Annelly Juda Fine Art, London and P.P.O.W Gallery, New York.

11.1 *ASICENE*
Post-Singularity Epoch
of Artificial Super
Intelligence Inhabitation
of Earth

2018

Wallpaper.
Dimensions
variable.



SURVIVOR (F) is a hallucinogenic exploration of a future reality in undetermined time and space.

Whether manifestations of a survivor of the human race, on earth, in space, on a new planet or in a parallel universe, or of an artificial superintelligence (ASI), *SURVIVOR (F)* presents visions of a post-futuristic sublime, charting an existential imaginary of potential human/non-human agency/non-agency, of the psychedelic consciousness of *SURVIVOR (F)*. *SURVIVOR (F)* is a poetics of the future, a contemporary futuristic alchemical depiction of the universe and beyond.

Utilising various media, including video, the internet, interactive technologies, photography, drawing and watercolour, Treister has evolved a large body of work which engages with eccentric narratives and unconventional bodies of research to reveal structures that bind power, identity and knowledge. An ongoing focus of her work is the relationship between new technologies, society, alternative belief systems and the potential futures of humanity.

11

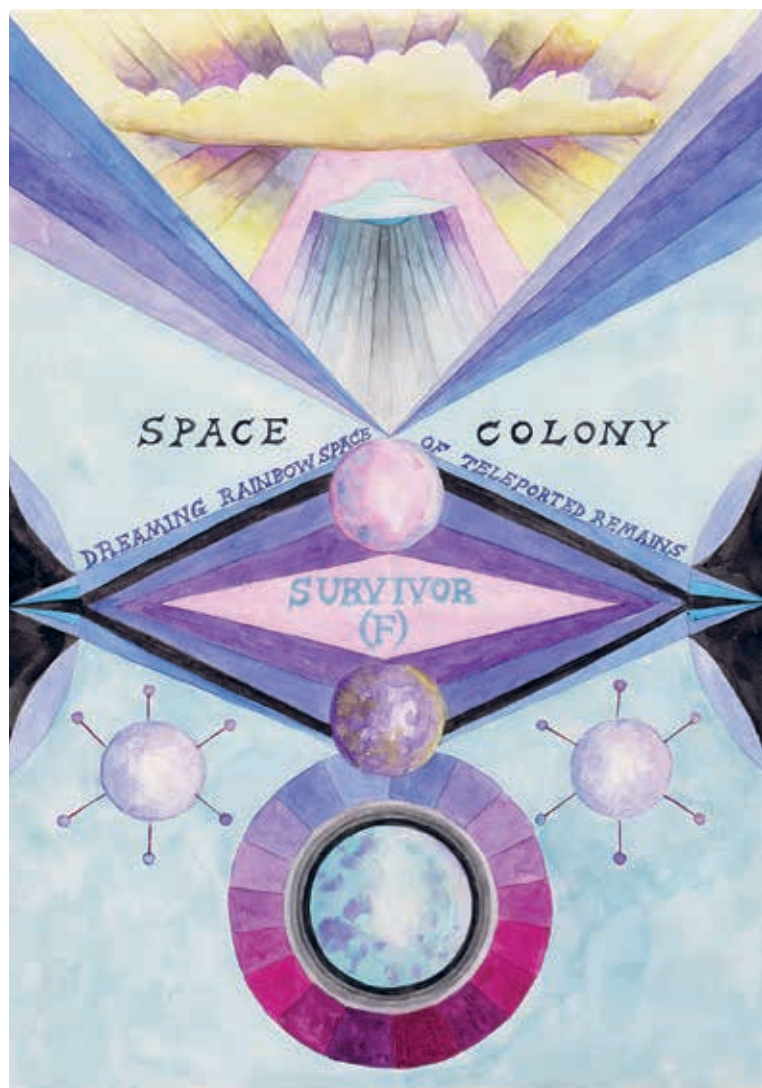
Suzanne Treister

11.2

SURVIVOR (F)/ Watercolour diagrams

2016–19

Selection of 30 Water-
colour diagrams.
Each 21×29.7 cm.



SURVIVOR (F)/Space Colony

11.3

SURVIVOR (F)/ Screensaver 02

2016

Video, 17 min, loop.

Suzanne Treister (b.1958, UK) is a British artist. Initially recognised in the 1980s as a painter, she became a pioneer in the digital/new media/web-based field from the beginning of the 1990s, making work about emerging technologies, developing fictional worlds and international collaborative organisations. Often spanning several years, her projects comprise fantas-

tic reinterpretations of given taxonomies and histories that examine the existence of covert, unseen forces at work in the world, whether corporate, military or paranormal. Treister studied at St Martin's School of Art, London (1978–1981) and Chelsea College of Art and Design, London (1981–1982). Based in London after living in Australia, New York and Berlin, she has had

numerous solo exhibitions, including at Schirn Kunsthalle Frankfurt; Yerevan Biennial, Armenia (2020); Istanbul Biennial, Turkey; Moderna Museet, Stockholm, Sweden (2019); Busan Biennale, Korea; EKKM, Tallinn, Estonia; CCCB, Barcelona; and ZKM, Karlsruhe, Germany (2018).

12

Basim Magdy

12.1

M.A.G.N.E.T

2019

Super 16 mm film transferred to Full HD. Colour and black and white, 21 min. Commissioned by MAAT Museum of Art, Architecture and Technology, Lisbon. Courtesy: the artist and artSümer, Istanbul.



Film still. © Basim Magdy.

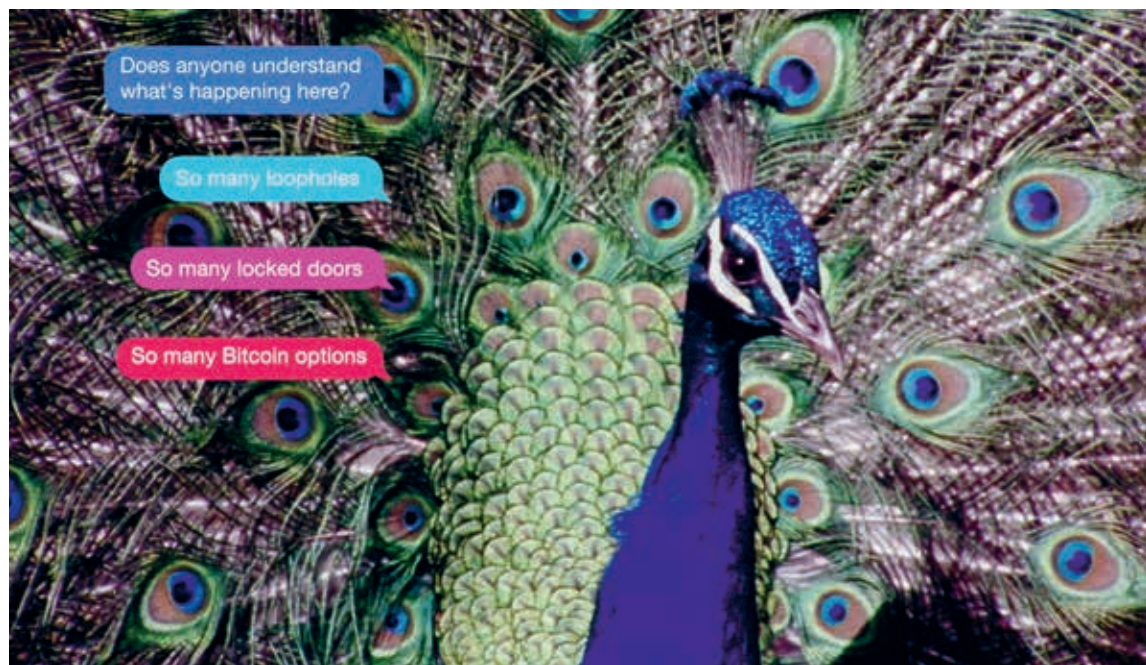
Basim Magdy's film *M.A.G.N.E.T* is a historiographic metafiction that short-circuits past, present and future in a fictional narrative full of ambiguity and mystery. The plot describes how different individuals and communities face the news of an increase in the planet's gravity – one of the four fundamental forces of nature – describing in a poetic yet realistic way a series of unexpected events and situations that take place in different locations and contexts. Using several effects and cinematic techniques, Magdy leads us into a series of bleak and seemingly abandoned places in a truly immersive and unsettling sensory experience. The film was shot over a period of almost two years in different locations in Europe, including a volcanic crater on the Greek island of Nisyros, a robotics

laboratory in Manchester, the Côa Valley Archaeological Park, and the Dino Parque in Lourinhã, which, taken out of their historical and geographical contexts, are presented as a purely fictional (and disruptive) background that serves the narrative. An oracular metaphor that warns us of an announced and impending catastrophe or the natural cycle of the earth, *M.A.G.N.E.T* is a reflection on the current situation that projects us into a future and hypothetical scenario in a mesmerising, tentacular and layered plot in which image, sound and narrative overlap and, in many cases, drift apart.

12 Basim Magdy

12.2 *New Acid* 2019

Super 16 mm and computer-generated text messages transferred to Full HD. 14 min. 18 sec. Commissioned by La Kunsthalle Mulhouse, France. Courtesy: the artist and artSümer, Istanbul.



Film still. © Basim Magdy.

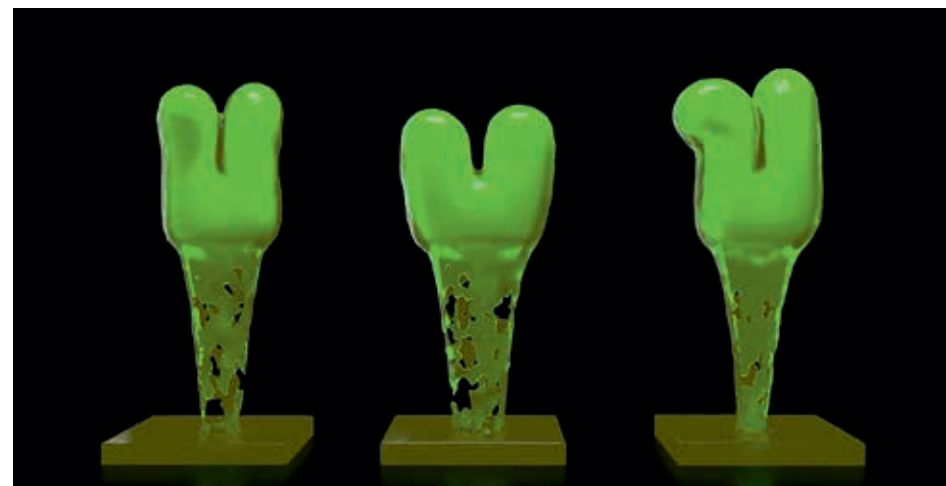
Several animals chat via text messages. Between their mundane exchanges of words void of life, conflict and rivalry emerge. Their mirrored physical appearance hints at entrapment inside a reality TV show, one where uncertainty and doubt prevail. Social media-induced insecurities and escapism become evidence that at least some of them are not bots. They question selfishness, self-love and self-destruction as the 'ugly ones' arrive wearing their 'cheesy sunglasses'. Is tradition an alter ego of racism? What about nostalgia and nationalism? Have they become what they always despised? Human? An escape attempt by a group of censored ring-tailed lemurs steals the show. A giraffe finally understands why this has been hell all along.

Basim Magdy (1977, Assiut, Egypt) lives and works between Basel and Cairo. His interest in the unconscious and memory is at the root of his often-surreal works employing paper, film, photography, and installations. His work has appeared in exhibitions worldwide, and in institutions including the M HKA, Museum of Contemporary Art, Antwerp; MAAT Museum of Art, Architecture and Technology, Lisbon; La Kunsthalle Mulhouse, France; MCA Museum of Contemporary Art, Chicago; and the MAXXI National Museum of the 21st Century Arts, Rome to name just a few. He was shortlisted for the Future Generation Art Prize, Kiev (2012) and won the Abraaj Art Prize, Dubai and the New:Vision Award, CPH:DOX Film Festival, Copenhagen (2014). He was named Deutsche Bank's 2016 Artist of the Year (2016). Magdy's work has been screened at the Tate Modern, the Locarno Film Festival, the New York Film Festival, the International Film Festival Rotterdam, and the ICA London, among others.

13 Claudia Comte

13.1 *Time Varying Viscosity and Sculpture Invasions* 2018
4D animation. 2'31" min. Loop. Courtesy: the artist and Galerie KÖNIG.

13.2 *Bunnies Emitting* 2018
4D animation. 2'08" min. Loop. Courtesy: the artist and Galerie KÖNIG.



4D animation still. © Claudia Comte.

Claudia Comte's work is defined by her interest in the memory of materials and by a careful observation of how the hand relates to different technologies. Like many of the artist's sculptures, her process begins humbly with a tree stump and chainsaw – a tool not known for its precision, but rather for its expediency and force. The finished sculptures retain none of the marks and inflections of the chainsaw, they are smooth and glisten to reveal the intricacies of the woods hidden grain. At this stage the sculptures are scanned with a 3D camera to create its digital replica, from which many material translations and formal manipulations are possible.

In 2018, Comte employed these digital copies to produce a series of 4D video animations using a liquid simulation technology developed by the Department of Computer Science at the University of Freiburg, Germany. In *Time Varying Viscosity and Sculpture Invasions* and *Bunnies Emitting* Comte's forms are subjected to a range of algorithmic actions causing them to atrophy over and over again. The algorithm – typically

an agent of "problem-solving" touted by global technology firms – is deployed here as an agent of visual subterfuge, reducing apparently solid, stable materials into viscous, runny matter.

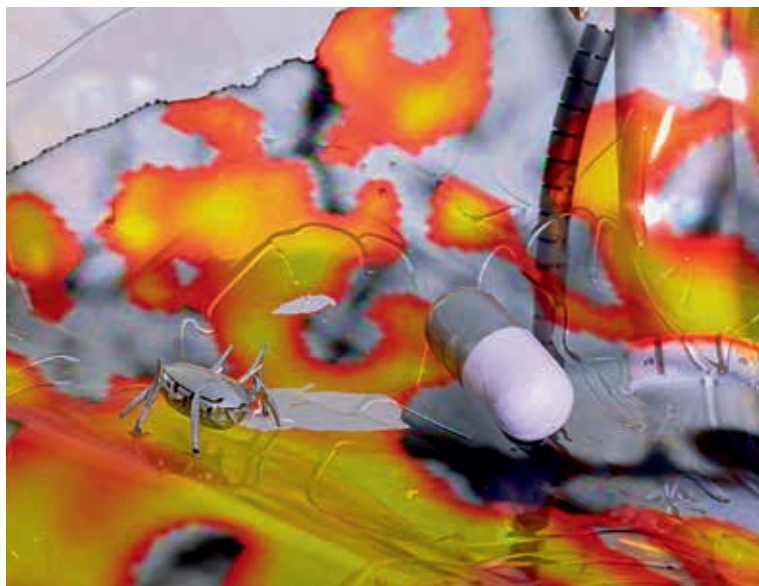
Claudia Comte (b. 1983, Grancy) studied at the Ecole Cantonale d'Art de Lausanne, ECAL (2004–2007), then obtained a Master of Arts in Science of Education at the Haute Ecole Pédagogique, Visual Arts, Lausanne, Switzerland (2008–2010). Comte's minimalist approach to producing art is equal parts methodical and dynamic; her works are infused with a distinct sense of playfulness. Her artistic output incorporates a diverse range of mediums from sculpture and painting to various multimedia installations. Claudia Comte has shown her work in solo and group exhibitions including: *How to Grow and Still Stay the Same Shape*, Castello di Rivoli (2019), *I have Grown Taller from Standing with Trees*, Copenhagen Contemporary (2019), *The Morphing Scallops*, Gladstone Gallery, 24th St, New York City (2019), *Zigzags and Diagonals*, MOCA Cleveland (2018) and *10 Rooms, 40 Walls, 1059 m²*, Kunstmuseum Luzern (2017).

Pattern of Activation (Mamaroo nursery, dawn chorus) 2017

3 electronic baby swings, 3 aluminium folding stands, plastic hoses, lasers, epoxy clay, digital prints, polyurethane, resin, robotic bugs, cable ties, plastic toy parts, Swarovski crystals, stress pills, elastic puffers, plastic drill plugs, silicon stress eggs, acrylic massagers, animal pattern stickers, fossil, tree mushrooms, power magnets, video projection. Unique. Courtesy: the artist and Kraupa-Tuskany Zeidler, Berlin.



Installation view. Photo: def image.



Detail. Photo: def image.

Katja Novitskova's work tackles the complexity and eventual failures of depicting the world through technologically driven narratives. By bringing together art and science to the level of nature, Novitskova brings awareness to the mediation and representation tools used to depict these realms.

More specifically, Novitskova's work focuses on the mapping of biological territories that are no longer outside but rather 'inside' biological bodies. The technological devices, such as microscopes or brain scans, used to mediate and depict those alternative geographies are able to merge datasets and biology, altering how biology and technology develop.

In Novitskova's mind "the look inside has somehow replaced the gaze into the future". From parasitic worms to robotic nurturing or incubating machines, technological devices are not only dominating the inner biological realm, but also the affective one. Katja's adoption of the baby swings as ready-mades, turning them into sci-fi-like creatures, is a wink to new technologies of affection and care, mediated through algorithms and artificial intelligence.

Those works bring up memories of the 'alien' depicted by science fiction, as well as the role of the non-human in a

hypothetical not-so-distant future. In a site-specific version, these robotic creatures are fed with imaging from the EPFL scientific labs – in particular the Microbiorobotic Systems Laboratory (MICROBS).

Katja Novitskova, born in 1984 in Tallinn, Estonia, lives and works in Amsterdam and Berlin. Her work focuses on issues of technology, evolutionary processes, digital imagery and corporate aesthetics. Key themes in her practice have evolved from an interest in post-internet art practices, technology and biological evolution within the current geological era (the Anthropocene).

Novitskova's work has been exhibited internationally in solo and group exhibitions, including at Sharjah Art Foundation (2020), the Powerlong Museum, Shanghai (2019); Hamburger Bahnhof, Berlin (2019); CCA Tel Aviv (2019); Whitechapel Gallery, London (2018), among numerous other venues. She had her first solo exhibition at Kraupa-Tuskany Zeidler, Berlin in 2012. Her work is in collections around the world, including the National Museum, Oslo; Museum Ludwig, Cologne; Moderna Museet, Stockholm; Yuz Museum Shanghai; Boros Collection, Berlin; CC Foundation, Shanghai; and Fondazione Sandretto Re Rebaudengo, Turin, to name just a few.

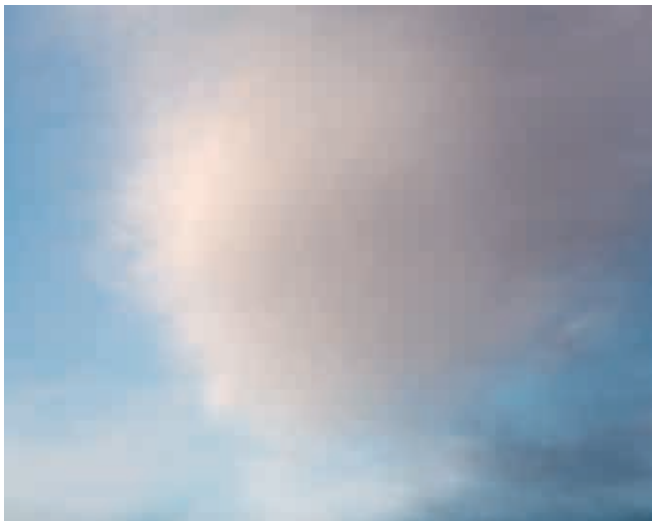


Detail. Photo: def image.

Untitled (Reaper Drones)

2010

C-print. 121.9 cm × 152.4 cm © Trevor Paglen. Courtesy: the artist; Metro Pictures, New York; and Altman Siegel, San Francisco.



Trevor Paglen's work draws on his long-time interest in investigative journalism and the social sciences, as well as his training as a geographer. His work seeks to show the hidden aesthetics of American surveillance and military systems, touching on espionage, the digital circulation of images, government development of weaponry, and secretly funded military projects.

Since the 1990s, Paglen has photographed isolated military air bases located in Nevada and Utah using a telescopic camera lens. In *Untitled (Reaper Drones)* he captured a dramatic section of the Nevada sky using a telephoto lens, revealing a drone, mid-flight against a luminous morning skyscape. The drone is nearly imperceptible, suggested only as a small black speck at the bottom left of the image. He recalls learning to see lethal Reaper drones in the Nevada desert air. They would watch him watching them. "It was one of those situations where you realise that if this was anywhere else in the world, that would probably be the last thing I would see," he says.

The artist's photographs are taken at such a distance that they abstract the

scene and distort our capacity to make sense of the image. Here, the pastel-coloured sky almost evokes a nineteenth-century Romantic landscape. Trevor Paglen's work both exposes hidden secrets and challenges assumptions about what can be seen and fully understood.

Trevor Paglen is known for investigating the invisible through the visible, with a wide-reaching approach that spans image-making, sculpture, investigative journalism, writing, engineering, and numerous other disciplines.

Trevor Paglen's work is included in the collections of the Metropolitan Museum of Art; the San Francisco Museum of Modern Art; the Smithsonian American Art Museum; the Whitney Museum of American Art; Berkeley Art Museum; the Solomon R. Guggenheim Museum, New York; the Victoria and Albert Museum, London; and the Nevada Museum of Art. Paglen has received numerous awards, including the 2018 Nam June Paik Art Center Prize and the 2017 MacArthur Fellowship, among others. He has had numerous solo exhibitions, including at the Museum of Contemporary Art San Diego (2019); the Frankfurter Kunstverein, Frankfurt (2015); and many other institutions.

Nature of Robotics

An Expanded Field

EPFL Pavilions, Lausanne
11.12.2020–25.4.2021

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EPFL Pavilions Director:
Sarah Kenderdine

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