ELECTRIC DREAMS

28 NOV 2024 – 1 JUN 2025

LARGE PRINT GUIDE

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CONTENTS

CONCOURSE

ELECTRIC DREAMS: ART AND TECHNOLOGY BEFORE THE INTERNET 28 NOV 2024 – 1 JUN 2025

GUCCI

Gucci remains steadfast in championing initiatives that foster community, inclusivity, and artistic diversity. Supporting the **Electric Dreams: Art and Technology Before the Internet** exhibition marks a significant milestone in the House's four-year partnership with Tate, which began in May 2024, alongside the Gucci Cruise 2025 fashion show.

This partnership underscores Gucci's dedication to cultural expression and innovation, exemplified by the exhibition itself. By celebrating early innovators of optical, kinetic, programmed, and digital art, the show reflects Gucci's pioneering spirit and commitment to exploring creative frontiers.

ANTHROPIC

Anthropic is pleased to support **Electric Dreams**, which examines technology as not only a production tool, but a medium for artistic expression. The exhibition shows us how artists have consistently used orthogonal thinking to embrace each technological leap and stretch the limits of their creativity and intuition.

As a public benefit corporation, Anthropic researches the societal impacts of artificial intelligence to guide people through this latest, extraordinary era of change. Beyond our research, we're also the team behind Claude—an AI companion designed to support ingenuity and spark imagination.

We hope this exploration of technology inspires your own electric dreams for the future.
Everett Katigbak
Creative Director, Anthropic

HYUNDAI TATE RESEARCH CENTRE: TRANSNATIONAL
In its mission to offer new perspectives on global art histories, the Hyundai Tate Research Centre: Transnational in partnership with Hyundai Motor has provided support for key scholarship and research with a focus on transnational artists' networks working at the intersections of art and technology.

Hyundai Tate Research Centre: Transnational fostered deeper conversations around the transnational genealogies of new media practices by supporting a performance and discursive event with Samia Halaby & The Kinetic Painting Group. Odessa Warren, Assistant Curator (Hyundai Tate

Research Centre: Transnational) contributed scholarship related to transnational networks of experimentation in arts and technology across cities in Japan, India and the US in the 1960s-70s.

Electric Dreams is presented in the Eyal Ofer Galleries

In partnership with

GUCCI

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THE TIMES
THE SUNDAY TIMES

Research supported by

HYUNDAI TATE RESEARCH CENTRE: TRANSNATIONAL

In partnership with

With additional support from The Electric Dreams Exhibition Supporters Circle:

The David Bermant Foundation
Marcin and Izabela Wiszniewski

Tate Americas Foundation, Tate International Council and Tate Patrons

Curated by Val Ravaglia, Curator, International Art, Tate Modern, and Odessa Warren, Assistant Curator, International Art (Hyundai Tate Research Centre: Transnational), Tate Modern.

This exhibition has been made possible by the provision of insurance through the Government Indemnity Scheme. Tate would like to thank HM Government for providing Government Indemnity and the Department for Culture, Media and Sport and Arts Council England for arranging the indemnity.

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Lighting
Lightwaves

Samia Halaby born 1936
Born Palestine, works US
Fold 2

1988
Kinetic Painting, Amiga software, shown as video, colour
Running time: 45 sec

Tate. Purchased with funds provided by the Middle East and North Africa Acquisitions Committee 2023
X88935

Vivid, brightly coloured geometric shapes and slanting lines fill this screen, shifting restlessly in all directions. Halaby calls these moving abstract animations ‘kinetic paintings’. They exist in motion, as dynamic forms that change over time.

Halaby created **Fold 2** after teaching herself how to code on a Commodore Amiga 1000. Released in 1985, it was one of the first widely available personal computers. For Halaby, who also paints with brushes and canvas, ‘The computer gave new attributes to the language of painting, and I want to be an artist at the edge of its investigation.’

ROOM 1

Right of entrance

[Wall Text]

1. INTRODUCTION

This exhibition brings together a network of artists inspired by scientific ideas and technologies. It tells a series of loosely connected stories about the early innovators of electronic art, from the 1950s to the widespread adoption of the internet in the early 1990s. Collaborating internationally, they experimented with cutting-edge media and hybrid methods to expand their collective creative horizons. Many believed technology should be a communal resource, working together to steer its development towards creative and social uses.

Some artists in the exhibition used electronics to shape light and sound. Others introduced mathematical principles and algorithms as creative partners. New fields of study, such as cybernetics, encouraged artists to think about the relationship between artworks and their audience as a 'communication system'. Viewers became active participants. Applying emerging technologies and scientific principles to art made it possible to interact with it in new ways.

Breakthroughs in telecommunications allowed artists

to collaborate across international boundaries, forming networks and communities. Computers went from the size of a room to discreet boxes sitting on a desk, transforming how people could work. For some, engaging with technology was a way of reclaiming it from the military and corporate interests that had driven its development. Many artists tinkered in high-tech research labs or with consumer electronics, often sharing access to expensive equipment with each other and their communities.

Electric Dreams is roughly chronological. Immersive installations of large-scale works combine with rooms exploring artists' shared interests and collaborations. It contains a wide range of ideas and technologies, from paintings inspired by mathematics and the science of perception to the earliest experiments with virtual reality. As technology continues to shape the world in ways we can't yet imagine, this exhibition presents how earlier artists coupled scientific thinking with human creativity.

Scan to view the exhibition texts and large print guide.

Clockwise round the room from left of entrance

Kiyoji Ōtsuji 1923–2001
Born and worked Japan

Atsuko Tanaka, Electric Dress, 2nd Gutai Exhibition

1956, printed 2012
Photograph, gelatin silver print on paper

Tate. Purchased with funds provided by the Asia-Pacific Acquisitions Committee 2019
P82296

Tanaka described her **Electric Dress** as 'a painting that moved'. The same idea inspired much of her early work. This photograph shows her preparing for a performance at the **2nd Gutai Art Exhibition**, in the Ohara Hall in Tokyo in 1956.

In early **Gutai Art Exhibitions**, members performed using their bodies to engage directly with various materials. Tanaka wore her **Electric Dress**, and other artists used physical forces – like gravity, tension or electricity – to perform actions and create dramatic effects.

Kiyoji Ōtsuji 1923–2001
Born and worked Japan

Atsuko Tanaka, Stage Clothes, Gutai Exhibition on the Stage

1956–7, printed 2012
Photographs, gelatin silver print on paper

Tate. Purchased with funds provided by the Asia-Pacific Acquisitions Committee 2019
P82317

This photograph records a moment from Tanaka's performance **Stage Clothes**. She changed into several costumes in quick succession, including variations of her **Electric Dress**.

Like her fellow Gutai artists, Tanaka made work that challenged how art was traditionally encountered and experienced. Many of their performances were created for outdoor locations and theatrical settings. **Stage Clothes** was part of the **Gutai Exhibition on the Stage**, held at the Sankei Kaikan music halls in Osaka and Tokyo in 1957. Ōtsuji took this photograph at the Tokyo exhibition.

[Wall Text]

ATSUKO TANAKA

What interests me most during the creative process is the switching on and off of the electric light bulbs. When I turn on the switch and the motor starts, the electric bulbs that I have installed take on an unreal beauty as if they were not made by human hands.

– Atsuko Tanaka

Atsuko Tanaka's **Electric Dress** is a sculpture, painting, installation and costume all at once. Created for a performance in 1956, Tanaka made the wearable artwork from hand-painted industrial bulbs and incandescent tubes. It was uncomfortably hot, heavy, and in the event of a short circuit, potentially deadly.

The idea for the dress came as the young artist waited for a train at Osaka Station, surrounded by neon advertising signs. Barely ten years after the end of the Second World War, the novelty of the electrified cityscape expressed the complexity of a new, developing Japan. Through **Electric Dress**, Tanaka could explore her intimate relationship to these emerging, everyday technologies.

Tanaka created **Electric Dress** while working with the Gutai Bijutsu Kyokai (Gutai Art Association), active in Japan between 1954 and 1972. Its founder, artist Jirō Yoshihara, called for the group to 'do what no one has done before!'. Tanaka's engagement with the visual language of technology and her presentation of electricity as an extension of the human body was highly unique at that time. Her favourite part of the **Electric Dress** performances was when she turned on the in-built motor, causing the lights to 'blink like fireworks'.

Atsuko Tanaka 1932–2005
Born and worked Japan

Drawing after 'Electric Dress'

1956
Ink, crayon and watercolour on paper

Drawing after 'Electric Dress'

1956
Crayon, oil-based ink, water-based ink
on paper

21st Century Museum of Contemporary Art, Kanazawa
X90428, X90428

In these drawings, wires and lights transform into abstract representations of flowing energy. They aren't preparatory studies for Tanaka's **Electric Dress**, but rather works made after and inspired by it.

Tanaka continued to explore the idea of the electrical circuit by drawing and painting many variations on the theme throughout her life. The original **Electric Dress** became an ever-expanding visual metaphor for imagining new relationships between humanity and technology.

Atsuko Tanaka 1932–2005
Born and worked Japan

Work

1957
Permanent marker and poster colour on paper

Ashiya City Museum of Art & History
X90184

Kiyoji Ōtsuji 1923–2001
Born and worked Japan

Atsuko Tanaka, Electric Dress, 2nd Gutai Exhibition

1956

Steina Vasulka born 1940
Born Iceland, worked UK
Woody Vasulka 1937–2019
Born Czech Republic, worked US

Matrix II

1974
Video, monitors, colour and sound (mono)
Running time: 8 min 23 sec

Tate. Purchased jointly by Tate, the Museum of Modern Art, New York, and the San Francisco Museum of Modern Art with funds provided by the New Art Trust and Tate Patrons 2024.
T16274

Matrix II explores the properties of images and sounds in the medium of video. Geometric shapes travel across a 'matrix' (grid) of cathode ray tube (CRT) screens. CRT televisions, which use manipulated electron beams to display images on a fluorescent screen, remained in widespread use until the early 2000s. The Vasulkas sought to test the limits of each monitor, creating a fluid motion resembling the behaviour of electronic signals.

Matrix II is an early example of video art, which first developed in the late 1960s and 1970s as artists came into contact with new consumer technologies for capturing moving images.

Electric Dreams Circuit Map

This map visualises the connections
between artists featured in **Electric Dreams**.

Like the exhibition, it records a sample of the many activities and international collaborations between arts and technology practitioners in the second half of the 20th century. It also features artist groups, research centres, publications and exhibitions relevant to the stories told throughout the show.

In cybernetic terms, it presents Electric Dreams as a system of creative interactions.

Take a photo of the map as a reference.

Designed by Alessia Arcuri with Elliott Higgs
and Val Ravaglia

Vera Spencer 1926–2021
Born Czech Republic, worked UK

Artist versus Machine

c.1954
Gouache on card, paper and cotton on paper

Tate. Presented by Tate Members 2018
T15128

Spencer made this collage by stitching rows of punched cards and paper cut-outs onto a painted board. The cards are the kind used by automated looms to weave complex patterns. This early technology of binary data storage had inspired the mathematician Charles Babbage in the 1830s to design a punched-card calculator, one of the earliest computers. Punched cards remained in use for computing until the 1980s.

Spencer likely showed this collage in a 1954 exhibition also titled **Artist Versus Machine**, held in London. It featured art which celebrated and simulated the look of machine-made objects. By contrast, Spencer's hand-made forms suggest human gestures disrupting an automated process.

[Wall Text]

CYBERNETICS

Cybernetics is the science of systems. It studies how systems behave and interact in machines, living beings and the wider world. The field was first developed during the Second World War by the US mathematician Norbert Weiner while working on a 'predictor device' that could increase the aiming accuracy of anti-aircraft guns. Early cyberneticists focused on principles of 'control' and 'communication'. They produced systems that could 'self-regulate', adapting themselves in response to their external environments.

As the field gained international popularity in the 1960s, second-generation cyberneticists introduced principles of 'observation' and 'influence'. This allowed them to link systems together into complex ecologies. Cybernetics became applied more widely to various social, environmental and philosophical contexts. It developed a cultural dimension among the 1960s hippie counterculture. They experimented with new technologies alongside their interest in alternative lifestyles and mind-altering experiences.

Many artists and thinkers turned to cybernetics to make

sense of a newly interconnected world, increasingly driven by technological development and interactions with machines. As a field concerned with constructing systems, cybernetics also holds the potential to dismantle existing structures and rebuild them anew. Artists responded to these ideas by creating systems-based works that performed creative acts with minimal human intervention, or which responded in real-time to the interactions of their viewers.

[Vitrine]

Jean Tinguely 1925–1991
Born Switzerland, worked France

Jean Tinguely's 'Painting machine or Métamatic'

1968
Gelatin silver print on paper

This photograph shows one of Tinguely's **Métamatic** machines. It belongs to an early series of sculptures that could automatically generate drawings. A motorised or manual mechanism moves a pen or pencil which leaves marks on a sheet of paper. Assembled from crooked scrap metal parts, its irregular movements result in chaotic scribbles. Also included here is a drawing made by a different **Métamatic**, likely during Tinguely's 1982 exhibition at the Tate Gallery (now Tate Britain).

Tate Archive
Z89713

Jean Tinguely 1925–1991
Born Switzerland, worked France

Méta-matic No 10

1965
Ink on paper

Tate Archive
Z89714

H. Philip Peterson 1931–1996
Born and worked US

Digital Norbert Wiener

1968
Facsimile

This portrait made of numbers is based on a photograph of the mathematician Norbert Wiener, one of the founders of cybernetics. Using a computer, Peterson scanned the image and mapped the darkness of each picture element, or pixel, as a number. The higher the number, the darker the digit. He then printed the image using a drawing machine called a plotter. A print of **Digital Norbert Wiener** was prominently featured in **Cybernetic Serendipity**, a 1968 exhibition of early computer art held in London.

Tate Archive
Z89712

Richard Brautigan 1935–1984
Born and worked US

All Watched Over by Machines of Loving Grace

1967
Mimeographic print on paper

In this poem, Brautigan imagines a future where machines live in harmony with all living beings. It reflects a utopian attitude to technology popular among the 1960s Californian counterculture. However, the poem can also be interpreted as an ironic exaggeration of that optimistic view. It was first published by the Diggers, a 'community anarchist' street theatre and activist group from San Francisco. This second edition features an image of a large computer turned on its side. It was produced using a mimeograph, a portable and low-cost copying machine.

Peter Harrington, London
X92137

Gustav Metzger 1926–2017
Born Germany, worked UK

Page 16 – Bulletin of the Computer Arts Society, June 1971

1971
Reproduction

This is a front cover of **PAGE**, the newsletter of the UK-based Computer Arts Society (CAS). Metzger was one of the first artists to join CAS and the first editor of **PAGE**. He wrote articles pointing out the direct connections between the development of computing, warfare and technologies of social control. The cover is illustrated with two found diagrams. One depicts the use of computers for surveillance and policing. The other compares the numbers of intercontinental ballistic missiles (ICBMs) launched between the US and the Soviet Union during various Cold War conflicts.

Tate Archive
Z76020

Black Chip issue 86:1, Spring 1986

1986

Black Chip was ‘A Journal about Computing for and by Anarchists’, later changing its subtitle to ‘A Radical Journal of New Technology’. Nine photocopied issues were published in London between 1985 and 1987. They feature resources and articles discussing information technologies in social, political and cultural terms. It was one of several publications engaging with computing while remaining explicitly critical of the military and commercial interests that drove its development. Satirical images appropriated from advertising and mainstream media illustrate the magazine, such as this 1986 back cover.

Private collection
X91175

ROOM 2

Clockwise round the room from left of entrance

[Wall Text]

2. MATERIALISING THE INVISIBLE

The 1950s saw rapid developments in science and technology. Recent discoveries such as quantum fields, DNA and microcircuitry presented new questions about the nature of reality. Transistor radios and other communications media were developed, making it possible to interact in unusual and exciting ways. By the end of the decade, many homes in affluent parts of the world had telephones and televisions for the first time. Probes were launched into space by the United States and the Soviet Union, and the increasing possibility of human space travel fired imaginations around the globe.

Artists saw the newly visible expanses of science and space described by physicists as a challenge to visualise what was barely thinkable. Electricity and simple, analogue 'programs' often played a crucial role in their work, alongside cosmic landscapes, optical experimentation and mathematical principles of growth and change. Many of the works in this room are 'kinetic', a term used for artworks in which movement is an essential component.

Top: **Soundings Two**, Signals Gallery, 1965. Installation view with works by Liliane Lijn, Takis, Lygia Clark, Sérgio de Camargo and Jesús Rafael Soto.
Photo: Clay Perry. Courtesy England & Co Gallery

Bottom: **Signals Newsbulletin** mailing, 1964. Left to right: Paul Keeler, Sérgio de Camargo, Guy Brett, Christopher Walker, David Medalla and Gustav Metzger.
Photo: Clay Perry. Courtesy England & Co Gallery

[Wall Text]

LONDON: SIGNALS GALLERY AND BEYOND

This section of the room presents a selection of artists working with technology and mathematics in London during the 1950s and 1960s. With the art gallery Signals London as their creative hub, they brought a vibrant, diverse and adventurous artistic scene to the city. The artworks on display here demonstrate early approaches of thinking through 'systems', and other cybernetic principles.

In early 1964, artists David Medalla, Gustav Metzger and Marcello Salvadori, along with art critic Guy Brett and curator Paul Keeler, set up the Centre for Advanced Creative

Study. The gallery was soon renamed Signals, after a series of sculptures by the kinetic artist Takis. Their exhibitions featured cutting-edge works by artists from Latin America, Europe and Asia. They shared an interest in creating interactive, generative and participatory works using light, air, gravity, motion and energy.

Signals developed an ambitious and influential artistic programme over the following three years. International artists such as Takis, Liliane Lijn and Jesús Rafael Soto were invited to exhibit in London, often for the first time. The organisers also published **Signals Newsbulletin**, a publication discussing the intersections between visual arts, poetry, science and technology.

Zero-Fest, 17 May 1962, Rheinwiesen, Düsseldorf. Photo: Reiner Ruthenbeck. Courtesy Stiftung Kunstfords and Estate Reiner Ruthenbeck

Mary Martin 1907–1969
Born and worked UK

Permutation of Six

1966
Ink, paint and papers on paper

Tate. Purchased with funds provided by Catherine Petitgas 2015
T14406

This work repeats and arranges six shapes using generative number patterns. Martin's starting point was an individual half-cube unit. She then used a mathematical algorithm allowing the work to develop freely within her given parameters.

Martin produced 36 parts using this algorithm. She then collaged them to make a larger square in a six-by-six grid. **Permutation of Six** is just one of Martin's many experiments with mathematical patterns, geometric modules and generative principles.

Takis 1925–2019
Born Greece, worked France, US and Greece

Télélumière No. 4

1963–4
Iron machine parts, light bulbs, wood, brass, steel, electromagnet, string and paint

Tate. Purchased with assistance from Tate International Council, Tate Members, Tate Patrons and with Art Fund support 2019
T15235

Télélumière No. 4 is part of a series of Takis works using mercury rectifiers, which convert alternating current (AC) to direct current (DC) electricity. Mercury rectifiers were once used to power electric railways, industrial motors and radio transmitters.

Here, the device stands upright, almost like a figure. The rectifier passes a current through mercury vapour, causing it to emit a distinctive, blue-tinged light. Beside it is a structure Takis refers to as a ‘Magnetic Ballet’, a sphere suspended from above that is kinetically activated by an electromagnet.

Takis 1925–2019
Born Greece, worked France, US and Greece

Electro-Magnetic Music

1966
Wood, paint, magnet, electromagnet, spark plugs, amplifier, metal wire and needle

Tate. Purchased with assistance from Tate International Council, Tate Members, Tate Patrons and with Art Fund support 2019
T15241

Electro-Magnetic Music is one of Takis's first musical works. It consists of a taut metal wire and needle that moves as an electromagnet switches on and off. The needle strikes the wire, creating a sound that is amplified through speakers. Takis harnessed fundamental forces in his work, aiming to make visible the energy fields that surround us. Here, electromagnetism becomes an invited musical collaborator.

David Medalla 1942–2020
Born Philippines, worked US, UK and Philippines

Sand Machine Bahag - Hari Trance #1

1963–2015
Wood, brass, sand, bamboo, acrylic sheet, glass beads and other materials

Tate. Purchased with funds provided by the Asia-Pacific Acquisitions Committee 2019
T15371

This kinetic sculpture is one of Medalla's 'sand machines,' originally conceived in 1963 and later remade in 2015. A mechanism rotates the central birch tree, causing the hanging beads to drag a circular drawing through the sand. The delicate nature of the work and Medalla's choice of organic materials challenges ideas of sculpture as monumental and timeless.
The word **bahaghari** in the title here is Filipino for 'rainbow'.

The Signals co-founder and curator Guy Brett coined the term 'biokinetics' to describe Medalla's interest in the natural sciences, movement and science fiction.

Liliane Lijn born 1939
Born US, works UK

Prism Flares

1967
Polymer lenses on acrylic and acrylic prisms in metal frame, lights and detachable programmed digital switching controller

Collection of the artist and Sylvia Kouvali, London/Piraeus
X90596

This is one of Lijn's first acrylic plastic sculptures investigating light, perception and optical phenomena. She explores the refractive qualities of prisms, which feature significantly in her early work.

Lijn incorporates several small spotlights in a structure made from acrylic sheets. She programmed the lights to turn on and off in a sequence, alternating the angle of the beams. The shifting lights shine through the prisms formed by the sheets, revealing constellations of dots. Lijn achieved this effect by injecting acrylic polymer into the plastic surfaces with a needle.

Stephen Willats born 1943
Born and works UK

Visual Automatic No.5

1965
Plywood, wood, plastic, metal, light bulbs, electrical components and motor

Tate. Purchased from funds provided by the Knapping Fund 2004
T11784

This work belongs to a series exploring pattern recognition. **Visual Field Automatic No.5** features coloured circles which light up in a random sequence determined by hidden environmental sensors. A rotating object in the centre of the structure creates a flickering light effect.

The light blinks ten times a second, referencing the frequency of alpha waves in the brain. These electrical signals occur when an individual is awake but not actively focused on a specific task. As viewers naturally attempt to find a meaningful pattern in the coloured circle sequence, the flickering light counteractively encourages relaxation.

Heinz Mack born 1931
Born and works Germany

Tele-Mack

1968
16mm film, shown as digital video, colour and sound
Running time: 24 min 58 sec

Courtesy Atelier Mack and SWR Media Services GmbH
X91093

In this film made for German television, Mack exposes his reflective sculptures and suit to sunlight in the Sahara, a north African desert. The film also shows the artist experimenting with different reflective and transparent materials, achieving various kaleidoscopic effects. Zero group artists were among the first to make artworks specifically for television broadcast.

Mack was attracted to what he considered vast, empty expanses like 'the sky, the sea, Antarctica, the deserts', where light effects can dazzle even in the daytime. In 1959, he began creating temporary works in the Tunisian sand dunes for his long-running **Sahara Project**.

Dadamaino 1930–2004
Born and worked Italy

Volume of Displaced Modules

1960
Plastic, paint and wood

Tate. Presented by Tate Members 2011
T13288

Dadamaino was an early adopter of synthetic materials such as plastic sheets. She recalled: ‘I wanted to create holes that were arranged in a perspective, translating volume through three or four layers of plastic. I found a semi-transparent material that is normally used for shower curtains … With a hand punch I perforated the sheets and then placed them on the frame. The warmth of my hand moved the holes, and this shift was the result of chance.’

Nanda Vigo 1936–2020
Born and worked Italy

Chronotope

1960–5
Aluminium, glass, neon tubes and
electrical components

Diaphragm

1968
Aluminium, glass, neon tubes and
electrical components

Archivio Eredi Nanda Vigo
X90594, X90595

Vigo believed that light has no dimension and can adapt itself to any form. Her **Chronotope** sculptures are named after the Greek words for time (**chronos**) and space (**topos**). Reflected and transmitted light spills out of their aluminum and industrial glass frames.

Vigo aimed to conjure otherworldly environments through the iridescent effect of her works. She used a range of materials usually associated with industry and high-end architecture such as textured glass, metals, mirrors, neon,

and acrylic. Her dynamic visual experiences have sometimes been installed as walk-though chambers and labyrinths.

Nanda Vigo 1936–2020
Born and worked Italy

Chronotope

1963
Aluminium, glass, neon tubes and electrical components

Chronotope

1960–5
Aluminium, glass, neon tubes and electrical components

Chronotope

1966
Aluminium and glass

Archivio Eredi Nanda Vigo
X90581, X90582, X90593

Jean Tinguely 1925–1991
Born Switzerland, worked France

Metamechanical Sculpture with Tripod

1954
Steel, cardboard, plastic and electric motor

Tate. Purchased 1984
T03823

The 11 cardboard shapes in this work are attached to straight wires linked to seven wire wheels. While the sculpture is now too fragile to run, a motor originally caused the cardboard shapes to move and rotate at different speeds. The wheels acted as cogs, while the straight wires drove back and forth as pistons. Because the construction of the machine was imperfect, the movement of the cogs and pistons was irregular and unpredictable. Random interruptions in the pattern of motion introduced the element of chance in the machine and made it behave more like a trembling living organism.

Jesús Rafael Soto 1923–2005
Born Venezuela, worked Venezuela and France

Cardinal

1965
Wood on chipboard, metal rods and nylon threads

Tate. Purchased 1965
T00793

In **Cardinal**, a cascade of stems hangs in front of a striped background, gently swaying in the air. This motion is enhanced by the optical effect of the rods viewed against the hand-drawn lines of the background.

Soto left Venezuela for Paris in 1950, where he set out to make paintings that appeared to move. His interest in transforming matter into energy led him to create a series of reliefs he called ‘vibrations’. In these works, layers of lines, either static or mobile, produce an optical disturbance.

Pol Bury 1922–2005
Born Belgium, worked Belgium, France and US

3069 White Dots on an Oval Background

1966
Wood, nylon and motor

Tate. Purchased 1967
T00918

In this work, white dots move in front of an oval surface. When facing the work, sudden yet subtle twitches of movement occur in peripheral vision, intended to disorient the viewer.

Bury was interested in what he called an 'aesthetic of slowness', creating mechanical artworks that demonstrate barely visible movements. In a poetic text for the publication **Zero 3** (1961), he wrote: 'There is that imperceptible moment between the motion and immobility … set between waiting for what will come and the present that is already moving away … and yet it moves.'

Günther Uecker born 1930
Born and works Germany

White Field

1964
Painted nails on canvas and board

Tate. Purchased 1964
T00684

The nails used in this work create patterns of shadows across the otherwise white surface of the canvas. They form a visual field, which appears to move as the viewer changes position. In a 1964 poem, Uecker compared the ‘vibration of light’ he wanted to achieve in his work to ‘the white of the beach / where the visible, crowned by light, is lost in the invisible’.

Uecker’s use of nails – and, by extension, of a hammer – connects to a broader understanding of technology. Namely, the use of simple tools as an abiding expression of human intelligence. At the same time, the repetitive hammering action performed by the artist resembles that of an automated process.

Heinz Mack born 1931
Born and works Germany

Light Dynamo

1963
Aluminium, glass, wood and motor

Tate. Purchased 1964
T00683

An aluminium disc decorated with a reed pattern rotates under glass moulded with a similar design. The mechanism driving the movement is hidden, causing the disc's shape and surface texture to dissolve into rippling light.

One of the founders of the Zero group, Mack made works that explored what he called 'structural movement' and 'vibration'. He often used reflective surfaces, both to harness light for his 'dynamic structures' and to amplify its illuminating effects.

[Wall Text]

ZERO AND THE ZERO NETWORK

Zero is silence. Zero is the beginning. Zero is round. Zero spins.
Zero is the moon. The sun is Zero. Zero is white. The desert Zero.
The sky above Zero. The night.

– from a poem by Heinz Mack, Otto Piene and Günther Uecker, 1963

The Zero group was founded by artists Heinz Mack and Otto Piene in Düsseldorf, Germany in 1957, joined by Günther Uecker in 1960. As collaborators, they shared a utopian view of the future and how art could transform society. Taking their name from the countdown for a rocket launch, Zero aimed to create 'a zone of silence and of pure possibilities for a new beginning'.

The group reacted against traditional approaches to painting, which emphasised the role of the individual artist and their subjective feelings. Instead, Zero artists often worked collaboratively. They used materials and techniques that incorporated light and motion, aiming to directly engage the full range of their viewers' senses.

Mack, Piene and Uecker organised lively and immersive one-night exhibitions (**Abendausstellungen**). These began in their shared studio and gradually evolved into outdoor events and large-scale projects. The exhibitions featured a growing roster of friends and collaborators from Europe, Japan, North and South America, some of whom are on display in this room. They began referring to this wider, loosely-knit international network as ZERO (in capital letters).

Zero-Fest, 17 May 1962, Rheinwiesen, Düsseldorf. Photo: Reiner Ruthenbeck. Courtesy Stiftung Kunstfords and Estate Reiner Ruthenbeck

ROOM 3

[Wall Text]

3. OTTO PIENE

I go to darkness itself, I pierce it with light, I make it transparent, I take its terror from it, I turn it into a volume of power with the breath of life like my own body.

– Otto Piene, 1973

Zero founder Otto Piene's **Light Room (Jena)** is installed in the following room. Five light-emitting sculptures with motors are synchronised to create a theatrical light play or 'ballet'. The work demonstrates Piene's life-long interest in using light as a material to stage immersive visual experiences.

Piene experimented with stencils during Zero's single-night exhibitions, organised by Piene and Heinz Mack in their Düsseldorf studio. He found that he could create dramatic moving projections by shining light through perforated holes with a candle. Piene exhibited his first arrangements of light machines, **Light Ballet** in 1959. The machines shown here mostly date from the 1960s, when his kinetic installations became increasingly performative. Evolving into mechanised environments, they feature metal screens, discs, motors, timers, and rotating electric lights. Piene brought these sculptures together as one installation in 2007.

In 1968, Piene became the first international fellow of the Center for Advanced Visual Studies (CAVS) at the Massachusetts Institute of Technology (MIT). CAVS had been founded by artist György Kepes the previous year. Piene was instrumental in bringing other artists to MIT, making CAVS an innovative and influential platform for experiments bringing together art and technology.

Otto Piene 1928–2014
Born Germany, worked Germany and US

Light Room (Jena)

exhibited 2007
Rubber, metal, foamboard, wood, electric motor, control unit and light

Tate. Purchased with Art Fund support and with funds provided by Tate Members, Tate Patrons and Tate International Council 2022
T15926

ROOM 4

Anti-clockwise round the room from right of entrance

[Wall Text]

4. BRION GYSIN

The Dream Machine may bring about a change of consciousness inasmuch as it throws back the limits of the visible world and may, indeed, prove there are no limits.

– Brion Gysin, 1962

Brion Gysin was a painter, poet, performance artist and inventor of experimental devices. In 1959 he created the **Dreamachine**, a meditative rotating light sculpture and 'the first art object to be seen with the eyes closed'. He refined the design with the creative technologist Ian Sommerville, in conversation with the novelist William S. Burroughs. Gysin and Burroughs were key figures in the Beat literary and countercultural movement, a group of underground writers and thinkers who critiqued society and experimented with psychedelic drugs.

Gysin was inspired by an experience he had on a Marseille bus in 1958. He saw bright patterns behind his closed eyelids, caused by sunlight passing through trees. He recalled, 'An overwhelming flood of intensely bright patterns in supernatural colours exploded behind my eyelids: a

multidimensional kaleidoscope whirling out through space.' The **Dreamachine** is intended to be experienced with both closed and open eyes. Gysin hoped to produce a flicker effect, triggering alpha waves and generating coloured images in the viewer's brain.

This room also contains literary collaborations between Gysin and Burroughs. Gysin popularised a writing method he called the 'cut-up', featuring fragments of texts snipped out of magazines and randomly reordered. Burroughs adopted the practice, collaborating with Gysin on several 'cut-up' books. Gysin also produced 'permutated' poems, which could be arranged in various ways to produce multiple meanings. With Sommerville, he generated some of these poems using a computer. Together, these approaches sought to engage with language itself as a technological system, influenced by chance and magical thinking.

Brion Gysin 1916–1986
Born UK, worked Canada, US, Morocco and France

Dreamachine no. 9

1961
Perforated metal, electronic motor and lamp

Musée d'Art Moderne de Paris
X90026

Brion Gysin 1916–1986
Born UK, worked Canada, US, Morocco and France

The Spoken Word (audio recording)
1960s

Cut-Ups Self-Explained
3 min 53 sec

I Am This Painter Brion Gysin
2 min 6 sec

Pistol Poem
1 min 15 sec

I've Come To Free The Words
1 min 28 sec

No Poets Don't Own Words
1 min 1 sec

Calling All Reactive Agents
1 min 31 sec

Junk Is No Good Baby
2 min 12 sec

Kick That Habit Man
1 min 17 sec

I Am That I Am
3 min 6 sec

Courtesy the estate of the artist and The British Library Board
X91278

[Vitrine]

Olympia: A Monthly Review from Paris, No.2

1962

This magazine front cover features a colourful photograph of Gysin and Sommerville with two **Dreamachine** cylinders. The image was captured in Paris in 1960 by photographer Herman Leonard. The issue contains an article by Gysin and Sommerville about the **Dreamachine**. It also includes instructions and cut-out patterns for readers to build a version of the device at home using their own record players.

Bronac Ferran
X91150

Charles Gatewood 1942–2016
Born and worked US

Brion Gysin and William Burroughs at the Dreammachine, Paris, 1972

1972
Photograph (exhibition copy)

Courtesy Topfoto
X90597

Sinclair Beiles 1930–2000
Born Uganda, worked South Africa
William Burroughs 1914–1997
Born and worked US
Gregory Corso 1930–2001
Born and worked US
Brion Gysin 1916–1986
Born UK, worked Canada, US, Morocco and France

Minutes to Go

1960

This was the first book published by Gysin with Burroughs and other collaborators from the Beat literary circle. This spread shows Gysin's 'permutated' poem 'I THINK THEREFORE I AM', with symbols assigned to each of the words on a column to the right. The symbols change order in each permutation, visualising alternate arrangements of the verse.

Tate Archive
Z89741

William Burroughs 1914–1997
Born and worked US
Brion Gysin 1916–1986
Born UK, worked Canada, US, Morocco and France

The Third Mind

1979

This is a collection of essays, poetic texts and collages created in the 1960s. It explains and demonstrates the cut-up technique as a literary technology where automation and chance play an essential role. The collages illustrating the book mix cut-up poems and found images from newspapers and magazines with Gysin's roller-stamped and calligraphic motifs. The title **Third Mind** refers to the combination of Burroughs' and Gysin's creative powers as its own 'consciousness', separate from the two authors as individuals.

Peter Harrington, London
X90597

William Burroughs 1914–1997
Born and worked US
Brion Gysin 1916–1986
Born UK, worked Canada, US, Morocco and France

The Exterminator

1960

From the late 1950s, Gysin started creating calligraphic paintings and drawings loosely based on Japanese and Arabic script. He made marks in grid formations to create dense patterns of abstract language. These drawings feature as covers and illustrations of the books he wrote in collaboration with Burroughs.

Tate Archive
Z89706–7

William Burroughs 1914–1997
Born and worked US
Brion Gysin 1916–1986
Born UK, worked Canada, US, Morocco and France

Electronic Revolution

1970–1

For the cover of Burroughs's **Electronic Revolution**, Gysin used modified rubber paint rollers to stamp grids onto a sheet of paper. In the book, Burroughs encourages readers to 'construct fake news broadcasts on video camera' and 'scramble your fabricated news in with actual news broadcasts'. He identifies Gysin's cut-up technique as a source of inspiration. Referring to Gysin's 'tape-recorder experiments' of the mid-1960s, he concludes, 'Playing back recordings of an accident can produce another accident.'

Tate Archive
Z89705

Brion Gysin 1916–1986
Born UK, worked Canada, US, Morocco and France

Electronic Revolution

1971
Lithograph on paper

Musée d'Art Moderne de Paris
X90190

Brion Gysin 1916–1986
Born UK, worked Canada, US, Morocco and France

No writers don’t own words
c.1961

Untitled
c.1973

Untitled
c.1973

Untitled
c.1973

Untitled
c.1973

Untitled
c.1973–9

Untitled
c.1973–9

Peinture
c.1973–9

Untitled
c.1976

The color of a tree
1976–9

Art is the tail of a comma
c.1977

Art is the tail of a comma
c.1977

Arme Larme Alarme
c.1978

Brion Gysin
c.1981

Structure Lumière
c.1982

35mm film digital slideshow

Courtesy Musée d'Art Moderne de Paris
X90496, X90497, X90498, X90499, X90500, X90501, X90502, X90503, X90505, X90506, X90507, X90508, X90509, X90510, X90511

Gysin scribbled lines from his poems and abstract calligraphic motifs onto 35mm slides. He projected them during live performances, which featured readings of his permutated poems and tape recordings. Other slides repeat and invert images using multiple exposures. This was a way of applying the principles of ‘cut-up’ arrangement to photography.

Many of these slides feature self portraits. Gysin would interact with the projected images to create dramatic doubling and superimposition effects.

Brion Gysin 1916–1986
Born UK, worked Canada, US, Morocco and France

Am I that I am ?
c.1961

Am I That ?
c.1961

That I am am I
c.1961

Self-portrait
c.1961

Self-portrait
c.1961

Self-portrait
c.1961

Self-portrait
c.1961

Self-portrait
c.1961

Brion Sings Ono

c.1961–80

Self-portrait
c.1961–4

Self-portrait
c.1961

Self-portrait
c.1961

W. S. Burroughs in front of the Beat Hotel
c.1961–4

Ian Ian
c.1961

Self-portrait
c.1980

35mm film digital slideshow

Courtesy Musée d'Art Moderne de Paris
X90435, X90437, X90438, X90439, X90440, X90441, X90442, X90443, X90444, X90445, X90446, X90447, X90448, X90449, X90450

ROOM 5

Anti-clockwise round the room from right of entrance

[Wall Text]

5. KATSUHIRO YAMAGUCHI

This room presents a selection of Katsuhiro Yamaguchi's explorations in new technologies. Working and teaching across a range of experimental artistic disciplines from the 1950s onwards, Yamaguchi's work helped to popularise art using emerging media in Japan. He was creatively prolific, collaborating with architects, designers, filmmakers and musicians.

Yamaguchi co-founded the artist collective Jikken Kōbō (Experimental Workshop) in 1951. The group's uniting principles were to embrace artistic experimentation and creative collaboration. Artists worked alongside engineers, composers and creatives, blurring the boundaries of traditionally defined artistic disciplines. They staged public exhibitions and performances in unusual places, conjuring aesthetic experiences through new technologies of sound and optics.

In the 1960s, Yamaguchi continued his experiments with new media by making sculptural light forms from acrylic and glass.

He also produced some of the earliest video works shown in Japan. Throughout his life, Yamaguchi remained deeply concerned with the pervasive presence of consumer advertising, the accelerated pace of technological advancement, and the resulting transformation of our lived environments.

Katsuhiro Yamaguchi 1928–2018
Born and worked Japan

Barnacle

1966, restored 2017
Acrylic and light

Annely Juda Fine Art, London
X90031

Barnacle is a modular light sculpture whose individual units can be reconfigured into different combinations. In the mid-1960s, Yamaguchi made a series of sculptural reliefs using raised forms in translucent acrylic containing fluorescent and coloured lights.

Katsuhiro Yamaguchi 1928–2018
Born and worked Japan

Vitrine: Deep Into the Night

1954
Watercolour on paper, oil on wood, corrugated glass, acrylic and plywood

Museum of Contemporary Art Tokyo
X90208

Yamaguchi started making glass artworks he called ‘vitrines’ in the 1950s. **Deep Into the Night** is a box-shaped structure containing a piece of painted glass covered with a corrugated glass sheet. Due to the textured nature of the glass panes, the painted images inside the box appear distorted.

Katsuhiro Yamaguchi 1928–2018
Born and worked Japan

Image Modulator

1969, reconstructed 2024
Reconstruction: acrylic, video, colour, cathode ray tube monitor and wood

Courtesy the estate of the artist
X90575

Image Modulator is Yamaguchi's earliest video work. He placed several colour television screens behind the same corrugated glass used in **Deep Into the Night** and his other 'vitrines'. The televisions play live broadcasts to generate abstract patterns from mass media images. Yamaguchi first showed the work as part of **Electromagica '69**, an exhibition of light and kinetic works he curated for the Sony Building in Ginza, Tokyo. This version is a scaled-down reconstruction using a single monitor.

Katsuhiro Yamaguchi 1928–2019
Born and worked Japan

Las Meninas

1974

Courtesy Christophe Charles

Yamaguchi's video installation **Las Meninas** featured two reproductions of a 1656 painting by Diego Velázquez. In Yamaguchi's work, one reproduction featured a hidden CCTV camera instead of the mirrored images of the queen and king in the original. Monitors displayed details of the painting alongside real-time images of people inside the installation. Expanding the scope of Velazquez's painting into the physical space of the gallery through video, **Las Meninas** implicated viewers as both participants and observers of multiple artworks at once.

Katsuhiro Yamaguchi 1928–2018
Born and worked Japan
Kiyoji Ōtsuji 1923–2001
Born and worked Japan

Composition for APN

1953–4, printed 2002
Photograph, gelatin silver print on paper

Tate. Purchased 2012
P80013–22

In a collaboration with the photographer Kiyoji Ōtsuji, Yamaguchi produced miniature sculptures from reflective and translucent materials. These assemblages interacted with studio lighting and reference different aspects of Jikken Kōbō's artistic practice as a collective. The popular Japanese weekly magazine **Asahigraph** (Asahi Picture News) published the photographs on display here.

Kiyoji Ōtsuji 1923–2001
Born and worked Japan

Mirai no Eve (L'Eve Future) from **'Experimental Ballet Theatre'**

1955

Courtesy Musashino Art University Museum & Library
X91554

This is a photograph of an elaborate mechanical stage set made by Katsuhiro Yamaguchi and other members of Jikken Kōbō for **Future Eve**, an experimental ballet performed at the Haiyuza Theatre, Tokyo. The ballet was based on an 1886 science fiction novel by the French writer Villiers de l'Isle-Adam, which first popularised the term 'android'.

Kiyoji Ōtsuji 1923–2001
Born and worked Japan

Katsuhiro Yamaguchi's environmental installation for Jikken Kōbō's concert 'Musique Concrète / Electronic Music Audition' at Yamaha Hall, Ginza, Tokyo

4 February 1956

Courtesy YOKOTA TOKYO

Yamaguchi's contribution to the **Musique Concrète / Electronic Music Audition** concert stage design was a large string installation suspended between the ceiling and the stage. This room features a partial and scaled-down reconstruction.Jikken Kōbō experimented with new technologies of optics and sound, including tape recorders. They were exposed to early experimental music from Germany and France (**musique concrète** / concrete music). Through these influences, Jikken Kōbō artists began treating recorded sounds as raw materials to be arranged and manipulated. Their 1956 concert also featured screenings of mixed media works created for automatic slide projectors, including Yamaguchi's **Adventure of the Eyes of Mr W.S., a Test-Pilot**, shown nearby.

Katsuhiro Yamaguchi 1928–2018
Born and worked Japan

Environmental installation for Jikken Kōbō's concert 'Musique Concrète/Electronic Music Audition' 1956

Remade 2024
String, wood, hardware

Courtesy of the estate of the artist

X91092

Katsuhiro Yamaguchi 1928–2018
Born and worked Japan

Mesh sculpture

1961
Painted wire mesh

Tate. Purchased with funds provided by the Asia-Pacific Acquisitions Committee 2015
T14164

Katsuhiro Yamaguchi 1928–2018
Born and worked Japan

Trial object in acrylic plastic

1960s
Acrylic sheet

Tate. Purchased with funds provided by the Asia-Pacific Acquisitions Committee 2015
T14165

Katsuhiro Yamaguchi 1928–2018
Born and worked Japan

Adventure of the Eyes of Mr W.S., a Test-Pilot

1953/86
Slideshow, projected from DVD
Running time: 4 min 55 sec
Soundtrack by Hiroyoshi Suzuki
Translation by Sayaka Ikeda

Courtesy Yokota Tokyo Gallery
X90433

This slideshow with a synchronised soundtrack tells the story of a test pilot exploring the scientific wonders of a new planet. The pilot, W.S., eventually goes blind from exposure to the bright glare of advanced materials used in an alien city. The narrative serves as an allegory for the dangers of technology in the nuclear age.

Yamaguchi and other Jikken Kōbō members made use of the cutting-edge technology of the auto slide projector. It was developed by Tokyo Tsushin Kogyo (later Sony) as an audio-synchronised presentation device for schools and other organisations.

ROOM 6

Clockwise round the room from left of entrance

[Wall Text]

6. THE PROGRAMMED ARTWORK: ART AS VISUAL RESEARCH

Many of the artists in this room belonged to the Italian Arte Programmata (Programmed Art) movement of the 1960s. Artists interested in kinetics, mathematical rules and modular design formed distributed groups in Milan, Padua and other locations. The writer and theorist Umberto Eco promoted the movement, and his book **The Open Work** 1962 was fundamental for many kinetic artists. It places emphasis on 'openness', leaving space for change, chance and interaction.

The work of Arte Programmata artists was influential for the early phase of Nove Tendencije (New Tendencies), an international movement of artists inspired by scientific research and the nature of vision. New Tendencies developed out of an exhibition of the same name organised in Croatia in 1961 by the artist Almir Mavignier and art critic Matko Meštrovic. Hosted by Zagreb's Gallery of Contemporary Art, this was the first of five **Tendencies** exhibitions. It featured optical effects, colour fields, geometry and kinetics, including many works by artists from the Zero circle. Several artists in this room showed work

in **Tendencies** exhibitions throughout the 1960s, turning Zagreb into an international hub of the evolving movement.

Most New Tendencies and Arte Programmata artists considered their work as a form of 'visual research'. They used scientific and mathematical principles as 'programmes' to generate artworks. Experimenting with fundamental sciences allowed artists to cut across cultural backgrounds and connect with international audiences in new ways. They believed that this kind of art could be more democratic, relevant to everyday life and thus socially beneficial.

New Tendencies, Gallery of Contemporary Art, Zagreb, 1961. Exhibition view of two artworks by Paul Talman and one by Julio Le Parc. Courtesy Museum of Contemporary Art, Zagreb

New Tendencies 2, Gallery of Contemporary Art, Zagreb, 1963. Exhibition view of Giovanni Anceschi and Davide Boriani with an artwork by Gianni Colombo.
Courtesy Museum of Contemporary Art, Zagreb

New Tendency 3, Gallery of Contemporary Art, Zagreb, 1963. Exhibition view of visitors interacting with works by Rudolf Kämmer.Courtesy Museum of Contemporary Art, Zagreb

Ivan Picelj 1924–2011
Born and worked Croatia

New Tendencies 2

1963
Screenprint and metalic paper on paper

Tate. Presented by Anja Picelj-Kosak 2016
P14475

Picelj gave visual expression to New Tendencies' experimental, collaborative nature through his posters for the New Tendencies exhibitions in Zagreb.

Picelj promoted the idea of an 'active' art which should permeate society. He said: 'Active art … should direct creative forces to positive social action. It should be present everywhere. It is imperceptible. It is international and universal. It will transform our visual habits in the direction of perceiving structure, order, and wholeness in relations.'

Almir Mavignier 1925–2018
Born Brazil, worked Brazil and Germany

Structure grey/pink/orange/white/yellow on red

1964
Oil paint on canvas

Atelier Almir Mavignier and 10 A.M. ART Gallery Milan
X90178

In this work, different coloured dots converge into a geometric mesh. They sit against a plain red background, producing an illusion of depth and distorting our perception of individual colours.

Mavignier was interested in occurrences of intersection, visible here between the coloured dots. He described these as 'points that collect and absorb dynamic energy', which together produce a 'geometry of the unknown'.

Mavignier was affiliated with the Zero group and curated the first New Tendencies exhibition in Zagreb with the art critic Matko Meštrović in 1961.

Lucia Di Luciano born 1933
Born and works Italy

Discontinuous Structural Articulation

1964
Household emulsion paint on hardboard

Tate. Presented by Archivio Lucia di Luciano e Giovanni Pizzo and 10 A.M. Art Gallery, Milan 2023
X89929

Di Luciano derives the patterns of her paintings from complex sets of mathematical formulae. In **Discontinuous Structural Articulation** she introduces random shifts in numerical sequences to produce a generative composition. All Di Luciano's works from the 1960s feature grids of intersecting thin lines and thicker rectangles painted mostly in black and white.

Di Luciano co-founded the Arte Programmata groups Gruppo 63 in 1963 and Gruppo Operativo R in 1964. In 1965, she participated in the **New Tendency 3** exhibition in Zagreb, Croatia.

Davide Boriani born 1936
Born and works Italy

Magnetic Surface

1965
Aluminium, iron filings, polyurethane foam, magnets, glass, motor and sensor

Private collection
X90430

In his series of **Magnetic Surfaces,** Boriani encloses iron shavings inside circular acrylic and aluminium containers. Magnets driven by a motor move in circles behind the container and shift the metal shavings into unpredictable configurations.

Boriani was interested in the experience of viewing an artwork that changed over time. He also explored the ways in which variations, repetitions and patterns affect perception. In 1959, Boriani became one of the founding members of Gruppo T, a Milan-based artist group which took part in many New Tendencies events.

Mohsen Vaziri Moghaddam 1924–2018
Born Iran, worked Iran and Italy

Untitled (Geometric Reliefs Series)

1968, remade 2015
Aluminium, wood and paint

Tate. Presented by Fondazione Mohsen Vaziri Moghaddam 2024
X84079

This relief features four partially painted wood and aluminium modules, which vibrate optically against one another. Undulating waves cut out of the aluminium sheet amplify the dynamism by echoing the forms of the base. The four modules can be displayed in any combination and orientation.

During his time in Italy, Vaziri Moghaddam turned away from figurative and towards geometric reliefs. He also started experimenting with metals like aluminium. This work is one of Vaziri Moghaddam's earliest 'open' works. With no fixed form, it invites to collaborate with the artist every time it is displayed, exploring the interactions between the modules and the space around them.

Paolo Scheggi 1940–1971
Born and worked Italy

Inter-ena-cubo

1970
Enamel paint on aluminium

Tate. Presented by Franca and Cosima Scheggi 2022
T15924

This work is constructed from movable cubes with circular holes and diagonal lines which create a 3D pattern. Scheggi made his series of **Inter-ena-cubo** reliefs out of brightly coloured modules that could be rearranged in different combinations. He produced these as editions of 'multiples' (artworks made in several identical copies). Scheggi's multiples challenged the emphasis often placed on 'unique' and 'original' artworks. Many New Tendencies artists embraced the format of the multiple as a way of making their art more accessible, inspired by processes of mass production.

Scheggi exhibited in Zagreb as part of **New Tendency 3** in 1965 and **Tendencies 4** in 1969.

[Centre of the room]

Julio Le Parc born 1928
Born Argentina, works France

Continual Light on Ceiling

1966/96
Painted wood, steel, nylon and spotlights

Atelier Le Parc
X91488

This suspended relief with reflective surfaces is part of Le Parc's series **Continual Mobiles**. The works in the series multiply and animate artificial beams of light.

Le Parc wished to move away from the idea of an 'absolute' or 'definitive' artwork and engage more fully with ideas of movement, indeterminacy and unpredictability. He moved from Argentina to Paris in 1958, and in 1960 became a founding member of GRAV (Groupe de Recherche d'Art Visuel). In 1964, on the occasion of the **Nouvelle Tendance** exhibition in Paris, Le Parc wrote a letter encouraging the New Tendencies movement to retain their critical approach and open-minded attitude.

Aleksandar Srnec 1924–2010
Born and worked Croatia

Luminoplastic

1965–7
Metal, motor and projector

Museum of Contemporary Art, Zagreb
X90024

Luminoplastic projects colourful abstract shapes onto rotating metal wire forms. The work makes use of an electric motor from a sewing machine and, originally, 35mm slides. Displayed inside a black box concealing the projector, the effect is ghostly. Lines hover and mutate as they catch the light in unpredictable and ever-shifting patterns.

In the early 1950s, Srnec was a member of the Zagreb EXAT 51 group. They proposed experimental approaches to art and participated in the early activities of New Tendencies.

Alberto Biasi born 1937
Born and works Italy

Light Prisms. Spectral Kinetic Mesh

1966
Mobile crystal prisms, acrylic blocks, electric engines and wooden case

ZKM | Center for Art and Media Karlsruhe
X90415

In this work, prisms and mirrors create dancing beams of coloured light. Biasi makes use of reflection and refraction, two of the basic laws of optics. White light originating from two bulbs travels through four transparent motorised prisms, where it is dispersed into coloured beams. The prisms rotate, causing the beams to shift constantly. Mirrors multiply the beams through reflection.

Biasi was a cofounder of Gruppo N, an Arte Programmata group based in Padua associated with the New Tendencies movement.

Martha Boto 1925–2004
Born Argentina, worked France

Helicoidal Chromokinetics

1968
Plywood, polished stainless steel, plexiglass,
light bulbs, plastic and motor

Musée d'Art Moderne de Paris
X91487

Boto's **Hélicoidal** structures cycle through repetitive movements to achieve simple yet striking interactions with light. Initially working with abstract geometry, Boto was one of the first artists in Argentina to incorporate movement into their work. She experimented with electric motors as well as materials that could absorb and reflect light such as acrylic, aluminium and stainless steel.

In 1956, Boto joined the 'concrete art' group Arte Nuevo. She co-founded Artistas No Figurativos Argentinos (the Non-Figurative Artists of Argentina) the following year.

Grazia Varisco born 1937
Born and works Italy

Variable Light Scheme R. VOD. LAB

1964
Wooden box, acrylic (methacrylate), electric motor 3/2 rpm and neon lamp

Archivio Varisco
X90206

Here, Varisco combines light and movement to generate constantly changing visual phenomena. Motors drive rhythmic, alternating patterns of light and dark. These create visual illusions and kaleidoscopic shapes.

Varisco joined the Milan-based Gruppo T in 1960, sharing the group's interest in concepts of time, interactivity and perception. She experimented with the illusion of movement, depth and space. Her works often feature materials with dynamic physical properties, such as magnets, mercury and patterned glass.

Marina Apollonio born 1940
Born and works Italy

Circular Dynamics 6S+S

c.1968–70
Screenprint on lacquered wood and motor

Tate. Presented by the Artist 2024
X90039

For her **Circular Dynamic** series, Apollonio painted patterns of concentric circles onto motorised spinning discs. She was inspired by Gestalt theories of visual perception, which explore how the brain processes visual information through pattern recognition.

Apollonio began her investigations into geometric abstraction and the nature of human vision in the early 1960s. She was close to Padua's Gruppo N and Milan's Gruppo T, showing work alongside theirs at **New Tendency 3** in 1965 and **Tendencies 4** in 1969 in Zagreb.

ROOM 7

The walls of this room are covered with bright wallpaper.
Wall text to the right of the entrance

[Wall Text]

7. GRAV
We want to make audiences show an interest, shed their inhibitions, and relax.
We want them to take part.
We want to place them in situations they can trigger and transform.
We want them to be aware of their participation.
We want them to tend towards interaction with other audience members.
We want to help audiences develop their ability to perceive and act.

– GRAV ‘Enough with the Mystifications!’, 1963

This is an extract from the manifesto that Groupe de Recherche d’Art Visuel (GRAV) wrote for the 1963 Paris Biennale. It was a declaration of intent: GRAV artists wanted to make art that engaged directly with the public, fundamentally rethinking the artist’s role in society. They favoured collective activity and worked against notions of the artist as an individual genius.

GRAV was founded in 1960 by a group of young international artists who converged in Paris. Among those at the forefront of the group were the French artists Jean-Pierre Yvaral and François Morellet, the Spanish artist Francisco Sobrino, and the Argentinian Julio Le Parc. Like other artists linked to the New Tendencies movement, GRAV were inspired by mathematical principles and pre-determined systems. Their works included paintings and constructions that played with sensorial perception by using striking optical effects and contrasting colours.

From 1960 to 1968, GRAV organised a series of interactive events called **Labyrinths**. These group exhibitions consisted of immersive environments with mounted reliefs, light installations and kinetic components. They were laid out in a sequence of narrow passages that visitors were invited to explore. The various mechanisms and components had to be 'activated' by the public, resulting in a collective experiment that changed every time. Works by Le Parc and Morellet, including the wallpaper in this room, are on display here.

Top: GRAV, Plan for a labyrinth for the exhibition **Nouvelle Tendence**, Musée d'Art Decoratif, Palais du Louvre, Paris, 1964. Courtesy Atelier Le Parc
Bottom: GRAV, **Labyrinth – Technological Environment**, third Paris Biennale, 1963.
Courtesy Atelier Le Parc Clockwise, from top left:

Julio Le Parc in the GRAV atelier, Paris, 1962

Julio Le Parc wearing **Eyeglasses for Another Vision**, 33rd Venice Biennale, Venice, 1966

Julio Le Parc **Games Room for Le Parc Retrospective Exhibition 1972**, Düsseldorf Kunstalle, 1972

Julio Le Parc **Seven Surprise Movements, Games Room**, 1966

All images Courtesy Atelier Le Parc

Left then right along the room

François Morellet 1926–2016
Born and worked France

Random distribution of 222,048 squares using the π number decimals, 50% odd digit blue, 50% even digit red

1963, remade 2024
Wallpaper

Courtesy the François Morellet Estate
X90028

Morellet originally created this wallpaper as a painting for the 1963 Paris Biennale. He intended 'to create a dazzling fight between two colours that shared the same luminosity … I wanted the visitors to have a disturbing experience when they walked into this room.'

Morellet created the pattern using a random system. He said: 'I drew horizontal and vertical lines to make 40,000 squares. Then, my wife or my sons would read out the numbers from the phone book … I would mark each square for an even number while leaving the odd ones blank. The crossed squares were painted blue
and the blank ones red.'

François Morellet 1926–2016
Born and worked France

2 Warps and Wefts of Short Lines
0° 90°

1955–6
Oil paint on canvas

Tate. Purchased 1974
T01840

This painting is made up of square patterns with lines of slightly different lengths. Morellet rotated and combined them to convey a sense of depth. He often used grids and repetitions to reduce the number of choices necessary for creating an artwork. Thinking of art as an experiment, Morellet actively incorporated scientific methods into his practice. Explaining his process, the artist said: 'The development of an experiment should run on its own, almost outside the control of the programmer.'

Julio Le Parc born 1928
Born Argentina, works France

Four Double Mirrors

1966–2016
Wood and plastic

Atelier Le Parc
X90224

These mirrors are part of Le Parc's **Salle de Jeux** (Game Room) series. Their textured surfaces distort, multiply and fragment the viewer's reflection. Le Parc intended this series to be interactive, activated by the audience. Other works in the series include unstable floors, target silhouettes of political figures, interactive board games and punching bags.

ROOM 8

[Wall Text]

When light comes into contact with an artwork, it changes it completely.
My challenge is to reveal to the viewer a reality without a past or a future:
my works exist in a perpetual present.

– Carlos Cruz-Diez, 2019

Carlos Cruz-Diez's immersive installation **Chromointerferent Environment** fills the following room. A sequence of moving parallel lines colour the gallery floor and ceiling. The projection is constantly in motion, changing the appearance of the objects and people in the room. This creates a disorientating effect. Visitors are invited to interact with the cubes and balloons positioned around the room, engaging directly with the dizzying optical patterns.

Cruz-Diez experimented with different properties of colour and light to generate visual illusions. This work is based on the effect generated by the movement of overlapping patterns. As a result, the human eye sees colours that are not in the source materials. **Chromointerferent Environment** was originally installed in 1974 using slide projectors with a 35mm frameless roll. A moving pattern of black lines was

projected onto white panels painted with red, blue, and green lines. This chromatic interference was transferred onto the objects and people in the space.

The installation seen here is a digital realisation of the original work. This version uses high-definition video projection created with a computer graphics program developed by the artist with his son, Carlos Cruz Delgado. The lines and speed are more varied, which means the colour combinations increase, and there are infinite possibilities for visual interference. Like GRAV's **Labyrinths, Chromointerferent Environment** turns viewers into active participants, interrogating the relationship between artwork and audience through visual effects. Cruz-Diez featured in the **New Tendencies 2** exhibition in 1963.

Carlos Cruz-Diez, **Chromointerferent Environment**, Caracas Museum of Contemporary Art (MACC), Venezuela 1974. Courtesy Atelier Cruz-Diez

Carlos Cruz-Diez 1923–2019
Born Venezuela, worked Venezuela and France

Chromointerferent Environment

1974–2019
Software, projections, painted wood and balloons

Courtesy Atelier Cruz-Diez
X90027

ROOM 9

Clockwise round the room from left of entrance

[Wall Text]

9. DIALOGUES WITH THE MACHINES

This room focuses on the rise of computers and electronics as tools for making art from the 1960s onwards. The Second World War significantly sped up the development of computer-based technology. Innovations such as display screens meant data could be visualised and manipulated in increasingly sophisticated ways. However, access to these machines was extremely limited. Many of the early computer artworks were created by mathematicians and engineers working in research laboratories equipped with room-sized computers like the IBM 7094, a machine also used by NASA in the Apollo space programme.

Programming languages like FORTRAN, originally designed for scientific computing, enabled artists to use mechanical tools in innovative ways. Some artists learnt how to use code so they could communicate with scientific devices, instructing them to draw lines and shapes using screens and plotter printers. At the same time, advancements in electronic components made new kinds of interactive artworks possible. Electronic sensors could detect sound and movement, allowing artists to create new ways

for artworks and audiences to interact.

The 1960s saw the first wave of group shows displaying computer art. The first in the UK was **Cybernetic Serendipity**, which opened at the Institute of Contemporary Arts (ICA) in London in 1968. It explored the creative potential of technology beyond the visual arts, including electronic music, dance and poetry. In 1969, the international touring exhibition **Arte y Cibernética** (Art and Cybernetics), organised by the experimental workshop Centro de Arte y Comunicación (CAYC), opened at Galería Bonino in Buenos Aires. The New Tendencies gatherings in Zagreb also embraced the move towards computers and visual research. The exhibitions **Tendencies 4** in 1968–9 and **Tendencies 5** in 1973 brought together early digital artworks from four continents.

Left: **Cybernetic Serendipity** exhibition, ICA, London, 2 August–20 October 1968. Installation view with works by Edward Ihnatowicz and James Seawright in the foreground.

Right: **Tendencies 4 – Computers and Visual Research** exhibition, Zagreb, 5 May–30 August 1969. Installation view with works by Charles Csuri, Robert Mallary, Leslie Mezei, Compos 68. Courtesy Museum of Contemporary Art, Zagreb

Cybernetic Serendipity
(Late Night Lineup)

1968
Video
Running time: 7 min 16 sec

Courtesy the British Broadcasting Corporation
X91272

Charles Csuri 1922–2022
Born and worked US

Sine Curve Man

1967
Screenprint on acrylic

The Anne and Michael Spalter Digital Art Collection
X91101

Csuri's self-portrait **Sine Curve Man** is known as one of the first figurative computer drawings created in the United States. Csuri digitally transformed a drawing using the sine curve, a geometrical function. He used an IBM 7094, a powerful 1960s computer used by NASA in the Apollo space programme and early missile defence systems. The computer output was stored on punched cards. These were then fed into a plotter which drew the image onto a sheet. This work, a computer drawing screenprinted onto acrylic plastic, is an example of Csuri's experiments with remediation – the translation of an image from its original medium into another.

Hiroshi Kawano 1925–2012
Born China, worked Japan

KD 29 – Artificial Mondrian

1969
Gouache on paper after computer-generated design

ZKM | Center for Art and Media Karlsruhe
X90431

This is one of a series of several computer-generated works that Kawano then hand painted. They are homages to artist Piet Mondrian, known for his geometric abstract works. Kawano created the forms in **Artificial Mondrian** by using the programming language FORTRAN. He programmed an algorithm that could determine how often and in what position a colour was most likely to appear in Mondrian's paintings. He then generated new images by translating those probabilities into random variables. These then defined the shapes and colours of the works in the series.

Franciszka Themerson 1907–1988
Born Poland, worked Poland and UK

Poster for Cybernetic Serendipity

1968
Screenprint on paper

Gregor Muir
X91136

This poster advertises the 1968 **Cybernetic Serendipity** exhibition at the ICA, London. It features an image of Nam June Paik's 1964 remote-controlled sculpture **Robot K-456** as a blue silhouette and a computer poem by composer Haruki Tsuchiya. **Ellipses and Circles** c.1966, a computer drawing by Petar Milojević, is superimposed in black over the robot's head and red on the poster's top right corner.

Themerson, a trained graphic designer as well as an artist and musician, composed the poster using analogue graphic design methods as she did not have access to a computer. She also designed the exhibition itself, along with students from the Bath Academy of Art.

[Wall Vitrine]

Hiroshi Kawano 1925–2012
Born China, worked Japan

7 of 3 d2 // Design 1–4

1964
Gouache on paper after computer-generated design

This is one of the first examples
of Japanese computer art and
computer-generated design. Kawano experimented
with pseudo-random number generators that produced
automated variations of linear forms. However, he could still
control specific parameters, such as objects' dimensions,
directions and numbers. With this method, a single input
could result in several different designs, which Kawano
would transpose on paper by hand.

ZKM | Center for Art and Media Karlsruhe
X90432

Ben Laposky 1914–2000
Born and worked US

Electronic Abstraction 4

1952
Photograph, gelatin silver print on paper

The Anne and Michael Spalter Digital Art Collection
X91099

Ben Laposky 1914–2000
Born and worked US

Electronic Abstraction 27

1952
Photograph, gelatin silver print on paper

This photograph, together with **Electronic Abstraction 4** on display on its left,
shows variations of electrical signals.
To obtain these images, Laposky used an oscilloscope, a device which captures and displays electrical signals as waveforms and shows how they change over time. He manipulated the displayed wave forms and photographed the results. Laposky called these images 'Oscillons'. They are considered the first graphics generated using an electronic machine.

The Anne and Michael Spalter Digital Art Collection
X91100

Vladimir Bonačić 1938–1999
Born Serbia (then Yugoslavia), worked Croatia,
Israel/Palestine and Germany

RS. PLNS. 0374. 1024. 0064

1969
Photograph, gelatin silver print

Dunja Donassy-Bonačić, bcd-Cybernetic Art Team
X99731

Vladimir Bonačić 1938–1999
Born Serbia (then Yugoslavia), worked Croatia, Israel/ Palestine, Germany

PLN 6

1969
Photograph, gelatin silver print on paper

PLN 6 is part of a series of computer-generated images visualising algebraic functions as light. The works are photographic reproductions of patterns created by Bonačić with an oscilloscope.
He could interact with the screen using a device of his own invention he called a 'luminous pen'. These computer-generated images were Bonačić's first works giving visual form to Galois fields, mathematical structures that produce symmetries and patterns. He also translated these into a series of reliefs using light and software. Some of these are displayed nearby.

Dunja Donassy-Bonačić, bcd-Cybernetic Art Team
X99730

[Wall captions]

Ivan Picelj 1924–2011
Born and worked Croatia

Tendencies 4

1969
Screenprint on paper

Tate. Presented by Anja Picelj-Kosak 2016
P14477

Picelj created this poster for the **Tendencies 4** exhibition in Zagreb in 1969. Picelj's black-and-white dot matrix pattern reflects a new phase for New Tendencies and its move towards computer-generated art. The dot pattern of the poster also formed the basis for **T-4**, an electronic and computer-programmed sculpture the artist made in 1968 in collaboration with Vladimir Bonačić, whose work is on display nearby. Picelj designed the posters for all New Tendencies exhibitions in Zagreb. His poster for **New Tendencies 2** is on display in room 6.

Vladimir Bonačić 1938–1999
Born Serbia (then Yugoslavia), worked Croatia,
Israel/Palestine and Germany

Random 63

1969
Aluminum, electronics, 63 glow switch starters and
63 lightbulbs

Dunja Donassy-Bonačić, bcd-Cybernetic Art Team – on
permanent loan to ZKM | Karlsruhe
X91041

Random 63 is a light installation made up of 63 electric lamps. To ensure complete randomness, Bonačić used independent switches activating each lightbulb in an unpredictable sequence. The work points to Bonačić's critique of the role of true randomness in computer art. He argued that 'maximal originality', or disorder created by random selection, could never surpass human creativity. Instead, Bonačić believed in using pseudo-randomness, which may appear random to the viewer while still conveying meaningful information and maintaining its aesthetic value. To demonstrate this, he arranged the bulbs in **Random 63** in a pattern generated by a mathematical function known as a Galois field. In Bonačić's view, visualising a mathematical principle with the work's layout counters the meaningless

random flicker of the bulbs.

Vladimir Bonačić 1938–1999
Born Serbia (then Yugoslavia), worked Croatia,
Israel/Palestine and Germany

GF.E 16 –S

1969–79
Custom-made hardware (Galois field generator); aluminium,
analogue and digital electronics,
256 glow lamps

GF.E 16–NS

1969
Custom-made hardware (Galois field generator); aluminium
analogue and digital electronics,
256 glow lamps

Dunja Donassy-Bonačić, bcd-Cybernetic Art Team – on
permanent loan to ZKM | Karlsruhe
X92148, X92175

The two works on display here are part of a series of installations Bonačić called ‘dynamic objects’. Built entirely from scratch, from hardware to software, they consist of digitally-programmed light patterns visualised on grids that the artist custom-made with metal tubes of various shapes and sizes. The ‘GF’ in the titles refers to Galois Field, a type of algebra. For Bonacic, this kind of work allows the viewer to visualise and understand otherwise imperceptible mathematical laws. The ‘S’ and ‘NS’ in the titles stand for ‘symmetrical’ and ‘non-symmetrical’ visual composition, depending on how the calculated algebraic results are shown.

Robert Mallary 1917–1997
Born and worked US

Quad III

1969
Plywood, metal and resin on plywood base

Tate. Purchased with funds provided by the Tate Americas Foundation 2019
T15312

This tall, elongated sculpture is composed of over 100 sections of plywood. Mallary drew these with the computer design program TRAN2. The program generated a vertical sequence of 48 forms, which Mallary then printed and used as patterns to cut the individual plywood 'slices' that form the sculpture. The sections are layered upon each other over a metal rod, glued together, sanded to a smooth surface and laminated. **Quad I**, a prototype Mallary made for **Quad III**, is considered one of
the first computer-generated sculptures.
Quad I was shown in the 1968 exhibition **Cybernetic Serendipity** and **Quad III** in **Tendencies 4** in 1969.

Vera Molnar 1924–2023
Born Hungary, worked France

Transformations 1–21

1976
21 digital plotter prints on paper

Tate. Purchased with funds provided by the Russia and Eastern Europe Acquisitions Committee 2020
T15545

Transformations 1–21 is a series of computer drawings, drawn by plotter. Each drawing consists of a five-by-five grid made up of concentric square graphics. Molnár conceived every grid as a distinct stage in a progression of squares. Together, the drawings show their transformation from a state of order to one of disorder. This creates a sense of movement and vibration across the series.

Molnár's works often explore every possible combination of a series, starting from a set of instructions and rules. Before she started working with computers in 1968, she used a similar algorithmic logic to generate patterns and sequences she would draw by hand.

[Images Above Vitrine]

Waldemar Cordeiro 1925–1973
Born Italy, worked Brazil

People Ampli*2

1972
Computer output on paper

The Museum of Modern Art, New York. Latin American and Caribbean Fund, 2016
X90170

This is a digital alteration of a newspaper photograph documenting a protest in São Paulo, Brazil, during a period of military dictatorship. Cordeiro divided the image into a grid by hand, assigning each square with alphanumerical symbols laid over each other. The density of the symbols depended on the tonality of the original photograph. He then processed the values using an IBM 360 computer which turned them into shades of grey. Through this manipulation, Cordeiro obscures the subjects' identities, emphasising the importance of collective political action.

Lilian F. Schwartz 1927–2024
Born and worked US

Enigma

1972
Film, 16mm, shown digitally, colour and sound
Running time: 4 min 20 sec

Courtesy the Collections of The Henry Ford. Gift of the Lillian F. Schwartz & Laurens R. Schwartz Collection
X90222

Enigma shows computer-generated visuals and image effects based on geometric shapes and patterns. They become progressively more colourful and complex. Schwartz made **Enigma** during her decade-long residency at Bell Labs, a research and development company which granted artists access to new technology.

With the use of an optical printer – a device used to add effects such as fades and superimposition – Schwartz was able to merge computer graphics with traditional filmmaking techniques. Questioning mechanisms of perception, she used stroboscopic effects that produce after-images on the viewer's retina, as well as other colour-altering effects.

Analivia Cordeiro born 1954
Born and works Brazil

0°⟷45° Version I

1974
Video shown digitally, black and white and sound

0°⟷45° Version III

1974
Video shown digitally, colour and sound

Courtesy the artist
X90427, X91026

0°⟷45° is a video-series of computer-generated works. In the series, Cordeiro dances solo, executing a choreography developed with the programming language FORTRAN. The choreography remained the same throughout the series. However, Cordeiro changed the stage and the costume design as well as the recording and editing style in each of the videos.
In **0°⟷45° Version I**, the dancer and stage appear merging, the horizontal lines of the set intersected by the curved lines created by Cordeiro's body. In **0°⟷45° Version III**, the dancer's position is shown through computer-generated stick figures juxtaposed with close-ups of each movement.

Analivia Cordeiro born 1954
Born and works Brazil

Drawing for 0°⟷45° Version II background

1974

This sketch was the basis for the stage design of Cordeiro's dance video
0°⟷45° Version II. The stage setting consisted of a pattern of black rectangles and diamond-like shapes, the positions of which had been randomly assigned by a computer. The dimensions of these shapes are based on Cordeiro's body measurements so that her silhouette can easily blend into the background of the black-and-white video.

Analivia Cordeiro born 1954
Born and works Brazil

0°⟷45° Version V

1974/2024
Video shown digitally, black and white and sound
Running time: 2 min 1 sec

TokenAngels Collection
X91027

Cordeiro shot **0°⟷45° Version II** in a TV studio using the computer-generated pattern reproduced in a sketch nearby as a backdrop. However, the artist was not completely happy with the result, as the contrast was not high enough to achieve the visual illusion she had envisioned. In 2024, Cordeiro shot a remake of **Version II** called **0°⟷45° Version V.** This version achieved the desired contrast value. Cordeiro herself performed in the new video, just as she did in the earlier works, returning to this choreography 50 years after its first realisation as a video dance.

[Vitrine]

Analivia Cordeiro born 1954
Born and works Brazil

0°⟷45° Dance Notation

1974/1984
Facsimile

Cordeiro developed this computer notation with the programming language FORTRAN. It determined the choreography for Cordeiro's video dance series **0°⟷45°** , shown on a nearby monitor in this room. The artist first created the notation in 1974. However, since no plotters were available to her at the time, it was only printed in 1984.

Courtesy the artist and Luciana Brito Galeria
Z89832

Analivia Cordeiro born 1954
Born and works Brazil

The Programming Choreographer from **Computer Graphics and Art,** Vol. 2 No. 1, February 1977

1977
Reproduction

Courtesy the artist
Z89833

[Wall Caption]

Harold Cohen 1928–2016
Born UK, worked UK and US

AARON #1 Drawing

1979
Acrylic paint on canvas

Tate. Purchased 2015
T14348

Cohen started developing his own drawing software in 1968. In 1973, he named this evolving program 'AARON'. AARON could draw by itself, improvising images from sets of rules. For Cohen, this process was a way to find out 'the minimum conditions under which a set of marks … functions as an image'.

To paint the large canvas on display here, Cohen combined several line drawings generated by AARON. He then enlarged the composition and reproduced it on canvas by hand, adding colour. Cohen painted this canvas for an exhibition in Reno, Nevada, where he had AARON create live drawings in the gallery while connected to a small drawing machine on wheels. One of these drawing machines, known as a 'turtle', is on display in a vitrine nearby.

Electric Dreams FM

Do you want to find out
more about Harold Cohen
and AARON?

After your visit, tune in to Electric Dreams FM, a radio show featuring artists included in the exhibition.

[Vitrine]

Cybernetic Serendipity: the Computer and the Arts. A Studio International special issue

1969
Facsimile reprint 2018

Feel free to browse

Late Night Lineup was a BBC arts & culture programme airing in the 1960s and 1970s. This segment is about the exhibition **Cybernetic Serendipity**. Featuring its curator Jasia Reichardt, it was filmed in the section of the exhibition dedicated to electronic music. It includes footage of works by Edward Ihnatowicz and Wen Ying Tsai, which are on display in this and the following room.

Gustav Metzger 1926–2017
Born Germany, worked UK

Maquette for **Five Screens with Computer**

1969
Ink and glue on paper

This model shows Metzger's plan for his largest ever 'auto-destructive' project. It consists of five enormous screens, each made up of multiple elements, controlled by a computer program. The elements would gradually be ejected over several years, and the sculpture ultimately disappear. The installation remained unrealised, but its outlines featured in the touring exhibition **Arte y Cibernética** organised by the CAYC in Buenos Aires. The project also appeared in the **Cybernetic Serendipity** publication and at the **Tendencies 4** exhibition in Zagreb.

Tate Archive
Z89611

Centro de Arte y Comunicación Buenos Aires

Arte y Cibernética: San Francisco, London, Buenos Aires

1971

This catalogue is from the **Arte y Cibernética** exhibition at the Centro de Arte y Communicación (CAYC) in Buenos Aires, Argentina in 1971. As well as computer art by Argentinians, it featured international artists such as Gustav Metzger. His work **Five Screens with Computer** is illustrated on this page as a study of its progressive disintegration.

Tate Library
Z89729

PAGE 12 – Bulletin of the Computer Arts Society

1970
Offset lithographic print on paper

Tate Archive
Z89708

Centro de Arte y Comunicación Buenos Aires

Arte y Cibernética catalogue

1969

Tate Library
Z89728

bit international 7

1971

bit international was a journal edited by the organisers of the New Tendencies exhibitions in Zagreb. Nine issues appeared between 1968 and 1972, with content reflecting the movement's shift towards electronic media and digital art. This issue documents the programme 'Computers and Visual Research', part of **Tendencies 4**. It also features the **Zagreb Manifesto** written by Jonathan Benthall, Gordon Hyde and Gustav Metzger. The manifesto stated: 'There are creative people in science who feel that the man-machine problem lies at the heart of making the computer the servant of man and nature. Such people welcome the insight of the artist in this context, lest we lose sight of humanity and beauty.'

Tate Library
Z89730

Tendencies 4 – Computer and Visual Research exhibition
installation view

1969
Photograph (exhibition copy)

Courtesy MSU Archive, Museum of Contemporary Art, Zagreb
X92058

Tendencies 5 exhibition catalogue

1971

Tate Library
Z89734

Tendencies 5 installation view

1969
Photograph (exhibition copy)

Courtesy MSU Archive, Museum of Contemporary Art, Zagreb
X92068

Tendencies 5 installation view

1973
Photograph, print on paper

The fifth edition of the **Tendencies** exhibition was held in Zagreb, Croatia in 1973. The show presented artists in three strands: 'constructive visual research', 'computers and visual research' and 'conceptual art'.

This installation view shows, from left to right, works by Hervé Huitric and Monique Nahas, Tomislav Mikulić, Edvard Ravnikar, Sergej Pavlin and Vladimir Bonačić.

Courtesy MSU Archive, Museum of Contemporary Art, Zagreb
X92068

Nicolas Schöffer 1912–1992
Born Hungary, worked France

La Ville Cybernétique

1969

In this manifesto, Schöffer presents the designs for **Cybernetic Light Tower**, his most ambitious work. The project was planned to be built in 1970 in La Défense, the business district of Paris. As tall as the Eiffel Tower and illuminating the city with four thousand different light combinations, Schöffer imagined creating a new landmark in the Parisian skyline. Construction of the **Cybernetic Light Tower** was ultimately abandoned due to its high cost. Schöffer participated in **Cybernetic Serendipity** with **CYSP** 1 1956, one of the earliest kinetic sculptures with sensors responding to light and sound from its environment.

Tate Archive
Z89711

Cybernetic Serendipity Music

1968

Record sleeve for **Cybernetic Serendipity Music**

1968

Tate Archive
X91412, Z75848

The compilation album **Cybernetic Serendipity Music** was released by the ICA in London to coincide with the **Cybernetic Serendipity** exhibition. It features a host of early experimenters in the field of electronic music, such as Iannis Xenakis, Haruki Tsuchiya and John Cage.

The sleeve notes from the record are available to browse on the interactive display below.

Edward Ihnatowicz 1926–1988
Born Poland, worked UK

Cybernetic Art of Edward Ihnatowicz

c.1985
Video (excerpt)
Running time: 4 min 18 sec
Music: Richard Ihnatowicz

Richard Ihnatowicz
X91271

Ihnatowicz's interactive sculptures interrogate the interactions between humans and machines. This video shows footage of **SAM** (on display nearby) and **The Senster**. The latter is one of the first computer-controlled interactive artworks. Microphones and radar sensors on the 4-metre-tall construction detect nearby sound and movement. The creature-like sculpture moves its head and body in the direction of the sound. Sudden movements or loud noises would make it shy away.

It was commissioned by the electronics manufacturer Philips and displayed between 1970 and 1974 in The Evoluon, and exhibition hall dedicated to science and technology in Eindhoven, the Netherlands.

[Sculpture]

Edward Ihnatowicz 1926–1988
Born Poland, worked UK

SAM (Sound Activated Mobile)

1968
Aluminium, fiberglass and electrical components

Richard Ihnatowicz
X91051

Both **SAM** and **The Senster** (seen in a video nearby) are interactive, sound-responsive sculptures using complex hydraulic mechanisms. **SAM**'s metal structure resembles a spinal column, with each vertebra made from hand-crafted aluminium castings. A flower-like reflector with four microphones tops the sculpture. When the microphones detected a sound, the vertebrae-like column moved towards it – or away from it if the noise was too loud.With this work, Ihnatowicz wanted to instigate in-person interactions between robots and people.

Today SAM is no longer functioning, but it can be seen in action on the nearby screen. This includes footage of visitors interacting with it when it was on display as part of the exhibition **Cybernetic Serendipity**.

[Vitrine]

Harold Cohen 1928–2016
Born UK, worked UK and US

Untitled Computer Drawing

1982
Ink and textile dye on paper

This is an example of a drawing
generated by the AARON software
and later hand-coloured by Cohen.
He programmed AARON's algorithm to draw lines that were less precise so that they would look like freehand drawings. AARON could also recognise when a shape was 'open' or 'closed' and decide whether to continue drawing inside or outside it. This gave its drawings an illusory sense of perspective and depth – at least to the human eye. By the early 1990s, AARON could draw plants as well as people.

Tate. Presented by Michael Compton 1986
T04167

Becky Cohen born 1947
Born and works US

Harold Cohen, Tate Gallery exhibition

1983
Photograph (exhibition copy)

Cohen noticed that having the turtle machine execute AARON's drawings in real-time proved too much of a distraction from the drawings themselves. In 1983, he stopped using turtle robots and continued to exhibit AARON at work in the gallery with the sole aid of plotters. The photograph on display here was taken at Cohen's exhibition at the Tate Gallery (now Tate Britain) in 1983. At this time, AARON could only generate line drawings, which Cohen or members of the public occasionally coloured in. Visitors were encouraged to take the drawings home.

Courtesy Becky Cohen
Z89836

Harold Cohen 1928–2016
Born and worked UK

Harold Cohen
Tate exhibition catalogue

1983

Tate Library
Z89732

Becky Cohen born 1947
Born and works US

Harold Cohen, Stedelijk Museum exhibition

1977
Photograph

During a series of exhibitions in the late 1970s, Cohen ran his software AARON on a minicomputer to make drawings in real time. The program would send drawing instructions to a plotter or to a small machine on wheels called a 'turtle' (also shown in this vitrine) to be printed. This photograph is of Cohen's 1977 exhibition at the Stedelijk Museum in Amsterdam, where he painted large murals based on AARON's drawings. The show marked the artist's return to painting after years dedicated to programming AARON.

Courtesy Becky Cohen
Z89834

Harold Cohen 1928–2016
Born and worked UK

Harold Cohen. An artist's use of the computer promotional postcard

1978
Offset lithographic print on card

Tate Library
Z89733

Harold Cohen 1928–2016
Born and worked UK

Drawing Machine ('Turtle')

1980
Steel, copper, plastic

Gazelli Art House (London, UK)
X90806

[Vitrine]

Desmond Paul Henry 1921–2004
Born and worked UK

Untitled

1962
Ballpoint pen plotter drawing
and black duplicator ink on card

Henry made this drawing using a repurposed bombsight computer, a military device designed to drop bombs more accurately. He was interested in capturing these computers' mechanical motions on paper. He combined them with other components to make three analogue drawing machines. Since analogue devices cannot store data, they could not be pre-programmed and required Henry's direct control. He often added embellishments by hand in black ink to the final drawing.

The Anne and Michael Spalter Digital Art Collection
X91146

Manfred Mohr born 1938
Born Germany, works US

P-026 Logical Inversion

1970
Benson plotter drawing on paper

Mohr used the FORTRAN programming language and custom software to create this work. The elements are horizontal, vertical and 45 degree lines, square waves and zigzags, with probabilities for widths and lengths. For each position in the matrix, the algorithm randomly chooses a new element from this selection of symbols to add to the existing motifs. It was then drawn on paper with a plotter. Mohr is also a jazz musician. His works show the influence of this musical background in their rhythmic structure, as lines and shapes progress through variations and unpredictable shifts.

The Anne and Michael Spalter Digital Art Collection
X91149

Tomislav Mikulić born 1953
Born Croatia, works Croatia and Australia

Rota – 45

1972
Plotter drawing in ink on paper

This work is one of Mikulić's earliest computer graphics. He developed a morphing algorithm using the programming language FORTRAN. He had access to the IBM 1130 computer through his work at the University of Zagreb. His design was then drawn using a plotter. Mikulić displayed it at the **Tendencies 5** exhibition in Zagreb in 1973. In 1976, he created the first computer-animated film made in his country, then Yugoslavia.

The Anne and Michael Spalter Digital Art Collection
X91969

Herbert W. Franke 1927–2022
Born Austria, worked Germany

Untitled from the **DRAKULA** series

1971
Plotter drawing on paper

This computer-generated work is part of the DRAKULA series Franke created in collaboration with computer scientist Josef Vordermaier. Vordermaier developed a program called **DRAchenKUrven überLAgert** (Dragon Curves Superimposed) that generated the images and inspired the title of the series. The program takes its name from geometrical fractal curves produced through repeated patterns of movement. Franke used these to structure his graphics. In the early 1960s, Franke was one of the first artists to generate images using an oscilloscope.

The Anne and Michael Spalter Digital Art Collection
X91145

Edward Zajec 1938–2018
Born Italy, worked US

RAM 2 V.3

1969
Plotter print using india ink on paper

This is one of Zajec's **RAM** (Random Number Generator) compositions, made using an IBM 1620 computer and a plotter. The artist evenly distributed linear elements over a square area. He tested various spatial combinations, randomly generated on a rectangular grid. In 1975 he called for digital art to become more participatory: 'Computer graphics in this context merely represents a transition stage … With a computer, we can now describe and communicate the organisation, structure and dynamics of a message [while] leaving it open to different interpretations and modifications … through direct interaction.'

The Anne and Michael Spalter Digital Art Collection
X91965

Grupo de Arte y Cibernética Buenos Aires

Miguel Angel Vidal 1928–2009
Born and worked Argentina

Untitled

1969
Screenprint on paper

This screenprint was produced from computer-generated drawings. To explore the potential of depth and patterns, Vidal's compositions make use of varying transparency. He also employs arrays of lines to create an illusion of depth.

Tate. Presented by the estate of Miguel Angel Vidal and Ungallery, Buenos Aires 2020
P15468

Miguel Angel Vidal 1928–2009
Born and worked Argentina

Untitled

1970
Screenprint on paper

Tate. Presented by the estate of Miguel Angel Vidal and Ungallery, Buenos Aires 2020
P15469

Ruth Leavitt born 1944
Born and works US

Computer Milled Sculpture

1977
Aluminium

Leavitt created this relief from a
computer-generated design she developed using custom-made
software programmed with FORTRAN.
The artist said, 'The "stretching" program from which all [my] art ... was derived was my idea. When I was a child, I had a rubber dollar bill and loved stretching George Washington's face in different ways. I thought that stretching patterns on a rubber sheet would be an innovative and effective use of the computer.' The final design was then machine-milled.

The Anne and Michael Spalter Digital Art Collection
X91148

Hervé Huitric born 1945
Born and works France
Monique Nahas born 1940
Born and works France

No. 3 (from the Handmade Pixel Series)

1971
Plotter print and gouache on paper

Huitric and Nahas explored different strategies to transform computer algorithms into coloured images, often completing their works by hand. Here, they first wrote a program that randomly distributed letters across a grid. Each letter corresponded to the colours red (R for rouge), yellow (J for jaune), blue (B) and their combined colours green (V), black and white. The artists then loosely applied the corresponding colours over the grid's print-out.

The Anne and Michael Spalter Digital Art Collection
X91147

Manuel Barbadillo 1929–2003
Born and worked Spain

Untitled (Number Painting)

c.1968–72
Impact print on fanfold paper

In 1968, Barbadillo wrote a computer program that enabled him to rotate U-shaped forms inside a grid. He then input different values to rearrange the
grid and create alternative motifs. He printed this work using a line printer, an early type of printer which uses force to stamp ink onto paper. Barbadillo often transposed his computer-generated patterns on canvas and paper by hand. The artist presented his programming experiments in a 1970 issue of **PAGE**, the newsletter of the UK's Computer Arts Society, displayed next to this print.

The Anne and Michael Spalter Digital Art Collection
X91139

Frieder Nake born 1938
Born and works Germany

Matrix Multiplication Series 29

1967
Computer-generated drawing, plotter print
on paper

To create this work, Nake generated a mathematical algorithm on a Telefunken T4 computer, creating a square matrix which he filled with numbers. The matrix then multiplied successively by itself, and the new matrices were translated into images. Each number was assigned a visual sign with a particular shape and colour. These signs were then processed using an electronic tape-punching machine. The punched tapes were fed
into a drawing machine which created
the image.

The Anne and Michael Spalter Digital Art Collection
X91960

Georg Nees 1926–2016
Born and worked Germany

Hall (Corridor)
From the **Computer Graphics Computer Sculpture** portfolio

1966, printed 1970
Offset lithographic print on paper

Nees created this lithograph after a unique plotter drawing, programmed using ALGOL (Algorithmic Language) software. His prints and sculptures explored the capacity of computers to generate architectural and spatial representations. Nees's February 1965 exhibition at the studio gallery of the Technische Hochschule in Stuttgart was one of the first to present computer graphics as art. The gallery was run by philosopher Max Bense, a key early theorist of digital aesthetics.

The Anne and Michael Spalter Digital Art Collection
X91152

Arte y Cibernética poster

1969
Offset lithographic print on paper

This poster advertised the first in a series of touring exhibitions of computer art organised by artist and curator Jorge Glusberg. The work illustrated on the poster is **Return to Square (b)** 1968 by the Tokyo-based Computer Technique Group (CTG), an art and engineering collective.

This exhibition launched the Grupo de Arte y Cibernética Buenos Aires. This group was closely associated with the Centro de Arte y Comunicación (CAYC, formerly CEAC), an arts organisation founded by Glusberg in 1968. The exhibition also included artists from the US and UK, as well as Japan.

The wall text for room 10 is in this room, at the entrance to the room.

ROOM 10

[Wall Text]

10.WEN-YING TSAI

Cybernetic sculpture … expresses a firm belief that scientific innovations when properly oriented to serve humanity … can be an effective means of delivering us from our present environmental chaos into a world of dynamic ecological equilibrium.

– Wen-Ying Tsai, 1971

Making use of his background in engineering, Tsai merged mechanics, electronics and optics to create kinetic works that respond to their environments. In the mid 1960s, Tsai began creating **Cybernetic Sculptures**, works that reference 'the poetic unfathomable wonder of the universe'.

Square Tops and **Umbrella**, the two cybernetic sculptures on display in this room, are made of vibrating metal rods lit by strobe lights. Although the rods vibrate at a constant rapid rate, the stroboscopic effect of the flashing lights creates the illusion of a slow, undulating movement. Viewers can interact with the works via an audio feedback control system: singing, stomping or clapping increases the frequency of the strobe flashes. This action creates an optical effect, making the rods' movement appear to change in a varied manner. When

visitors leave, and the room falls silent, the system returns to its original homeostatic state.

Tsai's cybernetic works were first exhibited in 1968 at a solo show at New York's Howard Wise Gallery, a venue closely associated with kinetic and electronic art forms. His work was also featured in the **Cybernetic Serendipity** exhibition at ICA, London. While Tsai continued to develop his cybernetic sculptures throughout his career, he also experimented with different media and technologies. In the late 1970s, he began creating works with light, colour and water elements controlled by computers.

Visitors are welcome to clap, sing or play music out loud in the room (for example from your phone) to interact with the work.

Wen-Ying Tsai 1928–2013
Born China, works US

Cybernetic Sculpture: Square Tops

1969
Aluminium, steel, concrete, electric motor, audio-control unit and strobe light

Tate. Lent by the Tate Americas Foundation, courtesy of Lee & Betsy Turner in recognition of their friendship with the artist 2022
L04611

Wen-Ying Tsai 1928–2013
Born China, works US

Umbrella

1971
Metal, concrete, wood and motor

Tate. Purchased 1972
T01521

ROOM 11

Anti-clockwise round the room from right of entrance

[Wall Text]

11. ELECTRONIC DIY

For many years, the only way creative practitioners could work with expensive hi-tech tools was to collaborate with the institutions and corporations that owned them. However, by the end of the 1960s, electronic consumer products became more widely available to the general public. This room focuses on artists experimenting with the new tools at their disposal, often repurposing them and inventing new ones, bringing a 'Do It Yourself' attitude to the introduction of emerging media in art.

In the 1950s and 1960s, tech companies like Bell Laboratories and IBM offered several 'artist-in-residence' programmes. Artists often developed innovative applications for new technology, leading to significant breakthroughs. Rebecca Allen invented new motion capture and 3D modelling, bringing her artistic practice into software engineering, and Nam June Paik was the creative force behind one of the first video synthesisers. In the 1980s, personal computers and graphics editing software became commercially available. Artists seized the opportunity to experiment with electronics on their own terms.

Venues like London's New Arts Laboratory and Centro de Arte y Comunicación in Buenos Aires were founded to foster international collaboration, hosting early experiments with video and 'intermedia' work. The 1972 exhibition **Video Communication: D.I.Y. Kit** in Tokyo,
Japan led to the establishment of Video Hiroba, an experimental collective that saw video technology as a community resource and alternative to mainstream media. Countercultural movements opposing mass consumerism and corporations' control of telecommunication
and technological resources began to emerge. Many publications,
such as the **Whole Earth Catalog** and **Radical Software**, encouraged people to develop their technical skills to reclaim technology for creative and social uses.

Lawrence Paul Yuxweluptun born 1957
Born and works Canada

Inherent Rights, Vision Rights

1992–3
Video documentation of original VR experience, colour and sound
11 min 12 sec

Courtesy Lawrence Yuxweluptun and Vtape
X91203

The video work is a recording of an immersive virtual environment created by Yuxweluptun. In this simulated parallel reality, the artist recreates a mystical vision in a cedarwood longhouse. This is a single-storey structure traditionally built by Coast Salish First Nations people on the west coast of Canada. Viewers can witness a religious ceremony in this virtual Indigenous landscape populated by mythological figures similar to those seen in Yuxweluptun's paintings. The work was originally displayed and experienced with a viewfinder, headphones and a joystick mounted on a custom cabinet. Yuxweluptun included rhythmic sounds as part of the experience to convey the spiritual and communing aspects of his world.

Image: Lawrence Paul Yuxweluptun, VR cabinet for **Inherent**

Rights, Vision Rights 1992-3. Photo: Kyla Bailey. Courtesy the Museum of Anthropology, University of British Columbia

Suzanne Treister born 1958
Born and works UK

Fictional Videogame Stills

1991–2
Photographs of original designs displayed on
Amiga 1000 computer screen, digitised and presented as video
Running time: 5 min (each slide: 10 secs)

Courtesy the artist, Annely Juda Fine Art, London and P.P.O.W. Gallery, New York
X91000

Suzanne Treister born 1958
Born and works UK

Would You Recognise A
Virtual Paradise?

Would You Recognise A Virtual Paradise?

Would You Recognise A Virtual Paradise?
Not Enough Memory

Would You Recognise A Virtual Paradise?
Presume Virtual Breakdown

Would You Recognise A Virtual Paradise?
Virtual Wilderness

Would You Recognise A Virtual Paradise?
Software Failure ...

Would You Recognise A Virtual Paradise?
Error Finding Question

Would You Recognise A Virtual Paradise?
No Message – Proceed

Would You Recognise A
Virtual Paradise?

Would You Recognise A Virtual Paradise?

Would You Recognise A Virtual Paradise?
Not Enough Memory

Would You Recognise A Virtual Paradise?
Presume Virtual Breakdown

Would You Recognise A Virtual Paradise?
Virtual Wilderness

Would You Recognise A Virtual Paradise?
Software Failure …

Would You Recognise A Virtual Paradise?
Error Finding Question

Would You Recognise A Virtual Paradise?
No Message – Proceed

1991–2
Photographs of original designs displayed on Amiga 1000 computer screen, digitised and presented as video

Running time: 5 min (each slide: 10 secs)

Courtesy the artist, Annely Juda Fine Art, London and P.P.O.W. Gallery, New York
X91000

These images are intended to look like stills taken from videogames. Treister created them on a Commodore Amiga 1000, one of the first widely available personal computers. The artist then photographed them straight from the screen. The original Amiga floppy discs storing the image files are corrupt, but the photographs have now been scanned into digital files. The works suggest a wider narrative and gameplay that remain open to interpretation. Treister first started working on videogame-inspired art in 1986 after she began frequenting videogame arcades. By the 1990s, ideas around virtual reality had begun to spread. Many of the **Fictional Videogame Stills** reflect on the meaning and promises of a parallel existance in a digital realm.

Samia Halaby born 1936
Born Palestine, works US

Fold 2

1988
Kinetic Painting, Amiga software, shown as video, monitor, colour
Running time: 45 sec

Tate. Purchased with funds provided by the Middle East and North Africa Acquisitions Committee 2023
X88935

Samia Halaby born 1936
Born Palestine, works US

Land

1988
Kinetic Painting, Amiga software, shown as video, monitor, colour, sound (stereo)
Running time: 1 min 15 sec

Tate. Purchased with funds provided by the Middle East and North Africa Acquisitions Committee 2023
X88937

Halaby created this abstract kinetic painting with a Commodore Amiga 1000 computer. Geometric and angular shapes fill the screen from side to side. Sonic elements emphasise their movement as they expand and contract. Halaby said she made this work 'in honour of my commitment to the land of Palestine'.

The artist fled her home country following the violent mass displacement of Palestinians during the establishment of the State of Israel in 1948, known to Palestinians as the Nakba. The shifting geometric shapes in **Land** reference Palestine's geographical territory. They point to themes of land occupation and fragmentation that mark Halaby's personal history.

Electric Dreams FM

Interested in hearing Samia Halaby talk about her life and art?

After your visit, tune in to Electric Dreams FM, a radio show featuring artists included in the exhibition.

Eduardo Kac born 1962
Born Brazil, works Brazil and US

Reabracadabra

1985
Minitel

Horny

1985–6
Minitel

Rechaos

1986
Minitel

Tate. Lent by the Tate Americas Foundation, courtesy of the Latin American Acquisitions Committee 2018
L04235, L04236

Tate. Promised gift of Catherine Petitgas, 2018
X71462

These animated poetic works are considered an early example of art made specifically for a computer network. Kac used the Minitel system, an interactive online service that users could access through the telephone line. He plays with the chromatic features of the Minitel display. Seemingly abstract geometric forms gradually reveal text, hinting at Brazil's unstable socio-political context in the 1980s and the idea of sexual desire as a subversive form.

The series engages with Brazil's rich history of experimentation with concrete poetry, where the layout and typography of words shape a poem's meaning.

Rebecca Allen born 1953
Born and works US

STEPS

1982
Video, shown digitally, colour and sound
Running time: 2 min 30 sec
Music: Carter Burwell

Courtesy the artist
X91028

This video merges performance with technology to create an illusion of dancing abstract forms. Allen was inspired by Bauhaus experimental theatre, which brought creativity and experimentation on stage through dance, play writing, masks and costumes. Allen was among the first artists to use computers for human motion simulation and motion capture, as seen here. Her works include experimental videos, performance and virtual reality (VR) and augmented reality (AR) installations that explore gender, identity and the human experience in the digital age.

Rebecca Allen born 1953
Born and works US

Creation Myth

1985
Video shown digitally, colour and sound
Running time: 2 min

Music: Carter Burwell

Courtesy the artist
X100255

To create the tree sequences in this video, Allen used a custom software based on fractal mathematics. This gave form both to the tree and to the sequence of its movements. It is one of the earliest animated generative artworks where an algorithm imitates organic growth. The video follows different stages of a creation myth, from particles of energy and light to animal and plant life. It was one of a series of artists commissions made for the opening of the New York nightclub Palladium.

Sonia Landy Sheridan 1925–2021
Born and worked US

Slideshow of digital works from **Drawing in Time (Infinite Series)**

1982–3
Digital video
Running time: 1 min 4 sec

The Daniel Langlois Foundation Collection of the Cinémathèque Québécoise. Sonia Landy Sheridan fonds X91202

In the 1980s, Sheridan started creating digital artworks using a black-and-white surveillance camera. She manipulated the images with a tablet and a stylus using the EASEL graphics software, the first available image manipulation program for personal computers. The software was developed by John Dunn, a student of the Generative Systems research programme founded by Sheridan at the Art Institute of Chicago in 1970. The course was dedicated to experimenting with art, science and technology, understood as intertwining systems of thought.

Top image: The Generative Systems classroom, Art Institute of Chicago, 1973
Bottom image: Sonia Sheridan at the EASEL/Cromemco Z-2D computer graphics system, 1982
Both photos courtesy the Daniel Langlois Foundation Collection of the Cinémathèque Québécoise. Sonia Landy Sheridan fonds

Flowers

1976
Photocopy on paper

The Daniel Langlois Foundation Collection of the Cinémathèque Québécoise. Sonia Landy Sheridan fonds
X91103, X91102, X91106

Sonia Landy Sheridan 1925–2021
Born and worked US

Top to bottom, left to right (continued):

Portrait of Sonia Sheridan

c.1970
Impression on paper

Stan VanDerBeek

c.1970
Photocopy on paper

Sonia through the Time Plane

1977
Photocopy on paper

The Daniel Langlois Foundation Collection of the Cinémathèque Québécoise. Sonia Landy Sheridan fonds X91104, X91105, X91107

These works demonstrate Sheridan's experimental reprography techniques. **Stan VanDerBeek** and **Flowers** were created using Color-in-Color photocopiers, the first commercially available colour copiers. Sheridan first started working with these machines during her residency at the Colour Research Laboratory at the science innovation company 3M. There, she created full-scale portraits by scanning sections of the subjects's bodies and then collaging them together. For **Untitled**, Sheridan exposed to heat the chemically treated surface of a Color-in-Color copy. She also worked with Xerox machines for **Portrait of Sonia Sheridan** and with a telecopier fax machine for **Nathan Lyons**. **Sonia through the Time Plane** was created using a Versatile Quality Copier. Sheridan covered parts of the paper for the first copy and then layered images by passing the sheet through the machine again.

[Wall]

Rita Keegan born 1949
Born US, works UK

Rites of Passage

1991
Video, shown digitally, colour, sound
Running time: 8 min 57 sec

Courtesy the artist
X91277

Rites of Passage is a video collage of photographs showing members of Keegan's family across generations, blending and dissolving into one another. She used a digital video editing tool to create ghostly visuals effects, highlighting the importance of family histories, memory and multi-layered identity.

Keegan owns an extensive archive of family photographs starting from the 1880s. She started using these photographs when she became interested in copy art, using photocopiers to create colourful monoprint collages. Her approach to video-making in **Rites of Passages** resonates with her body of work.

Rita Keegan born 1949
Born US, works UK

Blue III

1988
White cartridge paper, sugar paper, toner ink on paper

Courtesy the artist
X99711

Radical Software, Volume I, N. 1

1970

Radical Software, Volume I, N. 2

1971

Radical Software, Volume I, N. 3

1971

Radical Software, Volume I, N. 4

1971
Offset lithographic prints on paper

Private collection
X91159

Tate Library
Z89613

Private collection
X91161, X91162

Radical Software was a groundbreaking journal discussing video as an artistic medium, founded by artists Beryl Korot, Phyllis Gershuny and Ira Schneider. It focused on the potential of video and other emerging technologies to challenge mainstream media narratives. The first issue, from spring 1970, featured a computer-generated cover image.

Its opening editorial declared: 'Power is no longer measured in land, labor, or capital, but by access to information and the means to disseminate it … Our species will survive neither by totally rejecting nor unconditionally embracing technology - but … by allowing people access to the informational tools they need to shape and reassert control over their lives.'

To mark the journal's ethos of free information, the publishers rejected the standard copyright mark. Instead, they used a circle with an X inside it, meaning 'please copy'. The cover of the second issue was designed by Julie Katz and Tom DeWitt, the third's by Andy Poyner and the fourth by the Ant Farm collective.

Nam June Paik 1938–2013
Born South Korea, worked South Korea, Japan, Germany and US
Jud Yalkut 1932–2006
Born and worked US

Video Commune (Beatles Beginning to End)

1970, re-edited 1992
Film, 16mm, shown as video, colour
Running time: 8 min 23 sec

Tate. Licence purchased with funds provided by the Tate Americas Foundation 2020
H00012

The work documents Paik's first interactive live television performance. The artist used a video synthesiser he had developed in collaboration with television technician and engineer Shuya Abe. Paik manipulated colours and shapes from multiple sources in real-time. In the collaborative spirit of the work, during the broadcast, Paik invited staff from the TV station and passers-by into the studio to perform and remix the video images. Jud Yalkut filmed the television screen to produce the final montage. The video is silent, but Paik recommended watching it while listening to music by The Beatles. The headphones provided here play the band's entire discography on repeat.

[Vitrine]

CopyArt Newsletter

1986

Community CopyArt was an arts collective founded in 1983 and based in Kings Cross, London. It organised workshops and screenings and made its equipment available to the local community. The organisation used photocopying as a versatile and accessible medium to create and communicate, combining elements of photography, collage and graphic arts.

Rita Keegan was a key member of this collective. Keegan saw the photocopier as a tool for the creation of artworks and publications that were cheaper to make and distribute. These strategies were used to increase the visibility of artistic practices by Black artists, especially women.

Tate Library
Z89736

Bruno Munari 1907–1998
Born and worked Italy

Xerography: Documentation of the creative use of the machine Rank Xerox

1971

This book documents Munari's experiments with the paper copier
Xerox 914. Munari would move the original images across the machine's surface during the scanning process, resulting in distorted patterns. The book contains instructions on how to subvert the commercial use of the machine to produce original images with experimental effects. Munari, a key figure in the Italian Arte Programmata movement, was one of the first artists to use paper copier technology with this purpose.

Tate Library
Z89737

Whole Earth Catalog: Access to Tools

1969

Peter Harrington, London
X91187

The **Whole Earth Catalog** (titled **Whole Earth Epilog** in the 1974 edition on display nearby) was a North American countercultural magazine. Half research journal, half mail-order catalogue, the publication brought together a diverse range of objects, ideas and resources under the subtitle 'access to tools'. It promoted a DIY ethos that merged technological and ecological practices, positioning the Earth as a 'whole system'. The **Catalog** was published by biologist and activist Stewart Brand from 1968–72 and then occasionally until 1998. From 1966 Brand campaigned for the release of the first photograph of the Earth seen in its entirety from space. He thought the image would radically change the way humanity understood its relationship with the planet. In 1968 he featured the photo on the cover of the **Catalog**'s first issue. The 1969 front cover features **Earthrise**, a photograph of Earth and part of the Moon's surface taken during the Apollo 8 mission.

Whole Earth Epilog: Access to Tools, October 1974

1974

Private collection
X100212

Radical Software, Volume II, N. 5

1972

This issue of **Radical Software** was dedicated to the relationship between electronic media and the environment. Chilean artist Juan Downey presents a utopian vision where 'Cybernetic technology operating in synchrony with our nervous systems is the alternative life for a disoriented humanity … Ironically, the man-nature chasm can only be closed by technology. The process of reweaving ourselves into natural energy patterns is Invisible Architecture, an attitude of total communication [that] re-explains electronic circuitry as a bio-feedback tool in evolving the collectivity of human brains … Human/electronics interaction sets humanity on a global interconnective level where technology becomes less and less necessary'.

Peter Harrington, London
X91163

Japan Video Art Festival:
33 Artists at CAYC

1978

This booklet details the programme for a festival of Japanese video art held at the Centro de Arte y Comunicación (CAYC) in Buenos Aires in 1978. It features Katsuhiro Yamaguchi, whose work is on display in room 5.

Between 1974 and 1978, CAYC organised ten 'video encounters' in London, Paris, Ferrara, Buenos Aires, Antwerp, Caracas, Barcelona, Lima, Mexico City and Tokyo, featuring vast rosters of international artists.

Tate Library
Z89735

Michael Shamberg born 1945
Born and works US
Fujiko Nakaya born 1933
Born and works Japan

Guerrilla Television

1971
Japanese edition 1974

This is the Japanese edition of Michael Shamberg's influential book **Guerrilla Television**. It criticised the monopolistic power of television. Shamberg suggests reclaiming the medium through newly available commercial videocameras. Designed by the Ant Farm collective, the book was both a manual and a manifesto for socially engaged video artists worldwide. The Japanese edition was translated by artist Fujiko Nakaya, who would later found SCAN, Japan's first gallery dedicated to video, in 1980.

Private collection
X99990

Yuzo Tateishi 1941–1998
Born and worked Japan

Video Communication:
DIY Kit exhibition

1972
Photograph (exhibition copy)

Courtesy Michael Goldberg
Z89848

Michael Goldberg born 1945
Born Canada, works Canada and Japan

Video Communication:
DIY Kit exhibition

1972
Photograph (exhibition copy)

This photograph shows the **Video Communication: D.I.Y. Kit** exhibition, held at the Sony Building in Tokyo. Widely considered the first exhibition of video art in Japan, it showcased a library of video artworks and demonstrated the capabilities of the Sony Portapack, the first commercially available portable video recorder. This event led to the founding of Video Hiroba ('Video Plaza'), Japan's first experimental video art collective. Artists Fujiko Nakaya and Katsuhiro Yamaguchi, whose work is on display in this exhibition, were key members of the collective.

Courtesy Michael Goldberg
Z89835

New Arts Lab

UFO+TV – Bachdenkel flier

1970

This flier advertises a two-day live event held at London's New Arts Lab. It features an image from a 1967 advert for the Sony Portapack, the first portable video recorder. The event was an experimental workshop in collective video production, organised around improvised live music by Birmingham's psychedelic rock band Bachdenkel. The New Arts Lab, or Institute for Research in Art and Technology (IRAT), was founded in London in 1969 by a group of artists and activists including video pioneer Hoppy (John Hopkins) and arts theorist John Lifton. It hosted early experiments with video, film, theatre and new media installation.

Tate Archive
Z89716

Samia Halaby born 1936
Born Palestine, works US

Spooling Up

1988
Kinetic Painting, Amiga software, shown as video, monitor, colour, sound (stereo)
Running time: 4 min 16 sec

Brightly coloured geometric and organic shapes fill this screen, morphing and blending into one another at different speeds to create a painting in motion. Programmed on a Commodore Amiga 1000 computer, a sound element accompanies the moving shapes. **Spooling Up** is the interpretation of a journey the artist made when she flew in a small plane over New Jersey, US. The title refers to a term pilots use when preparing the plane's engine for flight. The visual and sonic elements of this work speak to Halaby's longstanding exploration of abstraction through computer experimentation.

Image: Samia Halaby working on her Amiga 1000, 1987. Courtesy the artist

Sonia Landy Sheridan 1925–2021
Born and worked US

Top to bottom, left to right:

Untitled (Process: Electrostatic Thermal)

c.1970
Photocopy on paper

Nathan Lyons

c.1970
Impression on paper

ROOM 12

Anti-clockwise round the room from right of entrance

[Wall Text]

12. TATSUO MIYAJIMA
The whole is a study of models of the world, of outer space, of time
and of human society.

– Tatsuo Miyajima, 1993

This room presents two of Tatsuo Miyajima's works from the 1990s. **Lattice B** and **Opposite Circle** are both made from two-digit LED number counting units arranged in geometric formations. The 40 intricately connected LED units of **Lattice B** are presented on a wall. In **Opposite Circle**, the LED displays form a three-metre ring that appears to hover a few centimetres above the floor. The counters are programmed to move upwards from one to 99 in a unique rhythm before resetting. The overall effect is a flickering and ever-changing display of numbers progressing at different speeds. The works are part of Miyajima's series **133651**, the title of which refers to the 133,651 potential combinations of the two works.

Miyajima's practice is inspired by three guiding principles: 'keep changing', 'connect with everything' and 'continue

forever'. These ideas are inspired by Buddhism. The artist explains, 'In Eastern and Buddhist philosophy, change is natural and consistently happening'. Technology allows Miyajima to articulate philosophical ideas about life cycles and repetition using light, time and movement. Modern technology is not 'an end in itself' for the artist, but a means of visually representing his ideas and visions. He says, 'It is not about creating a beautiful image or system, it is more about creating an inner spiritual quality in the world. My idea of the future is not a pictorial image but a spiritual concept.'

Tatsuo Miyajima born 1957
Born and works Japan

Opposite Circle

1991
30 light emitting diodes units, 3 transformers
and aluminum panel

Tate. Presented by Janet Wolfson de Botton 1996
T07180

Tatsuo Miyajima born 1957
Born and works Japan

Lattice B

1990
40 light emitting diode units and 10 transformers

Tate. Presented by Janet Wolfson de Botton 1998
T07407

ROOM 13

Anti-clockwise round the room from right of entrance

[Wall Text]

13. TATSUO MIYAJIMA

The purpose of Experiments in Art and Technology is to catalyse the inevitable active involvement of industry, technology and the arts.

– **E.A.T. News**, Vol. 1, 1967

Experiments in Art and Technology (E.A.T.) was a creative group founded in the United States in 1967 by engineers Billy Klüver and Fred Waldhauer with artists Robert Rauschenberg and Robert Whitman. Its goal was to promote collaboration between artists and engineers. E.A.T. organised technically daring projects and developed a programme of residencies with renowned artists, musicians, choreographers and composers. The works and archival material in this room focus on the years 1967 to 1972. They capture a snapshot of the international network of people and places connected to the group's activities.

E.A.T. famously took part in Expo '70 in Osaka, Japan. The 1970 iteration of the World Exposition – the first to take place in Asia – featured pavilions commissioned by national

governments and corporations, with a strong focus on new technologies. On the invitation of Pepsi Cola, E.A.T. designed the Pepsi Pavilion as a sequence of immersive environments. It contained laser and sound installations, as well as an enormous hemispherical mirror. A fog sculpture enveloped its exterior. The room also includes some contextual material on Expo '70 at large – and artists' critiques of its use of art as promotional spectacle.

While developing the Pepsi Pavilion, E.A.T. connected with the National Institute of Design (NID) in Ahmedabad, one of several experimental hubs emerging in India at that time. In 1971, NID collaborated on E.A.T.'s **Utopia: Q&A 1981** project. This one-month event connected E.A.T. outposts in Stockholm, New York, Tokyo and Ahmedabad through telex machines in a participatory project that represented the culmination of E.A.T.'s international collaborations. It anticipated the spirit of chatrooms and message boards years before the invention of the internet.

Atul Desai 1934–2013
Born and worked India

Music Track for Osaka Expo ‘70

1970
Audio
Running time: 2 min 50 sec

Courtesy the National Institute of Design, India
X91276

Desai composed this audio track for the Indian Pavilion at the Osaka Expo in 1970. Described as a sound collage, the tape was recorded at the National Institute of Design in Ahmedabad. The NID housed India’s first electronic music studio.

Created using a Moog, one of the first commercial synthesisers, Desai’s track plays with the tones of traditional and familiar instruments and melodies, fusing them with experimental electronic sounds of the time.

Image: box containg Desai’s tape **Music Track for Osaka Expo ‘70**. Photo: Paul Purgas. Courtesy Paul Purgas and National Institute of Design Archives, Ahmedabad

Electric Dreams FM

Listen to artist and musician Paul Purgas discuss his work in the NID archives.

After your visit, tune in to Electric Dreams FM, a radio show featuring artists included in the exhibition.Digital

Tom Gormley 1937–2005
Born and worked US
János Kender 1937–1983
Born Hungary, worked US
Harry Shunk 1924–2006
Born and worked US

American Artists in India

1970–71

Courtesy the Moderna Museet, Stockholm, Julie Martin and Getty Research Institute, Los Angeles

This poster features the hand of dancer and choreographer Chandralekha (Chandralekha Prabhudas Patel). Chandralekha also worked as a designer, and was connected to the National Institute of Design in Ahmedabad. The poster advertised an event to raise funds for E.A.T.'s 1970-71 initiative **American Artists in India**. This was a series of residencies for North American artists, organised in collaboration with the NID. It was initially devised as an opportunity for E.A.T. artists travelling to Japan for Osaka Expo '70 to extend their stay in Asia thanks to E.A.T.'s network and connections in India.

Katsuhiro Yamaguchi 1928–2018
Born and worked Japan

E.A.T. Tokyo, Utopia Q&A 1981, Sony Building, Ginza

1971

Courtesy Fujiko Nakaya

This poster is from a participatory project organised by Yamaguchi for the Tokyo station of E.A.T.'s project **Utopia Q&A 1981,** located at the Fuji Xerox showroom in the Sony building in Ginza, Tokyo. Printouts of the telexed questions and answers were hung on the walls, and visitors could add their own interventions. Yamaguchi installed a photo booth next to the telex desk. Visitors could have their photos taken, and more than 1,500 miniature portraits were collected and assembled into this poster.

The poster mistakenly lists Ahmedabad, the location of the project's outpost in India, as 'Bombay'.

Akbar Padamsee 1928–2020
Born and worked India

Syzygy

1972
Video, shown digitally, black and white
Running time: 16 min 33 sec

Courtesy Future East Film Akbar/Padamsee Studio
X91411

Syzygy is a short film Padamsee made in collaboration with animator Ram Mohan. It is an abstract, stop-motion animation film created out of nearly 1,000 drawings, in which the artist develops sequences of shapes. Here Padamsee – who was primarily a painter – turns numbers, letters and dots into straight, dashed or curved lines. The film was made at VIEW, the Inter-art Vision Exchange Workshop Padamsee founded in Mumbai, India in 1969. VIEW was a short-lived but influential platform for artists to experiment and exchange ideas across disciplines.

National Institute of Design

I.S. Mathur and Atul Desai working in the NID studio

c.1970

Tape and voiceover work at the NID sound studio

c.1969
Photograph (exhibition copy

Courtesy Archives, National Institute of Design, Ahmedabad and The state51 Conspiracy
Z89845-6

These two photographs show musicians Mathur and Desai in India's first electronic music studio, housed by The National Institute of Design (NID). The NID was founded in 1961 in Ahmedabad, India, during a period of significant investments in media, design and technology. The studio became a hub for Indian musicians experimenting with new technologies who produced the earliest examples of electronic music in India. NID also fostered relationships with international artists, such as the E.A.T. collective. Composer David Tudor, member of E.A.T., helped bring a Moog modular synthesiser to NID – the very first in India. This can be seen in the background of the top photograph.

Visitors entered the pavilion through a tunnel. The ground floor hosted the Clam Room, a darkened space with concave flooring. It featured a sound-activated **Laser Deflection System**, designed by engineer Lowell Cross with composer David Tudor, which projected colourful moving patterns on the floor. A stairway led into Dome Room, a performance space with a huge hemispherical mirror that reflected visitors in unexpected ways. Engineer Elsa Garmire took part in its design with a study of its optical properties. The entire pavilion was fitted with a programmable audiovisual system.

Dashrath Patel 1927–2010
Born and worked India

Installation view at the India Pavilion at Montreal World's Fair 1967

1967
Photograph (exhibition copy)

Dashrath Patel in the India Pavilion at Montreal World's Fair 1967

1967
Photograph (exhibition copy)

Courtesy The Marg Foundation and The Dashrath Patel Archive, SPACES, Chennai
Z89843, Z89844

These photographs document **Journey in India**, Patel's nine-screen, 360-degree panoramic projection. It was created for the India Pavilion at the Montreal Expo '67, and featured a soundtrack by the NID's electronic music studio. To shoot the work, Patel travelled across India with a plywood structure housing nine cameras mounted around his neck. Patel was a founding member of the NID and organised the India Pavilion at the Osaka Expo '70.

Rosemary Jean Eggleston

Indian Pavilion at Osaka Expo 70

1970
Photograph

Courtesy Kiran and Ravin Sachdev
X91583

India Pavilion (Osaka Expo ‘70)

1970

This book was published to commemorate India’s participation in Osaka Expo ‘70. It illustrates selected aspects of Indian history and society and presents an optimistic view of the country undergoing an accelerated modernisation process. By 1970 India had only been independent for 23 years and its government was eager to show its growth and potential to the rest of the world. Technology played a key role in this narrative, as seen in the illustrations for this spread.

Paul Purgas
X92136

E.A.T. (Experiments in Art and Technology)

Utopia Q&A 1981 – Sample questions from Ahmedabad, India

1970
Photocopy

Tate Archive
Z89724

Rosemary Jean Eggleston

India Pavilion, Osaka Expo ‘70

Photograph (exhibition copy)

Courtesy Kiran and Ravin Sachdev
X91583

E.A.T. (Experiments in Art and Technology)

Utopia Q&A 1981 – Messages from Ahmedabad, India

1971
Photocopy from original telex

Tate Archive
Z89725

E.A.T. (Experiments in Art
and Technology)

Utopia Q&A 1981 – Samples of Questions and Answers

1971
Photocopy from original telex

Tate Archive
Z89726

Shoji Fukazawa

E.A.T. Tokyo, Utopia Q&A 1981,
Sony Building, Ginza

1971
Photograph (exhibition copy)

Utopia: Q&A 1981 was a project organised by E.A.T. Telex machines (printers that can send and receive text messages over phone lines) were installed in four cities around the world. This photograph features Fujiko Nakaya, a member of E.A.T.'s Tokyo chapter.' E.A.T. invited various members of the public (including artists and scientists) to ask questions concerning life ten years in the future. These were telexed back and forth between the four terminals. This communication chain lasted for a month, with more than 400 questions asked and answered.

Courtesy Experiments in Art and Technology Tokyo
Z89847

[Wall]

Ivan Dryer 1939–2017
Born and worked US
Elsa Garmire born 1939
Born and works US

Laserimage

1972
Film, shown digitally, colour and sound
Running time: 10 min

Courtesy David Dryer
X91053

Laserimage is a test video, made to document a laser show that Garmire and Dryer were developing for the Griffith Observatory planetarium in Los Angeles. This later became a long-running attraction called **Laserium**. Garmire invented her own techniques for diffracting the laser beams that generated the patterns in **Laserimage**. Garmire was a member of the collective Experiments in Art and Technology (E.A.T.), and a key engineer in the team that designed E.A.T.'s Pepsi Pavilion for Expo '70 in Osaka, Japan.

János Kender 1937–2009
Born Hungary, worked US
Harry Shunk 1924–2006
Born and worked US

Fujiko Nakaya in front of the Pepsi Pavilion, Expo '70, Osaka

1970

Courtesy Fujiko Nakaya and Getty Research Institute, Los Angeles

Nakaya is best known for her fog sculptures. She creates ephemeral structures from water and air currents. The fog generated by her sculptures can either evaporate or hang in the air for several minutes depending on the surrounding environment. Nakaya was a member of E.A.T. She is shown here in front of E.A.T.'s Pepsi Pavilion. Nakaya made her first fog sculpture for the occasion, which was installed on the roof of the pavilion in order to keep it shrouded it in a cloud-like mist.

Eric Saarinen born 1942
Born and works US

Great Big Mirror Dome

1970
Film transferred to digital video, colour and sound
Running time: 18 min

Courtesy the artist and Getty Research
X91022

This film documents the conception, design and opening of the Pepsi Pavilion at Expo ‘70 in Osaka. The documentary, also commissioned by Pepsi Cola, starts with the construction of a full-scale model of the mirror dome in a former dirigible hangar in the south of Los Angeles. The film then moves to Osaka, interviewing participating artists and showing behind-the-scenes images of the pavilion being installed. It also features an interview with artist Fujiko Nakaya as well as footage of Nakaya’s **Fog Sculpture #47773**, Lowell Cross’s **Laser Deflection System** and E.A.T.’s **Mirror Dome** during and after the pavilion’s inauguration.

Tjebbe van Tijen born 1944
Born and works Netherlands
Nic Tummers 1928–2020
Born and worked Netherlands

Osaka. Progress and Harmony for Mankind

1968
Offset lithographic print on paper

Private collection
X91454

This manifesto, published in Amsterdam in 1968, took a critical stance against the announced Osaka Expo '70. It called for a debate on the function of world fairs as instruments of established political and economic powers. It also brought into question the complicity of artists, designers and architects that took part in these events. An extract from the manifesto reads: 'The World's Fairs have become Olympian demonstrations of national ideas. Ideals formed by power monopolies which use their own norms as a standard to determine the freedom of other people … Don't the World's Fairs force themselves upon us as manifestations of the "freedom" to have to produce things for which there is no need and to have to consume what we were forced to produce?'

British Movietone

News in Colour – Expo ‘70

1970
Video
Running time: 8 min 33 sec

Courtesy the Associated Press
X91273

[Vitrine]

E.A.T. (Experiments in Art and Technology)

Statement of Intent

1967

Tate Archive
Z89718

E.A.T. (Experiments in Art
and Technology)

Application form to join E.A.T.

c.1968

This application form to become a member of E.A.T. lists the many possible fields of interest of a prospective applicant. The options carry across multiple artistic practices and scientific disciplines. E.A.T. was founded during preparations for the performance series **9 Evenings: Theatre & Engineering**, which took place in New York in October 1966. This event featured projects by visual artists, composers and choreographers, developed in collaboration with engineers. E.A.T.'s goal was to expand the networks of relationships forged during the making of those performances.

Tate Archive
Z89720

E.A.T. (Experiments in Art
and Technology)

Announcement card for ‘Some More Beginnings’ exhibition

1968

This card reproduces a computer-processed image by Manfred Schroeder, a scientist at Bell Laboratories. He depicts the facade of the Brooklyn Museum through letters and numbers, repeating the title, dates, and location of the exhibition. **Some More Beginnings** showcased the many artworks submitted to a competition E.A.T. organised for engineers collaborating with artists.

Tate Archive
Z89719

János Kender 1937–2009
Born and worked US
Harry Shunk 1924–2006
Born and worked US

Installation of the nozzles for Fog Sculpture #47773 on the outer dome of the Pepsi Pavilion, Osaka Expo ‘70

1970
Photograph (exhibition copy)

Courtesy Fujiko Nakaya and Getty Research Institute, Los Angeles
Z89842

Tatsuro Murota

Fujiko Nakaya, wind tunnel test with 1/200 scale model of Pepsi Pavilion, Osaka Expo ’70

1969
Photograph (exhibition copy)

Courtesy Fujiko Nakaya
Z89841

E.A.T. (Experiments in Art and Technology)

Pepsi Pavilion, Osaka Expo ’70 postcards pack

1970
Offset lithographic print on card

Tate Archive
Z89721

E.A.T. (Experiments in Art and Technology)

Pepsi Pavilion, Osaka Expo ’70 booklet

1970

Tate Archive
Z89722

E.A.T. (Experiments in Art and Technology)

Description of the Pepsi Pavilion, Osaka Expo '70

1970

Tate Archive
Z89723

ROOM 14

[Wall Text]

14. LILIANE LIJN

My feelings about science – in particular the physics of light and matter – are that they are pure poetry.

– Liliane Lijn, 2018

This room explores Liliane Lijn's experiments with light and industrial materials. Since the 1960s, exploring new technological practices in the service of art has been at the forefront of Lijn's practice. The works on display in this room, made in the 1980s, demonstrate her continued interest in electricity and other forms of energy.

Lines of Power is one of a series of rotating copper sculptures called **Linear Light Columns**. The work consists of tightly wound bands of copper wrapped around motorised and slowly revolving cylinders. A light beam falls onto the reflective copper surface, creating a hypnotic pattern. Copper is a material commonly used to conduct electricity.
The light effects animating the work's surface appear to travel endlessly down and around the cylinders, resembling a live current.

The dramatic figure of **The Bride** pulses with energy. It speaks

to the artist's interests in mythology and death, as well as in the sculptural properties of light. Lijn described the imposing enclosure as 'offering protection to the fragility' of the Bride figure behind it, rather than trapping her. Mica crystals, feathers and papier-mâché egg-like forms can be seen through the mesh. The work represents Lijn's interest in spiritual, feminist approaches to the material world. She said, 'I wanted to find a new way of looking at the feminine and to bring into that everything: plants, animals, humans and machines.' By highlighting **The Bride's** feminine qualities, Lijn opposes the common perception of mechanical materials and processes as inherently masculine.

Electric Dreams FM

What inspires Liliane Lijn to combine technology, feminism and ecology in her work?

After your visit, tune in to Electric Dreams FM, a radio show featuring artists included in the exhibition.

Digital content supported by

Liliane Lijn born 1939
Born US, works UK

The Bride

1988
Steel mesh cage, blown glass, epoxy bonded mica, ostrich feathers, lacquered papier-mâché balls, crocheted stainless steel and enamelled copper, forged iron

Collection of the artist and Sylvia Kouvali, London/Piraeus
X90255

Liliane Lijn born 1939
Born US, works UK

Lines of Power

1983
Steel, copper wire and motors

Collection of the artist and Sylvia Kouvali, London/Piraeus
X90579

[Vitrine]

Liliane Lijn born 1939
Born US, works UK

Electronic Symbols 01

1966–9
Letraset letters and electronic symbols on card

Electronic Symbols 04

1966–9
Letraset letters and electronic symbols on card

Electronic Symbols

1972
Letrafilm and Letraset electronic symbols on card

Collection of the artist and Sylvia Kouvali, London/Piraeus
X91095-6, X91098

Many of Lijn's works bring together expressive forms through kinetic sculptures and inventive works on paper and publications. Lijn drew attention to the poetic potential of industrial processes in a series of graphic works called **Electronic Symbols**. The series was made with symbols found on sheets of dry-transfer lettering and technical logotypes

that Lijn first came across in London in 1964. She noted that this ‘field of visual code’ seemed to ‘run parallel to poetry’, and ofter made connections between electricity and brain activity.

Liliane Lijn born 1939
Born US, works UK

Neurographs: Untitled I

1970
Letrafilm and Letraset electronic symbols on card

Related to **Electronic Symbols**, Lijn’s **Neurographs** series was prompted by her friend, the poet Sinclair Beiles, who asked Lijn to illustrate a notebook of writings he had developed during psychiatric treatment. Lijn explained, ‘I thought I could create poignant metaphors for mental disturbance using electronic symbols, relating electrons to neurons. I thought of the brain as an electro-chemical system, a kind of organic machine. I found that using these delicate symbols, code for the control and use of electrical energy, opened up a new imaginative field for me.’

Collection of the artist and Sylvia Kouvali, London/Piraeus
X91097

Liliane Lijn born 1939
Born US, works UK

Crossing Map

1972

Loosely based on the artist's own biography, **Crossing Map** is a book that traces a spiritual journey where the material body becomes one with nature. The open copy in this vitrine shows one of the closing poems. The text is overprinted with colourful patterns. Lijn considers these to be a 'visual score' rather than illustrations, 'as if the writing were lyrics that could be set to music'. Lijn intervened in the printing process, distributing the colours and varying the flow of inks throughout. As a result, each copy of the book is unique.

Tate Library
Z89739–40

ROOM 15

[Wall Text]

15. FLEISCHMANN AND STRAUSS

The interactive stage manifests itself as a thinking space where art, science and technology are intertwined.

– Monika Fleischmann and Wolfgang Strauss, 2015

Monika Fleischmann and Wolfgang Strauss were among the first artists to create immersive digital artworks featuring interactive technologies. Their work **Home of the Brain** 1989-91 was likely the first virtual reality artwork to make use of a head-mounted display and a dataglove. These devices, still in use today in videogames and virtual reality settings, allowed people to explore a simulated 3D space created by the two artists. In this cyberspace, viewers encountered the voices and ideas of philosophers commenting on the rise of digital media technologies.

Liquid Views – Narcissus' Digital Reflections, on display here, features a touchscreen simulating a pool of water. The pool 'reflects' the viewer's image, captured by a camera. The image distorts as the screen is pressed, generating rippling effects on this virtual liquid reflection. At the same time, the participant's distorted image appears on a large screen allowing an audience to watch this interaction. The

installation uses video texture mapping software, generating visual effects in real time.

When the work was made in 1992, interaction with one's digitised image was still a completely new experience. According to the artists, 'the encounter of the self with a shadowy virtual doppelganger [acts] as a metaphor for the internet and predicts the emergence of the Second Self as a selfie data body.' **Liquid Views** echoes the ancient Greek myth of Narcissus, who fell in love with his own reflection in a pool. He then pined away, realising his feelings could never be reciprocated. **Liquid Views** projects the subject's reflection outwards, entwining personal perception with public visibility.

Monika Fleischmann born 1950
Born Germany, works Germany and Italy
Wolfgang Strauss born 1951
Born Germany, works Germany and Italy

Liquid Views - Narcissus' Digital Reflections

1992
Computer, camera, touch screen, software, projection screen and sound

ZKM | Center for Art and Media Karlsruhe
X90209