KINETISMUS

100 YEARS OF ELECTRICITY IN ART
22 2—20 6 2022

English

Introduction

The idea for the exhibition *Kinetismus: 100 Years of Electricity in Art* was prompted by the history of Kunsthalle Praha's building: an electrical substation from the 1930s now converted into an art gallery. In addition to the theme of electricity suggested by its original function, the former Zenger substation offers an added peculiarity—an enigma that is both intriguing and inspiring.

Since its construction during the interwar period, the building has been closely associated with Zdeněk Pešánek, a major artist of the Czechoslovak avant-garde who created a series of allegorical lumino-kinetic sculptures entitled *One Hundred Years of Electricity* for the façade of the Zenger substation. Pešánek presented this visionary work at the International Exposition of Arts and Technology in Paris in 1937. Consisting of four monumental assemblages that brought together art, science, and sound, his project perfectly embodied the theme of the exposition: *Technology in Modern Life*.

The *One Hundred Years of Electricity* series mysteriously disappeared after it returned from the Paris exhibition to Prague, and was never installed on the pedestals built for its purpose. Failing to recover these lost sculptures—of which only the preparatory models remain—we chose to focus on bringing Pešánek's ideas back to life and exploring their legacy. Kunsthalle Praha's first exhibition is therefore a tribute to this pioneer of kinetic art and creator of a fascinating body of work, which is still too little known outside the Czech Republic.

Kinetismus: 100 Years of Electricity in Art explores how electricity has transformed artistic practice from the start of the 20th century to the present day. The exhibition portrays the development of electronic art: from cinematography, the illusion of motion; to kinetics, the art of real motion; to sound art; radiophonic and televisual art; computer-based art, and immersive installations by internationally renowned artists. The achievements and possibilities of electricity, both past and future, have had a crucial impact on our realities, something that artists have reflected on with various intentions and on different levels ever since electricity became ubiquitous.

The exhibition has been conceived by guest curator Peter Weibel (theoretician, artist and director of the ZKM | Zentrum für Kunst und Medien Kalsruhe, Germany), alongside co-curator Christelle Havranek (chief curator at Kunsthalle Praha) and Lívia Nolasco-Rózsás (scientific associate).

Curatorial Concept

The term kinetismus derives from the ancient Greek verb κῑνέω (kīnéō), which means 'to move', thus kineticism is the art of real motion. In the word cinematography κῑνέω is also included, and based on this etymology cinematography can be understood as the writing of movement. The industrial revolution of the 19th century was very much a machine revolution centring on wheeled vehicles. With the new, rapid pace of machines it was inevitable that speed and motion strongly attracted artists towards the end of the century. In the late 19th century photographers had investigated motion, and by the beginning of the 20th century painters of Cubism and Futurism had represented motion, too. As photography turned into cinematography, many Cubist and Futurist painters turned to photography and film. The technology of cinema was also essentially wheel-based: cameras were developed in which celluloid strips rotated, and projectors in which celluloid was turned by wheels. Machines of real circular motion developed into media of moving images. Cinematography is considered as the art of illusory movement. The link between kineticism and cinematography is motion, and therefore we speak specifically of the *moving* image as an achievement of 20th century art. Motion is based on electricity, including the motors in kinetic art and the projectors in cinematographic art. Equally the light bulb and other forms of artificial light, from neon to spotlights, all run on electricity. Therefore motion and light in all their variations (e.g. lumino-kineticism) build a pair of deep influences in the development of 20th and 21st century art. This is why there have been so many media artists that work kinetically, cinematographically, sculpturally, or visually with machines, artificial light sources, and with electrical sources of sound simultaneously.

Kinetics and cinematography are two complementary phenomena of the art of movement. In the seminal book *Kineticism* (1941) by the Czech artist Zdeněk Pešánek, the transition from one to the other was demonstrated. In addition, he presented this unique perspective through his kinetic light sculptures. One of them, *Sto let elektřiny* (*One Hundred Years of Electricity*, 1932–36), was conceived for the façade of the Zenger substation, the building that houses the newly founded Kunsthalle Praha.

Pešánek was probably the first artist to use neon in 1929–1930, and as of 1925 he had created light projections using his spectrophone (a colour piano) and lumino-kinetic sculptures. In 1930 he constructed the model for a kinetic light sculpture (made of plaster, metal and coloured light bulbs, that were programmable) for the Prague Edison substation, as well as a sculpture series and a fountain with neon tubes for the Paris world's fair of 1937. Despite his visionary inventiveness, he has barely been integrated into the international history of kinetic art. The present exhibition aims to explore and contextualise Pešánek's legacy, and underline the fact that kineticism, as an art form, already existed prior to the famous Paris exhibition *Le Mouvement* at the Galerie Denise René in 1955.

Following Pešánek's legacy, this exhibition offers a new concept in which cinematography leads to kinetic art, followed by cybernetic and computer art, thus revealing

the link between moving machines and moving images: electricity. This concept has never been explored before.

The exhibition shows artists who work in the fields of kinetic art, film, and additionally, light—because film is also called the art of light (*Lichtspieltheater*). These include László Moholy-Nagy, Marcel Duchamp, Len Lye, Robert Breer, and many of their contemporaries, such as the pioneers of the German abstract avant-garde (e.g. Viking Eggeling, Walter Ruttmann), who created 'absolute film' in the 1920s. Later on in the 1950s, film gradually became a proper, accepted medium of art.

With the advent of electromagnetic and electronic technologies, artists could develop new approaches to kineticism, such as participatory installations and interactive environments, for example *The Legible City* (1989—91) by Jeffrey Shaw and Dirk Groeneveld. With the advanced uses for electricity large-scale immersive installations became possible; a selection of these are featured in the exhibition by the artists Otto Piene, William Kentridge, or Refik Anadol, which alternate with landmark pieces of art history, such as Naum Gabo's *Kinetic Construction (Standing Wave)* from 1919—20.

In the years following Pešánek's *Kineticism*, kinetic art and op(tical) art turned away from subjective, expressionist gestures towards scientific and objective research. The GRAV and Dvizhenie groups are the most striking examples of this phenomenon. With the scientific and technical revolutions of the 1950s and 1960s, kinetic art developed into cybernetic art. As one of the first of his contemporaries, Nicolas Schöffer brought the ideas of Norbert Wiener, the father of cybernetics, to art, creating a series of cybernetic artworks, one of which (a version of *Chronos* from 1965) is part of this exhibition.

Parallel to the theories of cybernetics, computation commenced its rapid rise, and computer art was soon born. Early pioneers such as Vladimir Bonačić experimented with computer-controlled objects and electronically generated images on oscilloscopes. Computer art evolved as rapidly as information technology, and led to diverse forms of artistic practices, such as deployments of digital light by Cerith Wyn Evans, or programmed ensembles of light by Olafur Eliasson. What Eliasson achieves today for the analogue world of light, Woody Vašulka achieved for the digital world of light some time ago. By means of his video systems he manipulated light as an electro-magnetic wave. Woody Vašulka worked with the signal, the medium of light itself, to investigate its spectrum of colours and shapes. His profound approach gives us a far closer understanding of the world of electromagnetic light than could any painting or film.

In the light experiments of the 1920s and 1930s, the transformation of material boxes into light boxes, of material reliefs into light-reliefs, through the work of László Moholy-Nagy to Zdeněk Pešánek was one of the main changes in the use of light in art. The development of artificial light emerged through this focus on new materials, technologies, and media. We can conclude that electrically powered art

is based on two pillars: motion and light. The famous exhibition *Electra*, which took place in 1983—84 at the Musée d'art moderne de la ville de Paris, was devoted to electricity and electronics, especially to light and motion. This exhibition expands the concept of the Paris exhibition into the digital dimension, creating a glorious quadruple: electricity, media, motion, and light, built on the four C's: Cinematography, *Cinétisme* (kineticism), Cybernetic, and Computer art.

Peter Weibel

Exhibition Manual

This exhibition presents around one hundred works of art by several generations of artists from all over the world—independent figures as well as members of emblematic groups such as Bauhaus, GRAV, Dvizhenie, ZERO, and teamLab. The selected artworks each correspond to one of the four categories developed in the exhibition concept: cinematography, kinetic art, cybernetic art, and computer art. These categories, showing the development of various electrically powered art forms, are easily identifiable throughout the exhibition by means of a colour code system.

The circuit of the exhibition is open and free—it follows no theme or chronology. This approach, imposing no pre-established direction, enables the visitors to advance at their own pace, to contemplate, touch, and listen as they like.

The brochure you are holding in your hands, including a map with the location of all the artworks in *Kinetismus: 100 Years of Electricity in Art*, is an indispensable tool for navigating the exhibition.

Exhibition Design Concept

The exhibition design uses different material qualities, such as transparency, density, tension and reflectiveness to create connections between exhibits and artworks, allowing them to overlap and refer to one another. The loose arrangement of the exhibition's various features allows for numerous spaces with different qualities and purposes. Cables and technical equipment are deliberately left exposed, creating a vast network of objects throughout the exhibition space, the common denominator for them being electricity.

Reflection Zone

Three dedicated spaces appear across the exhibition that consist of seats and information boards that present texts about the four categories. These spaces give visitors the chance to rest, linger, and exchange views on the exhibits, and to learn more. The form and the colour of each of the information boards adopts the characteristics of the corresponding category.

Catalogue

A richly illustrated catalogue published by Hatje Cantz and Kunsthalle Praha features contributions by the curatorial team and many other relevant authors, and a timeline tracing the milestones of technological, theoretical, and artistic developments brought about by electricity from the 1920s to the present day.

Digital Guide

You can also walk through the exhibition with our digital guide! Connect to the internet (you can also use our free Wi-Fi) and choose one of the two thematic routes—'Visionary' and 'PLAY'—representing all the key works. Scan the QR codes on the labels and learn extended information about the authors as well as exhibited works, including 'reality checks' and four thematic clusters.

You can find your way through the exhibition thanks to a map with marked routes and artworks. If you prefer audio guides, you can simply play the content in your headphones. Scan this QR code and choose your preferred route. The whole digital guide, including related videos, is also available on www.guide.kunsthallepraha.org

Art Wall

The Art Wall is a nine-metre wall at the back of Gallery 2 that offers the unique experience of creating your own work. The space is dedicated to 'light graffiti', which thanks to an interactive console allows you to draw with light and create large-format works. Like actual graffiti, you can co-create and follow up on works already created. Leave your light trace directly on a gallery wall!

Kidshalle

Kidshalle is a playful space for exploring various artworks and art approaches that use movement, light and electricity. The room covered with interactive images allows you to create your own light theatre, put together a portrait of an artist, create a kinetic work, or an art statement. Kidshalle is not only for children, it is open for all and at all times.

The Tower

This site-specific installation offers a space for audiovisual detox and relaxation after visiting the exhibition. You can contemplate what you have seen or simply free your mind of all things. This year the artist Tomáš Moravec has created an elevated ground that allows you to sit and ponder above a crater with your legs free in space, or to lie down on this imaginary shore and feel the energy of the highest point in the building.

Podcast

Listen to our narrative podcast introducing the life of Zdeněk Pešánek, tumultuous changes in society at the beginning of the 20th century, fascination with kinetic and light objects, as well as the Czech representation at the 1937 Paris International Exposition. The thread of the story is an exciting search for Pešánek's sculptures intended for the façade of the former Zenger substation, today Kunsthalle Praha. Tune in on all podcast applications or on our website.

CINEMATOGRAPHY

The invention of chronophotography in the 1880s, the animated sequencing of still photographs, opened the gateway for the medium of film as we know it today. By 1891, 35 mm film had already been patented and it remained an enduring standard for what would become one of the most important media of the 20th century. Advances in cinematography enabled the production of all kinds of motion pictures, but throughout the first decades of the medium's existence film was not considered an art form, derisively regarded as mere imitation. However as theories of the moving image began to proliferate in the first half of the 20th century, this view was soon rejected and it came to be seen as a valuable medium of artistic production.

One early and influential manifesto published in 1916, *The Futurist Cinema*, declared cinema to be 'an autonomous art', setting the tone for decades of avant-garde films across Europe. Abstract film, as well as abstract art, accompanies the history of the medium in the early 20th century, making its first appearance in the 1920s. Abstract films came out of many European movements, such as Dada and Constructivism among others, becoming a junction for avant-garde and experimental filmmakers of many kinds.

In the second half of the 20th century, film and video technology became available and affordable for artists without institutional backgrounds. This was essential for the rise of experimental cinematic movements, such as Structuralist film. In parallel, the 1967 invention of the first portable video camera marked the birth of video art.

Since this time the moving image has occupied a permanent place in the visual arts, with museums and galleries adapting their 'white cubes' to include the 'black box' of the cinema. This space provides opportunities for video installations to be presented in new modes. Films can be looped, or projected across multiple screens and spaces where the public is enabled to control their experience of the artwork like never before.

Selection of artworks

p. 12
Mary Ellen Bute
Rhythm in Light, 1934
35 mm film, digitised, b/w, sound
4:45 min
Center for Visual Music, Los Angeles
photo: © Center for Visual Music, Los Angeles

❷ Robert Breer
HOMMAGE TO JEAN TINGUELY'S 'HOMMAGE TO NEW YORK', 1960

Robert Breer (Detroit, 1926 — Tucson, 2011)
Hommage to Jean Tinguely's 'Hommage to New York', 1960
16 mm film, digitised, b/w, optical sound; 9:29 min
The Robert Breer Estate and Light Cone, Paris

Robert Breer began his career as a painter in 1949 after graduating from Stanford University. In the same year he moved to Paris, where he remained until 1959 and found frequent representation for his paintings and kinetic sculptures with Galerie Denise René. His shift to filmmaking began with the animation of forms from his Neoplasticism-influenced abstract paintings, but became far more complex in works such as *Hommage to Jean Tinguely's 'Hommage to New York'* (sic) (1960). This film is made from footage of Tinguely's self-destructing machine being assembled, installed, and finally destroying itself; an event that took place in the same year at the Museum of Modern Art in New York. Far from being a documentary, the film uses crossfades, montages, and a soundtrack into which fragments of speech and other original sounds are mixed to recreate the complexity of Tinguely's machine. Although it functions as a homage to *Homage to New York*, Breer created a work of his own which stands alone in the oeuvre of this master of fine irony in abstract film.

❸ Mary Ellen Bute
RHYTHM IN LIGHT, 1934

Mary Ellen Bute (Houston, 1906 — New York, 1983)
Rhythm in Light, 1934
35 mm film, digitised, b/w, sound; 4:45 min
Center for Visual Music, Los Angeles

Describing her artistic vision as 'one that unites sound, colour and form', American filmmaker Mary Ellen Bute explored the laws of optics and the principles of music as the basis for her abstract animated films. In this early work she used hand-drawn geometric figures and everyday objects to create abstract forms, employing out-of-focus shots, different film speeds, and prisms to distort them. Like other artists of her generation Bute was highly interested in bringing together image and sound, a mission that is boldly announced at the start of the film. What set Bute apart from her contemporaries was her popular audience, which she anticipated in her use of accessible classical music. *Rhythm in Light* premiered at Radio City Music Hall and several of her works were programmed to play before other film features to large crowds.

7 Viking Eggeling
DIAGONAL SYMPHONY, 1921—1924

Viking Eggeling (Lund, 1880 — Berlin, 1925)
Symphonie Diagonale / *Diagonal Symphony*, 1921—1924
16 mm film, digitised, b/w, silent; 7:29 min
The New American Cinema Group, Inc. / The Film-Makers' Cooperative, New York

Viking Eggeling began as a painter who, like many in his generation, was highly concerned with finding a non-representational pictorial language for his art. He was initially influenced by Henri Rousseau and Paul Cézanne, but soon moved towards abstraction with Suprematist and Cubist tendencies, and finally abandoned painting in 1915. He developed his abstract motifs through large, evolving scroll drawings which would later become the basis for his films, such as *Diagonal Symphony,* (1921—1924), which vividly animate his compositions. Although screened without music his films are music for the eyes, following conventions drawn from music that modulate the intensity, duration, and rhythm of his forms. Eggeling's films were a major influence on other abstract filmmakers, such as Dadaist Hans Richter with whom he later collaborated. Having settled in Zurich in 1918, Eggeling was close with many members of the Zurich Dada group, and was later familiar with members of Berlin Dada.

8 William Kentridge
NOTES TOWARDS A MODEL OPERA, 2015

William Kentridge (Johannesburg, 1955)
Notes Towards a Model Opera, 2015
3-channel video installation, HD video 1080 p / 16:9 aspect ratio, projected on paper screens, sound; 11:22 min
choreography and dancer: Dada Masilo; music composition and arrangement: Philip Miller; additional music composition: Johannes Serekeho with music performed by First St John Brass Band; video editing and construction: Zana Marovic and Janus Fouché; sound mix: Gavan Eckhart; costume design: Greta Goiris
Kentridge Studio, Johannesburg

Notes Towards a Model Opera takes its name from the Chinese model operas developed during Mao's Cultural Revolution which combined classical French ballet with propaganda.

Similarly to the original model operas, South African dancer Dada Masilo combines far-flung themes including ballet, Chinese and African dance, and more. The constant movement between these seemingly unrelated things illustrate what Kentridge calls 'peripheral thinking', which allows engagement between unlikely associations.

At one point a bird can be seen fluttering frantically over pages of Chinese texts and notes by the artist. It refers to the killing of millions of sparrows during Mao's Four Pests campaign to eliminate rats, flies, mosquitoes, and sparrows. This created a devastating ecological imbalance that led to a plague of locusts and decreasing rice yields, exacerbating the Great Chinese Famine that killed millions of people. In stark contrast, slogans that Kentridge found on posters from the Cultural Revolution constantly urge growth and forward motion.

14 Man Ray
EMAK BAKIA, 1926

Man Ray (Philadelphia, 1890 — Paris, 1976)
Emak Bakia, 1926
35 mm film, digitised, b/w, sound; 19:00 min
The New American Cinema Group, Inc. / The Film-Makers' Cooperative, New York

'Leave me alone' is the translation from the Basque of *Emak Bakia*, title of Man Ray's 1926 film made at the request of his hosts Arthur and Rose Wheeler at their summer residence near Biarritz. The film is characterised by a typical Surrealist tension where the boundaries between dream and waking life, conscious and subconscious, are blurred. Man Ray's strong disregard for conventional narrative is immediately clear in the dynamic and contrasting sequences with no obvious link between one another, often switching from abstract imagery to scenes of social activity. Despite this, the theme of bourgeois high society frequently recurs, and other sequences explicitly build on techniques that Man Ray employed in his still photography such as the Rayograph and double exposure. *Emak Bakia* is, to a large extent, a self-reflexive work dealing not only with the formal strategies of the time, but also with the charm, wit, and exclusivity of the avant-garde and its associated social groups.

16 17 Walter Ruttmann
LIGHT-PLAY OPUS I—IV, 1921—1925

Walter Ruttmann (Frankfurt, 1887 — Berlin, 1941)
Lichtspiel Opus I / Light-Play Opus I, 1921
16 mm film, digitised, colour, separate digital sound; 9:26 min
Light Cone, Paris

Lichtspiel Opus II—IV / Light-Play Opus II—IV, 1921—1925
16 mm film, digitised, colour, silent; 12:08 min
Light Cone, Paris

Walter Ruttmann was a German director, painter, and cinematographer who, along with others in his generation, was an early pioneer of abstract film. In his own words,

he sought to lay 'the foundations for an entirely new way of making art', which drew on abstract painting, animation, and music. In *Light-Play Opus I* (1921) Ruttmann decisively abandons the imitation of movement in a static image that a painter would normally undertake, instead using chronologically organised painted images in sequence. To this end he invented and patented a multiplane animation stand with three transparent, moveable panels onto which he could paint; the same approach was used for the rest of the *Opus* series, and accounts for the handcrafted feel of the forms. Ruttmann asked composer Max Butting to write the music to *Opus I*, which is treated as an equal to the visuals. Later, Ruttmann was influenced by collaborator and Bauhaus student Lore Leudesdorff, who shifted the expressionist forms in *Opus I* toward the geometric, constructivist elements seen in *Opus IV.*

21 Stefan and Franciszka Themerson
THE EYE AND THE EAR, 1944—1945

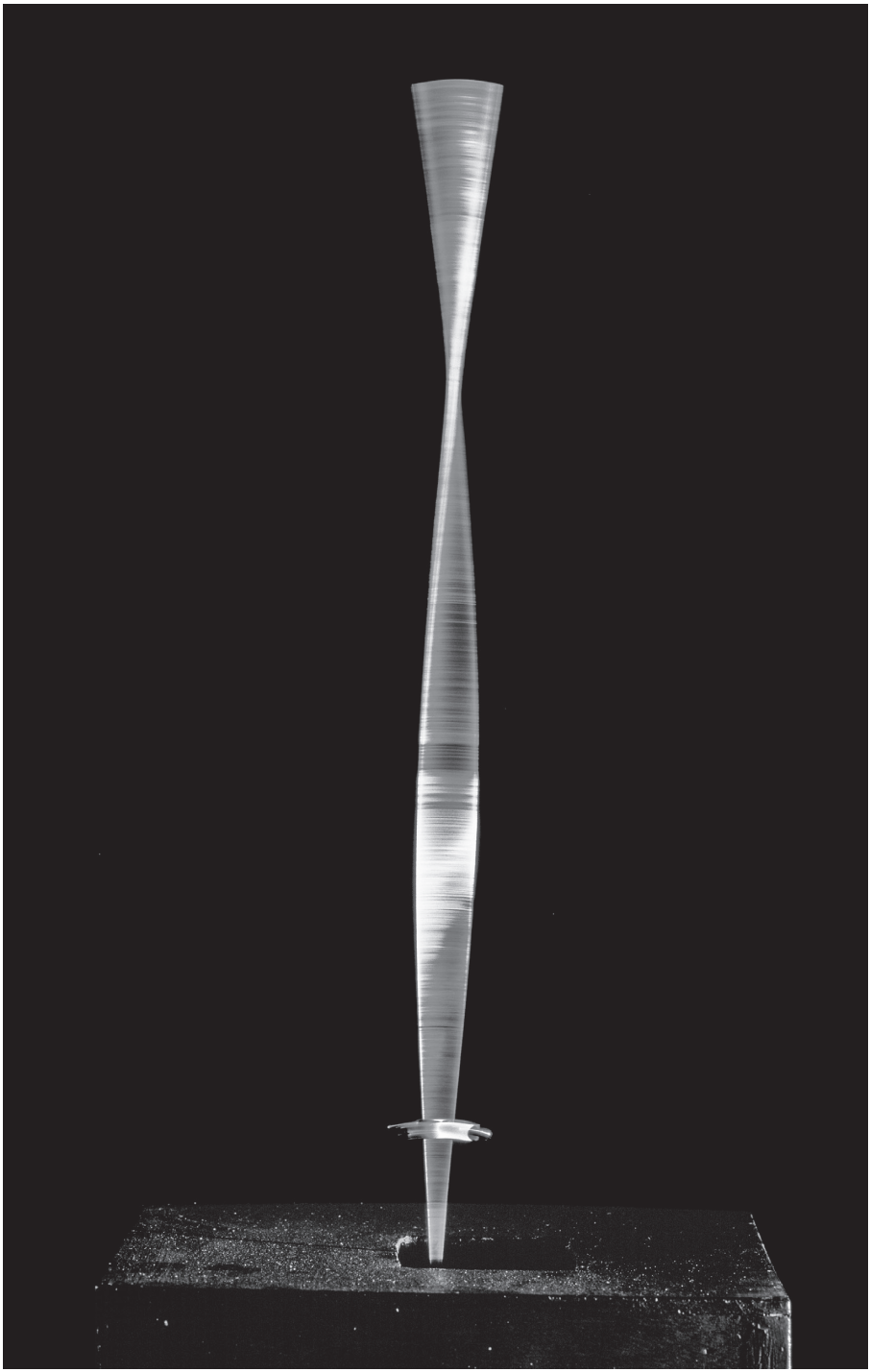
Stefan Themerson (Płock, 1910 — London, 1988) and Franciszka Themerson (Warsaw, 1907 — London, 1988)
The Eye and the Ear, 1944—1945
35 mm film, digitised, b/w, sound; 10:00 min
LUX, London

The Themersons were a Polish couple who adopted a transdisciplinary approach to art, their careers covering illustration, painting, publishing, filmmaking and more. This was the last film they made together in London, the original idea for which was conceived in Poland. *The Eye and the Ear* is an experiment in translation, beginning with poetry into music, then music into images. The film consists of four chapters that offer different ways of visualising music from Karol Szymanowski's *Słopiewnie*, which is based on Julian Tuwim's poem cycle of the same name. The Themersons studied the soundtrack very closely in order to represent it in film, meticulously counting the number of frames needed to synchronise perfectly with the music. They animated the film using entirely their own methods on a self-constructed animation stand, much of it achieved directly by hand using cutouts and other objects.

23 Peter Weibel
THE MAGIC EYE, 1969/2019

Peter Weibel (Odessa, 1944)
Das magische Auge / The Magic Eye, 1969/2019
expanded cinema installation, plastic film, sensors, computer, projector, speakers, wiring, video, b/w, silent; 5:21 min, 300 × 400 × 500 cm
courtesy of the artist

The Magic Eye was developed in 1969 by Peter Weibel together with his then partner Valie Export, and was reconstructed for his solo show at the ZKM | Karlsruhe in 2019. The installation is centred on a unique, auto-generative method of producing sound. Unlike conventional sound films, here the sound is not produced in the projector via the film's audio track, but by projecting images onto a transparent foil equipped with electronic photocells (light dependent resistors). By converting light waves into sound waves, the volume and quality of the sound corresponds to the level of brightness on the screen. In earlier versions of this work Weibel has manipulated sound using shadows of the viewers falling on the screen and gestures made in front of it, but for this reconstructed version from 2019 a film was created specifically for it. In this case the filmmaker has control over the images on screen, but they are never completely in control of the sound, which is dictated by fluctuations in the light, form, and colour of what is projected.



KINETIC ART

By the end of the 19th century the phenomenon of motion had entered the art world. Before real, motoric, mostly wheel-based movement could be integrated into artworks, references to motion occurred in various forms. Many of these efforts happened in conjunction with or were preceded by Eadweard Muybridge's and Étienne-Jules Marey's chronophotography, which recorded the consecutive stages of various moving subjects.

It wasn't until the 1920s that kinetic art had its formative phase, when artists across Europe embarked on integrating movement into their works in parallel with (but independent from) one another. Unlike earlier visual art that only represented movement, kinetic artists created carefully engineered objects that perpetuated movement which could be perceived directly. Works from this period included constructions that moved with the aid of electric motors, and sculptures where quasi-movement was induced through the manipulation of artificial light.

Questions of how perception and cognition work and relate to each other have been key to kinetic art since its emergence. Investigations into such things were present in early kinetic experiments, such as Naum Gabo's *Kinetic Construction (Standing Wave)*, that gave the illusion of volume through motion.

The Czech artist Zdeněk Pešánek significantly contributed to the theory of kinetic art in his 1941 book *Kineticism in Fine Art — Coloured Music*. He is particularly remembered for his lumino-kinetic constructions from the 1920s onward, and was an early adopter of new technologies such as neon tubes, which he used in his artworks.

Although groundbreaking kinetic works were created throughout the 1920s, it was only in the 1950s that kinetic art started to establish its international reputation. In particular, the exhibition *Le Mouvement* at the Galerie Denise René, Paris in 1955, is acknowledged as a milestone in reaching a wider audience for the movement. In the following decades, large scale exhibitions were dedicated to kinetic art worldwide.

Selection of artworks

p. 20
Naum Gabo
Kinetic Construction (Standing Wave), 1919–20
(replica 1985)
metal, wood, electric motor
61.6 × 24.1 × 19 cm
Tate (presented by the artist through the
American Federation of Arts, 1966)
photo: The Work of Naum Gabo © Nina and
Graham Williams / Tate

29 Pol Bury
PUNCTUATION, 1959

Pol Bury (Haine-Saint-Pierre, 1922 — Paris, 2005)
Ponctuation / Punctuation, 1959
painted and perforated hardboard, metal, and electric motor
Ø 70, ht. 5 cm
Kunsthalle Praha, Prague

Pol Bury's first forays into kinetic art were highly inspired by an exhibition of Alexander Calder's mobiles that he saw in 1950, prior to which he had largely worked as a painter experimenting with Surrealism and geometric abstraction. By 1958 he was working on his well known *Punctuation*, a series of works involving concealed electric motors that create movement so slow that it is barely perceptible. This work consists of two discs, one white covered with black dots, the other a black perforated disc that turns very slowly enabling the viewer to see the changing patterns that occur. Through its sensitive and gradual movement, the piece reveals complexities and subtleties that would otherwise be lost to more hurried kinds of movement. Bury was a member of the ZERO group, where the affiliated artists engaged with the possibilities of 'new beginnings' in the arts, one of which was based on movement.

38 Naum Gabo
KINETIC CONSTRUCTION (STANDING WAVE), 1919—20 (replica 1985)

Naum Gabo (Brjansk, 1890 — Waterbury, 1977)
Kinetic Construction (Standing Wave), 1919—20 (replica 1985)
metal, wood, and electric motor
61.6 × 24.1 × 19 cm
Tate (presented by the artist through the American Federation of Arts, 1966)

Around 1920, Naum Gabo showed *Kinetic Construction* to a group of Moscow students to demonstrate the ideals of the recently penned *Realistic Manifesto*, a Constructivist tract that Gabo co-authored with his brother Antoine Pevsner. The manifesto called for a closer relationship between art and the sciences, and *Kinetic Construction* in particular illustrated the potential for sculpture to illustrate volume. Set in motion by an electric motor, a single steel rod rapidly oscillates to give an apparent sense of three-dimensional volume. The investigation of illusionistic, virtual volume was shared by artists of the same generation such as László Moholy-Nagy, who makes specific reference to the topic in his 1929 book, *From Material to Architecture*, and Zdeněk Pešánek who continued to explore kinetic sculpture across his career. Though Gabo did not produce many

kinetic works, the motor-driven movement of *Kinetic Construction* is regarded as a major precursor to mechanical works by the likes of Jean Tinguely later in the 1950s and 1960s.

42 Žilvinas Kempinas
LEMNISCATE, 2007

Žilvinas Kempinas (Plungė, Lithuania, 1969)
fan, magnetic tape
dimensions variable
Szépművészeti Múzeum, Budapest

Žilvinas Kempinas creates complex spatial situations using limited means and accessible, everyday materials. *Lemniscate* (2007) belongs to a larger series of works that use two components, strips of magnetic tape and fans, to conjure up archetypal shapes that defy gravity and dance in the air. The installations present precarious states of equilibrium, Kempinas describing them as 'self-balancing sculptures,' referring to the fact that all living creatures are entities that strive to keep in balance with their environments. A lemniscate is a seemingly simple but conceptually complex geometric formation that recalls the infinity symbol or Möbius strip. Here, the lemniscate floats against the wall in the currents of air generated by the fans. Despite the constantly evolving nature of the work, themes of memory and history are also embedded through the use of the magnetic tape, an outmoded carrier of data here reduced to a formal component.

45 Vollrad Kutscher
21 SHINING EXAMPLES FROM THE HISTORY OF ELECTRICITY, 1990—2021

Vollrad Kutscher (Braunschweig, 1945)
21 Leuchtende Vorbilder aus der Geschichte der Elektrizität / 21 Shining Examples from the History of Electricity, 1990—2021
outdoor installation, terrace of Kunsthalle Praha, Prague, 2021/2022
drawing on glass, halogen
dimensions variable
courtesy of the artist

Vollrad Kutscher has long been concerned with reinventing the art of the portrait, in this case by combining traditional techniques with new media. In 1987 Kutscher painted his own face in miniature on a tiny glass lightbulb for his *Self-portrait Installation*, something he was partly inspired to do through medieval stained glass art. The same technique has been used in *Shining Example*s, a title that

alludes both to the artistic process and the subject matter. It consists of portraits of numerous significant figures associated with the history of electricity who 'shone' through their visionary spirit. The installation invites the viewer to a mystical contemplation of figures who paradoxically embody both scientific progress and a secular vision of the world. Reconciling spirituality and science, Kutscher's *Shining Example*s questions our relationship to faith in a technological society.

53 54 Zdeněk Pešánek
THE SPA FOUNTAIN, 1936—1937

Ležící torzo / Reclining Torso, 1936
from the work *The Spa Fountain*, created for the Czechoslovak pavilion of the International exposition of Art and Technology in Modern Life in Paris, 1937
synthetic resin, neon tubing, light bulbs, artificial stone
48 × 155 × 57 cm
Národní Galerie Praha, Prague

Mužské a ženské torzo / Male and Female Torso, 1936
from the work *Fontána lázeňství* (*The Spa Fountain*), created for the Czechoslovak pavilion of the International Exposition of Art and Technology in Modern Life in Paris, 1937
synthetic resin, neon tubing, light bulbs, artificial stone, metal, paint
136 × 64 × 39 cm
Národní Galerie Praha, Prague

55 56 57 58 Zdeněk Pešánek
ONE HUNDRED YEARS OF ELECTRICITY, 1932—1936

Zdeněk Pešánek (Kutná Hora, 1896 — Prague, 1965)
final models for the set of kinetic light sculptures *Sto let elektřiny* (*One Hundred Years of Electricity*), created for the Zenger Transformer Station in Prague
plaster, wood, metal, wire, luminescent paint; each 102.2 × 29.4 × 14 cm
Národní Galerie Praha, Prague

Most of what we know about Zdeněk Pešánek's lumino-kinetic artworks comes from his theoretical text *Kineticism* published in 1941, the works themselves no longer existing in their entirety. The 'struggle for new art forms' that he writes of can be clearly seen in these hybrid works that were originally shown at the 1937 International Exposition of Art and Technology in Modern Life in Paris, both demonstrating Pešánek's groundbreaking use of neon tubes and other industrial materials. *One Hundred Years of Electricity* was commissioned by the Prague Electricity Works, destined for the façade of the recently completed Zenger substation. *The Spa Fountain*, featuring the *Torsos*, was created in celebration of the national culture of thermal spas for the Czechoslovak pavilion at the 1937 Paris Expo, intended to be brought to life by synchronised, coloured light in the centre of a fountain.

59 Otto Piene
LIGHTROOM PRAGUE, 2002/2017

Otto Piene (Bad Laasphe, 1928 — Berlin, 2014)
Prager Lichtraum / Lightroom Prague, 2002/2017
kinetic light installation with perforated plates, 5 light mills, 1 light cube, 1 light cylinder, timer
ca. 370 × 475 × 460 cm
ZERO foundation, Düsseldorf (donated by Otto Piene and Elizabeth Goldring Piene)

Light has been a crucial medium for Otto Piene since the 1950s, and the format of *Lightroom Prague* has its genesis in works such as *Light Ballet* (1959) which similarly features 'dancing' lights projected into a dark space. Originally Piene moved lights by hand, but soon began to introduce automated movement into his work inspired by contemporaries such as Jean Tinguely and other members of the ZERO group who were equally invested in the marriage of art and technology. The multimedia approach he took was driven by a desire to help repair the broken relationship between humankind, technology, and nature that was felt widely by the post-war generation of artists. *Lightroom Prague* was created for a retrospective exhibition devoted to Otto Piene, which was presented at the Prague City Gallery in 2002.

60 Konrad Balder Schäuffelen
THE EYE (SQUARE, CRICLE, TRIANGLE), 1984

Konrad Balder Schäuffelen (Ulm, 1929 — Munich, 2012)
Das Auge (Quadrat, Kreis, Dreieck) / The Eye (Square, Circle, Triangle), 1984
square tabletop on cubic beam table, camera on wheels, motor, rails, painted wooden triangle
200 × 150 × 150 cm
ZKM | Zentrum für Kunst und Medien, Karlsruhe

In this kinetic installation an antique camera is mounted atop a model train which runs laps around an elevated track and passes through a blue, wooden triangle at one point. This enigmatic scenario is one of Schäuffelen's numerous explorations of the theme of the eye, here bringing together two historically significant technologies of visual media and transportation. Both photography and rail transportation brought about a major perceptual shift for society, and famously the Lumière brothers filmed state-of-the-art subjects such as steam trains for their early films. The importance of the triangle can be understood only at the moment when the camera-train enters it. If seen at the correct time and angle, together the two elements resemble the all-seeing Eye of Providence, except the eye of God is replaced by a camera lens. Finally, the difficulty for the audience in seeing all this from their limited perspective on the work leaves them perceptually challenged in comparison to the roving, mechanical eye before them.

62 Takis
ELECTROMAGNETIC SPHERE, 1970

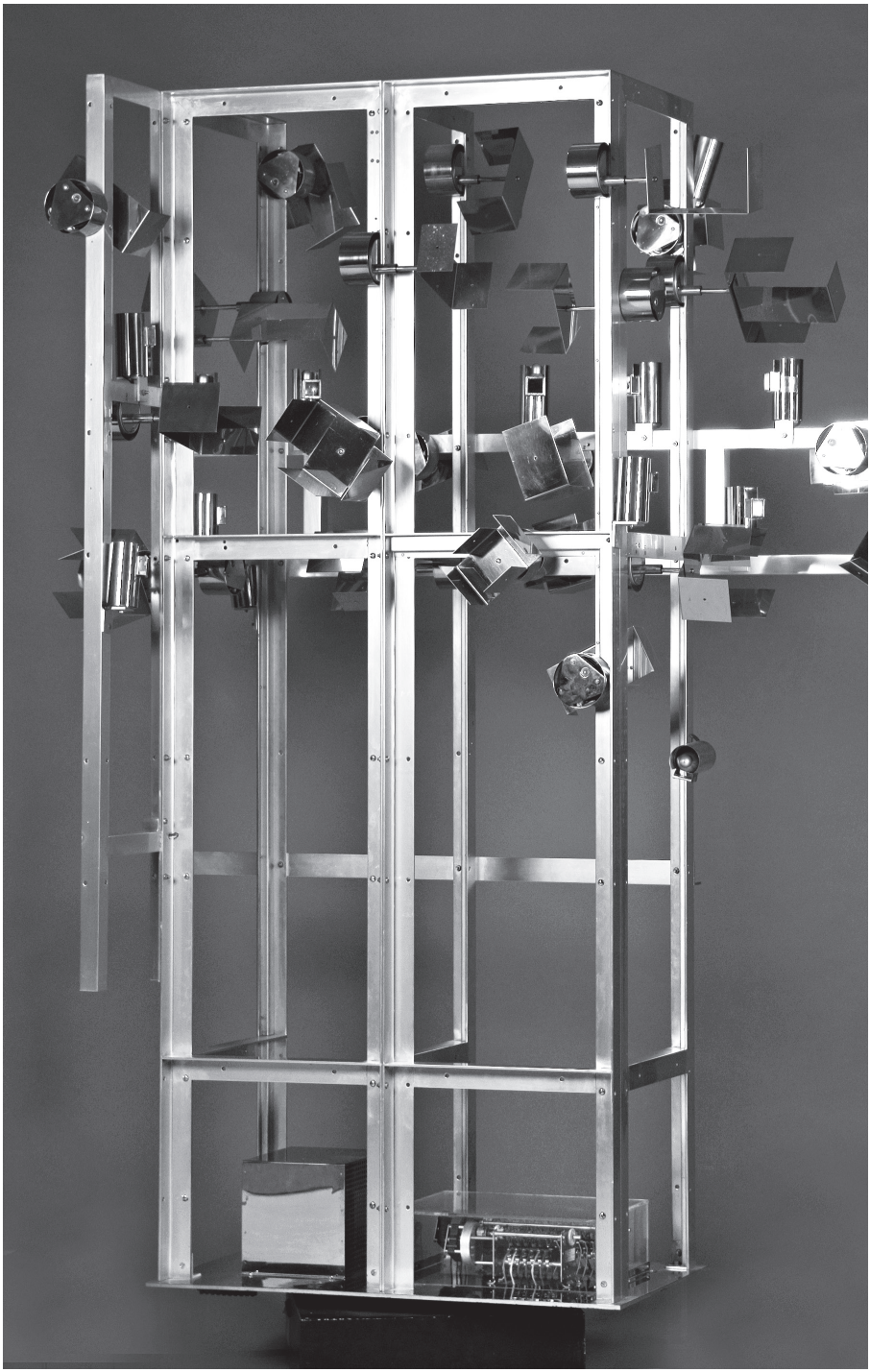
Takis (Athens, 1925 — Athens, 2019)
Electromagnetic Sphere, 1970
plexiglass, electromagnet, polystyrene sphere, magnet, and wire
57 × 83 × 83 cm
Takis Foundation, Athens

Greek sculptor Panagiotis Vassilakis, known as Takis, spent his career incorporating invisible energies into what he called a 'fourth dimension' in his art. Magnetism became of specific interest to him through his numerous encounters with modern technology, embarking on his first experiments with electromagnetic energy from the mid-1950s. For Takis, magnetism provided a means by which he could bring his sculptures to life and relieve them of their static appearance. *Electromagnetic Sphere* is one of his many 'Télé-sculptures', all of which include a kinetic element. Here an electromagnet is set on a black acrylic disk on the gallery floor and a foam sphere containing a piece of iron is suspended by a thin cord from the ceiling. When the electromagnet switches itself on and off, the sphere alternately bounces off, shudders to a stop inside, or is accelerated through the resulting magnetic field.

66 Peter Weibel
SAVOIR, 2011

Peter Weibel (Odessa, 1944)
Savoir, 1966/2011
view of the exhibition *respektive Peter Weibel*, ZKM | Zentrum für Kunst und Medien, Karlsruhe, 2019
neon tubes, cables, timer
47.5 × 200 × 15 cm
collection of the artist

Since the early 1960s Peter Weibel has investigated how language affects our experience of reality through his art and poetry. Some of his first attempts were 'mobile texts' that invited audiences to create their own poems from a selection of words and letters, allowing them to decide the meaning of the text. In this work Weibel takes his approach into the medium of light as part of a series known as *Motion Poems*. Words made of neon tubes are equipped with a timer that lights up different groups of letters. With each illumination new meanings are revealed before quickly changing again. Words are discovered under words, such as the French 'savoir' [to know] which contains 'avoir' [to have] as well as 'voir' [to see]. Much more than a collection of puns, political meanings are made very clear in words such as 'Patri(di)oten' [patri(di)ots], where we find 'Patrioten' [patriots], 'Idioten' [idiots], and 'Toten' [the dead].



CYBERNETIC ART

Cybernetics, the science of communication and control in animal and machine, was a movement that profoundly impacted the arts and sciences for decades. This interdisciplinary version of systems theory was advocated by founder Norbert Wiener in the late 1940s, and though its significance gradually decreased from the 1980s, a revival has been seen in recent years due to the increased interest in artificial intelligence.

Cybernetics focuses on what systems do, how they use information, and how they achieve their goals. It is specifically concerned with questions of how systems regulate themselves and learn, and how stability is maintained within them. Thus, cybernetics frequently uses technical terminology borrowed from biology and other branches of science, such as feedback, control loops, and homeostasis.

Wiener among other cybernetic thinkers proposed that there be a cybernetic theory of both artificial and natural systems, whether computational, biological, or even sociological. He emphasised that what these seemingly disparate systems have in common is that they rely on a set of random processes and stabilise themselves through reflexive feedback.

Cybernetics has explicitly and profoundly impacted the arts from its very beginning, and on both sides of the iron curtain seminal exhibitions brought together artworks touched by the discipline. For example, *Nove tendencije (New Tendencies)* was a series of five exhibitions held between 1961 and 1973 in Zagreb, Yugoslavia, and in London, at the Institute of Contemporary Arts, *Cybernetic Serendipity* took place in 1968. Both featured a comprehensive selection of cybernetic and computer-oriented art from engineers who had turned to art and artists who had themselves learned how to program.

The legacy of cybernetics continues to be felt in the arts, especially in work that is environmentally-responsive, uses circular feedback, or requires the participation of the audience: many examples of which can be seen in this exhibition.

Selection of artworks

p. 28
Nicolas Schöffer
Chronos, 1965
chromium steel
208 × 170 × 90, Ø 240 cm
Szepművészeti Muzeum, Budapest
photo: © Szepművészeti Muzeum / Museum of Fine Arts, 2022, © ADAGP, Paris, 2021

67 Vladimir Bonačić
RANDOM 63, 1969

Vladimir Bonačić (Novi Sad, 1938 — Bonn, 1999)
Random 63, 1969
aluminium, light bulbs, electronics
76 × 76 × 7 cm
ZKM | Zentrum für Kunst und Medien, Karlsruhe

Vladimir Bonačić began his artistic career in 1968 as a participant in the Zagreb-based *Nove tendencije* (*New Tendencies*) group, who sought to connect artistic research with science and technology. As a doctor of the technical sciences, Bonačić was particularly concerned with representing scientific phenomena in visual form. This was the aim of *Random 63*, an attempt to visualise the mathematical Galois theory. *Random 63* uses 63 light bulbs arranged according to computer calculations to explore elements of chance in art and science. The movement of light is partly pure randomness and partly calculated pseudo-randomness. Ideally the viewer's interaction with the installation would begin with the pure visual pleasure of observing light, then move towards an understanding of the principles behind its movement.

68 Shilpa Gupta
UNTITLED (SHADOW 2), 2006

Shilpa Gupta (Bombay, 1976)
Untitled (Shadow 2), 2006
interactive video projection incorporating the simulated shadow of the viewer
480 × 650 × 350 cm
ZKM | Zentrum für Kunst und Medien, Karlsruhe

Shilpa Gupta is a Mumbai-based artist whose work spans a large number of mediums. Her art often concerns the fragile nature of perception and frequently utilises illusion. *Untitled (Shadow 2)* is part of a series of media installations involving the shadow created between 2006–2007. Upon entering the room visitors immediately become participants in it as their silhouettes interact with animated drawings of various objects that appear on a large screen. This inevitable involvement suggests that the closed circuit of action and reaction in this installation, just as in the outside world, is largely beyond our control. This feeling is compounded by the objects and sounds drawn from the domestic environment, adding that our surrounding environment may also be something we accidentally find ourselves in the midst of. Nevertheless, the result is a dynamic series of micro-stories that unravel as interaction between participant and shadow develops.

69 György Kepes
FLAME ORCHARD, 1972

György Kepes (1906, Selyp — 2001, Cambridge, Mass.)
(with the collaboration of Dr. William Walton, Mauricio Bueno, and Paul Earls)
Flame Orchard, 1972
6 boxes divided into two sections
360 x 60 cm each
collection of Kepes Institute

György Kepes was a Hungarian artist and founding director of the Center of Advanced Visual Studies (CAVS) interdisciplinary research programme at MIT. *Flame Orchard* draws on Kepes' ethic of 'inter-thinking', a collaborative enterprise that united established artists with scientists to produce new works. Consulting physicist William Walton helped Kepes to create a synaesthetic choreography that used the unique plasticity of flames. Several scientific points of reference were used, including Chladni figures, an 18th century method for visualising vibrations, and John LeConte's observations of how sound modulated gas flames. The electroacoustic music of Paul Earls was used to alter the flames in size, shape, direction, and intensity through concealed speakers.

72 Christina Kubisch
CLOUD, 2019

Christina Kubisch (Bremen, 1948)
Cloud, 2019
electromagnetic sound installation
dimensions variable
courtesy of the artist

Cloud is an installation made up of over one thousand metres of electrical cable suspended at ear level and a multichannel composition that can only be heard using headphones specifically designed by the artist. Kubisch uses wireless electromagnetic induction (the mutual interaction of magnetic fields) to transmit audio between the sculpture and the audience, who can navigate a variety of sounds that become more or less intense depending on their position. The sounds themselves are all recordings of data being processed or electricity being produced in locations such as power plants, garages, security centres, and more. The title *Cloud* evokes both the natural world and the form of digital storage, an association that Kubisch engages to probe the entangled relationship of the two. For her, the digital world relies on the terminology of the natural world to mask its technical and synthetic character, something clearly seen in the highly physical presence of *Cloud* that contradicts the lightness and movement associated with the term itself.

74 Frank Joseph Malina
VOYAGE II, 1957

Frank Joseph Malina (Brenham 1912 — Boulogne-Billancourt, 1981)
Voyage II, 1957
fluorescent lamps, electric motor, painted acrylic glass panes, metal
81 × 62 × 8 cm
ZKM | Zentrum für Kunst und Medien, Karlsruhe

Voyage II, with its touchpoints between light and movement, perfectly encapsulates Frank Joseph Malina's artistic output. Malina was a pioneer of kinetic art, but was also an aeronautical engineer who worked on the launch of the first U.S. high-altitude rocket. Around 1953, Malina dedicated himself almost exclusively to art, making extensive use of his prior research. By integrating electric light into his paintings, Malina created the concept of electropainting. Together with scientist Jean Villmer he developed an electromechanical system called Lumidyne for this method, of which *Voyage II* is an example. The system combines motors and light bulbs with coloured plexiglas and transparent diffusion screens. In 1968, he founded the influential magazine *Leonardo* as an open forum for artists working at the intersection of art, science, and technology.

76 Nicolas Schöffer
CHRONOS, 1965

Nicolas Schöffer (Kalocsa, 1912 — Paris, 1992)
Chronos, 1965
chromium steel
208 × 170 × 90, Ø 240 cm
Szépművészeti Múzeum, Budapest

Nicolas Schöffer was a Hungarian-born artist who spent most of his life in Paris, where he helped pioneer cybernetic art. Inspired by the thought of Norbert Wiener, the founder of cybernetics, Schöffer sought to make artworks that could sustain themselves on feedback loops that constantly detect, receive, and process information from their environment. His *Chronos* sculptures bring together space, light, and time as metallic plates rotate at incredible speed, the light they produce made random by the means of an 'indifferent cell', an electromechanical system that disrupts the running program. His dedication to a dynamic, technological art draws on the earlier developments of artists such as László Moholy-Nagy, whose *Light-Space Modulator* works to similar goals. Schöffer's work holds a tension between high precision and ultimate control on one hand, and a commitment to create spectacular, autonomous sculptures on the other—which might be described as his very own internal cybernetics.

77 Wen-Ying Tsai
UMBRELLA, 1971

Wen-Ying Tsai (Xiamen, 1928 — New York, 2013)
Umbrella, 1971
metal, concrete, wood, and motor
265.4 × 180.3 × 180.3 cm
Tate (purchased in 1972)

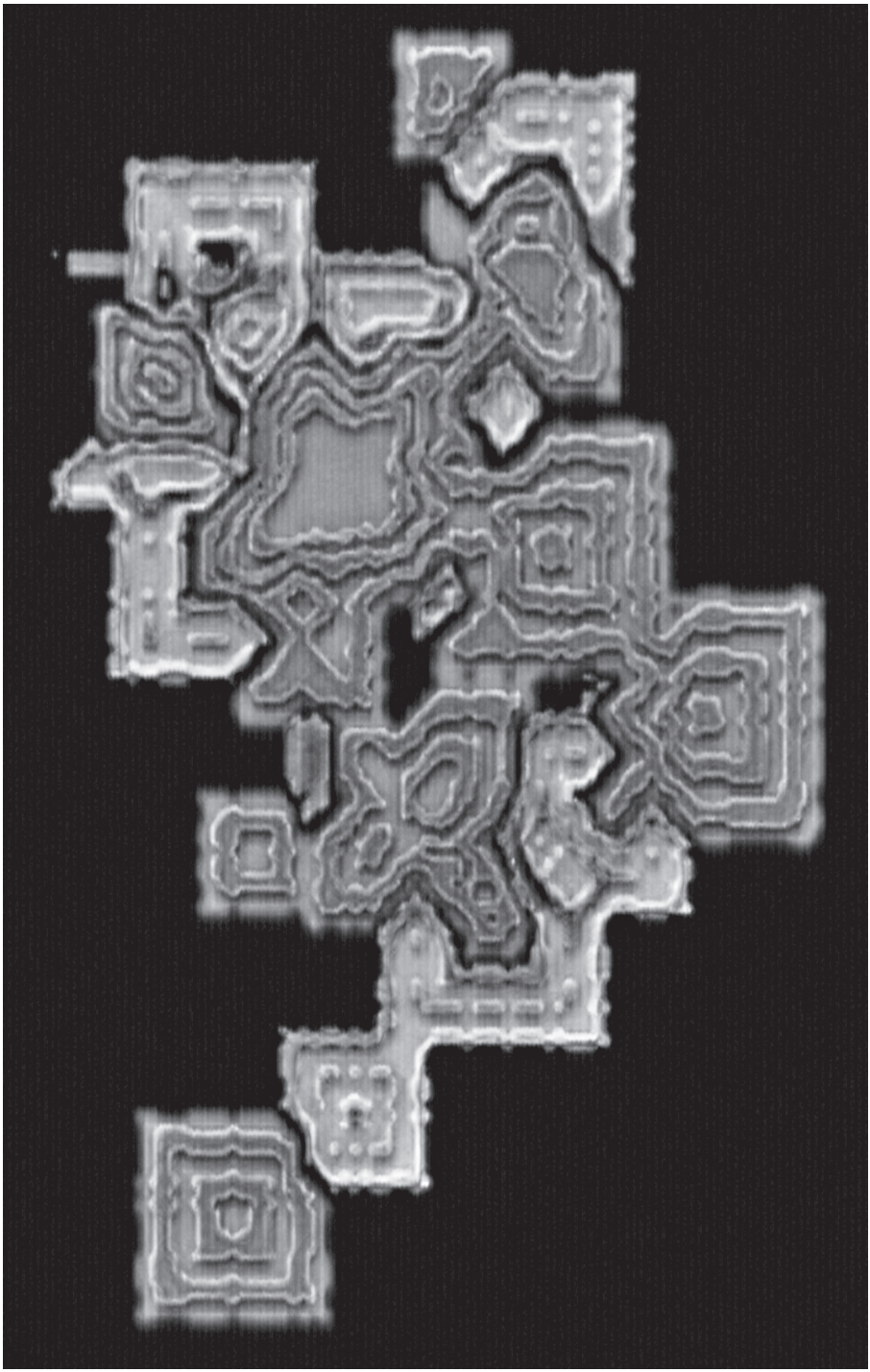
Wen-Ying Tsai was a pioneer of cybernetic and kinetic art whose interest in the poetic potential of science and technology began after his career as an architectural engineer. Tsai started working with vibrating stainless-steel rods and stroboscopic light from the mid-1960s, originally inspired by the observation of natural phenomena such as flickering daylight through groves of trees. *Umbrella* is one of his early experiments in this medium, featuring metal rods vibrating at about 20–30 cycles per second and flashes of stroboscopic light lasting less than a thousandth of a second. As the human eye cannot perceive the transitions of the flashing strobes, the visual effect of the work depends on an afterimage. Moreover, the work responds to environmental sound, thereby changing the frequency of the flashes and ultimately what the viewer sees: when the rate of flashes is close to the rate of vibrations, the motion appears as a slow-moving harmonic curve. If the rate is significantly slower or faster, then the rods appear to dance. As one of the first Chinese-born artists to achieve international recognition in the 1960s, Tsai was an inspiration to generations of Chinese artists around the world.

81 Woody Vašulka
LIGHT REVISITED, 1974–2001

Woody Vašulka (Brno, 1937 — Santa Fe, 2019)
Light Revisited, 1974–2001
spatial interpretation of Woody and Steina Vašulka's collaborative video piece *Noisefields*, 1974
AV installation, variable dimensions, system of semi-permeable dichroic mirrors, steel construction, video projector, player, stereo sound, source tape: 3/4" U-matic, colour, sound, looped; 12:05 min
Vašulka Kitchen Brno (on permanent loan from BERG Contemporary, Reykjavík)

The single channel video *Noisefields* was made in 1974 by Steina and Woody Vašulka whilst they were living in New York City. In 2001, Woody Vašulka comprehensively reworked the same video material into a complex audiovisual environment, *Noisefields — Light Revisited.* This multi-sensory work can be described simultaneously as a sound-to-image machine and an experiment in perception. The intense, pulsating abstract patterns are modulated by frequencies emitted

in the sound, and in turn the sound is synchronised with the rhythm of the flickering images. This piece was strongly influenced by experiments in binocular perception conducted in collaboration with painter Alfons Schilling, who shared many of the same concerns as the Vašulkas. *Light Revisited* continues earlier investigations into the relationship between sound and image.



COMPUTER ART

Computation and its exponential development in the 20th century radically changed practically every segment of life and society in many parts of the world. In particular, the growth of information technology in the 1990s enabled a worldwide digital network that in its early days was described by numerous artists and theoreticians to be the ultimate social utopia.

The history of computer art began with the partially automated generation of images and grew to include digital art, software art, net.art, and its contemporary fringes like post-internet art. All these can essentially be traced to the 1960s, when a handful of enthusiasts began to experiment on the borders of technology and art. Hubs of innovation such as Bell Laboratories in New Jersey and the Technische Universität Stuttgart became centres of 'generative art' and 'information aesthetics'. Due to the inaccessible nature of computers at the time, the infrastructure that such labs provided was essential for artists until personal computers became practically ubiquitous from the 1990s onwards, in conjunction with the availability of the internet.

Soon after the World Wide Web became commercially available, the golden age of net.art started. Since its emergence the media of digital art has fluctuated between palpable objects and elusive software. While net.art artists used the internet as a medium, post-internet art from 2008 onwards engages with digital culture and its societal impacts, regardless of the format.

Although experiments with computer graphics are no longer the main concern of computer art, its expanded capacity in recent years has allowed artists to visualise entirely new worlds and push the potential of visual art in general. Today almost all forms of art, at least implicitly, have been impacted by computing, software, or algorithmic thinking, including traditional mediums such as sculpture and painting.

Selection of artworks

p. 36
Lillian F. Schwartz
ENIGMA, 1972
16 mm film (computer graphics film), digitised, sound
4:05 min
from the Collection of The Henry Ford, Dearborn
(a gift from the Lillian F. Schwartz and
Laurens R. Schwartz Collection)
photo: from the Collections of The Henry Ford,

83 Refik Anadol
INFINITY ROOM, 2015

Refik Anadol (Istanbul, 1985)
Infinity Room, 2015
four-channel audiovisual installation with seven noise algorithms running on custom software
400 × 400 × 400 cm, 14:00 min
Refik Anadol Studio, Los Angeles

Infinity Room invites visitors to step into a mirrored room that uses light, sound, and technology to create an unprecedented immersive space. The installation uses projection mapping to conceive a constantly changing virtual landscape. Light is the major element of the work, used to signify the threshold between the simulated latent space created by the projection technology and the physical, architectural space where the viewer stands. Rather than approaching the medium as a means of escape into some disembodied techno-utopian fantasy, the project offers a means of return, facilitating a temporary release from our habitual perceptions and culturally biased assumptions to enable us to perceive ourselves and the world around us anew. The project emerges from the artist's ongoing research that he calls 'Temporary Immersive Environment Experiments,' which refers to the state of consciousness during immersion.

84 Michael Bielický and Kamila B. Richter
SEVENTYNINE, 2021

Michael Bielický (Prague, 1954) and Kamila B. Richter (Olomouc, 1976)
SEVENTYNINE, 2021
metallic object with golden surface, spatial sound, microphone, AI,
spherical display, custom-made software
ca. 230 × 200 × 200 cm
artistic supervisor / engineering concept: Alex Wenger; artistic supervisor / programmer: Nikolaus Völzow; sound artist: Kimin Han; artistic supervisor: Paul Kenig
courtesy of the artists

SEVENTYNINE is the name of the artificial being at the centre of this collaborative work, whose head manifests in a specially engineered spherical screen. The audience can interact by speaking to the being, who will return their words in the form of melodic, contemplative chants. The being itself and its relationship to the audience was inspired by the idea of the *homunculus*, an alchemical term referring to a miniature, fully formed human that could be created in a laboratory, which is here compared to contemporary artificial intelligence. Today's homunculus or AI is able to create new homunculi through *imitatio Hominis* and these can then create further AI *ad infinitum*. Both Bielicky and Richter have previously experimented with data-driven works involving the visualisation of data and the

use of algorithms, but *SEVENTYNINE* is one of their first attempts to create an autopoetic artwork.

89 Laurent Mignonneau and Christa Sommerer
PORTRAIT ON THE FLY, 2015

Laurent Mignonneau (Angoulême, 1967) and Christa Sommerer (Gmunden, 1964)
Portrait on the Fly, 2015
interactive work on a TV screen
dimensions variable
courtesy of the artists

Mignonneau and Sommerer's installations often feature generative algorithms which enable the audience to shift from observers to participants in their works. *Portrait on the Fly* is deceptively simple, featuring just a flat screen hanging vertically like a mirror and a disorganised swarm of virtual flies hovering aimlessly on it, the algorithm coming into effect when someone steps in front of the screen. Doing so directs the flies to assume the contours of the viewer, creating the uncanny effect of likeness through other biological entities. This particular effect has a distinct tradition in the history of visual art known as the Arcimboldo effect. By trying to read our own image in an ever-changing swarm of digital flies, we are prompted to reflect on our place within a complex ensemble of technology, intelligent programming, and living nature.

90 Haroon Mirza
SELF-TRANSFORMING EMDRIVE, 2017

Haroon Mirza (London, 1977)
Self-Transforming EmDrive (Solar Powered LED Circuit Composition 34), 2017
addressable LEDs, wire, copper tape, acrylic, and optical lenses on a photovoltaic panel
163.5 × 99 cm
Kunsthalle Praha, Prague

Haroon Mirza is a multimedia artist whose sculptural installations involve sound, light, and electric current. His work refers to a time when the relationship between technology and culture has been redefined, where technology is an element in our society in which we participate both actively and passively. He experiments with visual and auditory disruptions in his work, often by subverting the original functions of various electrical objects or by juxtaposing obsolete with contemporary technologies. *Self-Transforming Emdrive* features several coloured LED strips on a photovoltaic panel which are controlled by the amount of light that falls on them. The LEDs can thus be manipulated by the viewer, who is invited to interact with the work and determine the intensity of their brightness through

their movements. The acrylic marks on the panel add an expressionistic touch that emphasises the meeting of the individual with an electronic and technological world.

92 Anna Ridler
MOSAIC VIRUS, 2019

Anna Ridler (London, 1985)
Mosaic Virus, 2019
3-screen GAN video installation
dimensions variable
courtesy of the artist

In *Mosaic Virus*, Anna Ridler draws upon a rich web of references including technology, data, capitalism, and the natural world. The work's title explicitly evokes a virus that caused variegated stripes in tulip petals, the chance and rarity of which drove 'tulip mania', the 17th century craze for tulip bulbs that saw wild spikes in price. The volatile demand of tulip mania is here linked to contemporary speculation around cryptocurrency and its similarly unpredictable fluctuation in value, which through an algorithm determines the appearance of the simulated tulips onscreen. To achieve this Ridler compiled a bespoke dataset of over ten thousand photographs and then used machine learning processes that allowed the generation of synthetic tulips based on currently existing examples. Though historically distant, the shared fragility and hysteria of these themes are conceptually and visually brought together in a mesmerising way.

93 Lillian Schwartz
ENIGMA, 1972

Lillian F. Schwartz (Cincinnati, 1927)
ENIGMA, 1972
16 mm film (computer graphics film), digitised, sound; 4:05 min
from the collection of The Henry Ford, Dearborn (a gift from the Lillian F. Schwartz and Laurens R. Schwartz Collection)

Lillian Schwartz helped pioneer the use of computer technology as an artistic medium through her art and research, both of which initially took place at the legendary centre of art and technology, Bell Laboratories. *ENIGMA* is one of her earlier experiments, closely linked to her research into visual and colour perception. Here the extremely quick succession of black-and-white geometric lines creates the illusion of saturated colour in certain parts of the composition, until colour is used more directly later in the film. The psychological and physiological effects of

the work are not produced by computers, only the imagery itself, which the artist used as a basis for her research in colour perception. Schwartz's persistently vibrating rectangles, like the Structural film movement, are late successors of the abstract films of the 1920s, but her computer animation retains a painterly spin. The artist collaborated with composer Richard Moore for the soundtrack, which was created using connections between an analogue synthesiser and computer.

94 Jeffrey Shaw and Dirk Groeneveld
THE LEGIBLE CITY, 1988—1991

Jeffrey Shaw (Melbourne, 1944) and Dirk Groeneveld (Amsterdam, 1956)
The Legible City, 1988—1991
interactive computer installation
360 × 550 × 650 cm
ZKM | Zentrum für Kunst und Medien, Karlsruhe

Audience interaction has been an important part of Jeffrey Shaw's work since the late 1960s, beginning with *Corpocinema* and *Moviemovie* (1967) which expanded the flat surface of the cinema screen into huge three-dimensional and tactile surfaces that brought viewers closer to what they saw. Made in collaboration with Dirk Groeneveld and software developer Gideon May, *The Legible City* continues these concerns by putting audiences in direct control as they navigate virtual cities by bicycle. Manhattan, Amsterdam, and Karlsruhe are all presented as building-high words that when followed tell different stories from each city. The immersive experience—an essential part of Shaw's media art—is further enhanced by its interactivity. Shaw specifically chose the bicycle as a familiar, accessible, and playful mode of navigation that emphasises the agency of the audience in the installation.

95 Karl Sims
EVOLVED VIRTUAL CREATURES, 1994

Karl Sims (Boston, 1962)
Evolved Virtual Creatures, 1994
video, colour, sound; 4:08 min
courtesy of the artist

Karl Sims is a computer graphics artist whose work often revolves around themes of evolution and the natural sciences. *Evolved Virtual Creatures* is a digital interpretation of the process of natural selection, featuring Sims' own digital code which is given the chance to 'evolve' on its own natural course. In various virtual landscapes, hundreds of block creatures are tested for their ability to perform

a specific ‘natural law’, such as to swim in a water environment. The most successful creatures contribute their genes to the genetic code, giving rise to further mutations that continue the process of evolution. This eventually results in generations of creatures with increasing complexity. Aside from swimming, other creatures compete for a green cube, jump across land, and follow a red target, each scenario with its own uniquely evolved creatures. Here, evolution has been digitised with the understanding that complex algorithms can come out of natural selection.

96 teamLab
UNITED, FRAGMENTED, REPEATED, AND IMPERMANENT WORLD, 2013

teamLab (Tokyo, 2001)
United, Fragmented, Repeated, and Impermanent World, 2013
interactive digital work, 8 channels; sound by Hideaki Takahashi
dimensions variable
courtesy of teamLab and Pace Gallery

teamLab is a Tokyo-based collective made up of more than 700 artists, programmers, engineers, animators, mathematicians, and many others. Their large-scale digital installations are guided by the concept of ‘active perception’, understood as an engagement with art in an active bodily state. *Untitled, Fragmented, Repeated, and Impermanent World* is a work that demands active perception from its audience, who become participants in its rich digital environment by triggering changes on the screen through their movements, contributing to a constant visual evolution. Its pixelated appearance, and the flora and fauna within it, are inspired by a particular painting of mid-Tokugawa period painter Itō Jakuchū (1716–1800), *Birds and Animals in the Flower Garden* (鳥獣花木図屏風, Chōjūkaboku-zu byōbu), which was painted using its own ‘pixels’ of coloured blocks arranged on a grid.

List of Artists

Yaacov Agam
Refik Anadol
Lubomír Beneš
Michael Bielický
Christian Boltanski
Vladimir Bonačić
László Zsolt Bordos
Jonathan Borofsky
Martha Boto
Robert Breer
Angela Bulloch
Pol Bury
Mary Ellen Bute
Nino Calos
Jim Campbell
Tony Conrad
Carlos Cruz-Diez
Gabriele Devecchi
Milan Dobeš
Karel Dodal
Irena Dodalová
Marcel Duchamp
Viking Eggeling
Olafur Eliasson
Cerith Wyn Evans
Naum Gabo
Shilpa Gupta
Milan Guštar
Brion Gysin
Angelika Huber
Ryoji Ikeda
Francisco Infante-Arana
Žilvinas Kempinas
William Kentridge
György Kepes
Krištof Kintera
Gyula Kosice
Piotr Kowalski
Brigitte Kowanz
Ted Kraynik
Christina Kubisch
Vollrad Kutscher
Bertrand Lavier
Carolin Liebl
Len Lye
Heinz Mack
Frank Joseph Malina
Adéla Matasová
Christian Megert
Laurent Mignonneau
Haroon Mirza
László Moholy-Nagy
François Morellet
Mihovil Pansini
Julio le Parc
Gordon Pask
Andrzej Pawłowski
Zdeněk Pešánek
Otto Piene
Marko Pogačnik
Random International
Man Ray
Hans Richter
Kamila B. Richter
Anna Ridler
Walter Ruttmann
Jan Ságl
Konrad Balder Schäuffelen
Nikolas Schmid-Pfähler
Nicolas Schöffer
Hans Schork
Lillian F. Schwartz
Miloš Šejn
Paul J. Sharits
Jeffrey Shaw
Karl Sims
Christa Sommerer
Takis
teamLab
Franciszka Themerson
Stefan Themerson
Jean Tinguely
Wen-Ying Tsai
Steina Vašulka
Woody Vašulka
Otakar Vávra
Xavier Veilhan
Kateřina Vincourová
Peter Vogel
Peter Weibel

List of Lenders

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EXHIBITION
KINETISMUS: 100 YEARS OF ELECTRICITY IN ART

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Co-curator Christelle Havranek
Scientific associate Lívia Nolasco-Rózsás

Exhibition design Schroeder Rauch
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Exhibition production Eliška Žáková
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Conservation and restoration Pavol Sás
Execution of exhibition architecture Gartium, Gerriets CZ s. r. o., N.A.D. New Aluminium Design s. r. o., CNC Studio s. r. o., REVYKO, spol. s r. o., TUCHLER jevištní a textilní technika spol. s r. o.
AV set-up and technical collaboration Lunchmeat Studio
Installation Patrik Adamec, Matej Al-Ali, Eva Havlová, Lubomír Holba, Jiří Kaňák, Mikuláš Sanko, Augustin Soukup, Jakub Šimek
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