

# Cryptograph:

## An Exhibition for Alan Turing

The brilliant British mathematician, logician, cryptanalyst, and pioneering computer scientist, Alan Turing (1912–1954), is being celebrated this year, the centennial of his birth. Turing's world-changing innovations include the Turing Machine, a conceptual machine that builds on the notion of the algorithm and lays the foundation of modern computing. As a cryptanalyst during World War II, Turing's breakthroughs in logic allowed him to decipher the German encrypting device known as the Enigma Machine, which was used extensively in communication between German U-boats. Turing was also deeply involved in the idea of "Machine Intelligence," and he developed a test for artificial intelligence that is still in use today. Late in his career Turing became fascinated with mathematical biology, a field that explores the mathematical underpinnings of morphogenesis—the origins and evolution of biological patterns.

This exhibition is co-sponsored by and was conceived in consultation and collaboration with KU's Information and Telecommunication Technology Center (ITTC) and the Biodiversity Institute. Our approach has been to seek works of art that resonate with the kinds of questions that drove Turing's research: finding meaning in patterns, and finding connections between mathematics, computing, intelligence, and natural form. We have also taken this exhibition as an opportunity to share works of art that would have been unthinkable without the advent of the computer.

## Alan Turing

### A brief chronology

1912 (23 June) : Birth, Paddington, London

1926-31 : Attends Sherborne School

1930 : Becomes atheist after the death of close friend  
Christopher Morcom

1931-34 : Undergraduate at King's College, Cambridge University

1932-35 : Quantum mechanics, probability, logic

1935 : Elected fellow of King's College, Cambridge

1936 : The Turing machine, computability, universal machine

1936-38 : Princeton University. Ph.D. logic, algebra, number  
theory

1938-39 : Returns to Cambridge; introduced to German Enigma  
cipher machine

1939-40 : Development of the Bombe, machine for Enigma decryption

1939-42 : Breaking of U-boat Enigma code

1943-45 : Chief Anglo-American crypto consultant

1945 : Appointment at National Physical Laboratory, London

1946 : Computer and software design

1947-48 : Programming, neural nets, and artificial intelligence

1948 : Appointment in mathematics at Manchester University

1949 : First serious mathematical use of a computer

1950 : The Turing Test for machine intelligence

1951 : Elected Fellow of the Royal Society. Non-linear theory  
of biological growth

1952 : Arrested as a homosexual; loses security clearance

1953-54 : Unfinished work in biology and physics

1954 (7 June) : Death (suicide) by cyanide poisoning, Wilmslow, Cheshire

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**Colette Stuebe Bangert**

born 1934, Columbus, Ohio

**Charles Jeffries Bangert**

born 1938, Fargo, North Dakota

**Large Landscape: Ochre and Black,**

1970

algorithmic drawing, colored inks  
on computer-plotter paper  
Gift of Colette Stuebe Bangert and  
Charles Jeffries Bangert, 1999.0232

Colette and Jeff Bangert were pioneers in the early days of computer-generated graphic art. This work, a unique algorithmic drawing, was produced by one of the Bangert's programs (MELLY) written in the Fortran programming language. The artists recall that the steps involved in making this and similar works included typing code onto IBM 80-column punched cards with a keypunch machine, delivering the cards to the I/O (input/output) desk at the KU Computer Center to have the program read from the cards and converted onto magnetic tape, receiving the tape from the I/O desk, and connecting the tape to a Calcomp plotter that did the actual printing.

Colette recently reflected, *"When I first saw this drawing plotting...I knew I had never seen such a drawing...it influenced much of what I did from then on, and then I began to very slowly see what Jeff and I had drawn then to even now."*

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**Colette Stuebe Bangert**

born 1934, Columbus, Ohio

**Charles Jeffries Bangert**

born 1938, Fargo, North Dakota

**The Plains Series II: MARCH,** 2012

algorithmic drawings,  
inkjet prints on paper  
Loaned by the artists

Colette and Jeff Bangert created an algorithmic work (*MARCH*) especially for this exhibition. The two programs were written in the C# programming language. AC4030 generates the foreground, which involves one-dimensional composition. AC4031 draws the background image, which involves blended colors.

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## Bruce Conner

born 1933, McPherson, Kansas  
died 2008, San Francisco, California

August 2, 1995, 1995

ink on paper

Museum purchase: Peter T. Bohan

Art Acquisition Fund, 2000.0068

Bruce Conner was active in many media and modes; his work spanned surrealism, cinema, assemblage, collage, and conceptual art. Throughout the 1990s he perfected a means of making drawings with multiple, nearly symmetrical inkblots. Conner was no doubt riffing on the work of the 1920s Swiss psychologist, Hermann Rorschach, who developed a psychological test that depended on the subject's interpretation of inkblots. These interpretations or perceptions were then analyzed psychoanalytically or through the use of algorithms.

Inkblots are made by applying ink to paper and then folding the paper while the ink is still wet so as to create a symmetrical (or nearly symmetrical) form by pressing the folded paper together and then opening it back up. Although seemingly random, Conner excelled at carefully controlling this process and he gave his drawings of multiple inkblots a sense of order through their grid-like organization.

You can see the fan-like folds that made this drawing possible by pushing the button to illuminate the work from the side. That these near-symmetrical forms are made possible by folds is provocative in computing science and genomics, where "folding" structures to find meaning and calculate values is a particularly important technique.

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## Stephen Johnson

born 1964, Madison, Wisconsin

The Letter "N", 1995

pastel, watercolor, gouache,  
charcoal, on paper

Museum purchase: Peter T. Bohan

Art Acquisition Fund, 2005.0059

In 1995 Johnson published an ABC book, *Alphabet City*, based on letters hidden in the urban environment. This is the letter N.

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## Xu Bing

born 1955, Chongqing,  
Sichuan province, China  
active China, United States

### Page proof from Book from the Sky (Volume 1, Page 91), 1987–1991

woodcut

Museum purchase: Gift of Arthur Neis,  
2008.0332

First exhibited in China in 1988 and 1989, *Book from the Sky* (evoked here by a page proof) is an undertaking of epic proportions that addresses the relationship between language and authority and expresses the artist's conflicted feelings toward words and books in post-Cultural-Revolution China. Xu Bing designed 4,000 characters, carved them in wooden blocks, and used them to print the four volumes of *Book from the Sky* with painstaking attention to traditional methods of printing and binding. However, the seemingly authentic Chinese characters are inventions of the artist and cannot be read. Although illegible, the work does carry a powerful message, as Xu Bing himself noted, "to change the written word is to strike at the very foundation of a culture."

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## Xu Bing

born 1955, Chongqing,  
Sichuan province, China  
active China, United States

### Landscript postcards (Helsinki- Himalaya Exchange)(4), 1999–2000

offset lithography on Nepalese paper  
Museum purchase: Gift of Arthur Neis  
and the Museum of Art Acquisition Fund,  
2008.0333.01–4

Adding a twist to the pictographic roots of Chinese writing, Xu Bing's landscripts represent landscape elements with appropriate characters—the character “tree” for a tree (or many of them for a forest), a pile of the character “mountain” for a mountain, etc. The landscripts also incorporate sentences describing the changing elements in the landscape. Thus the “landscape” can be read both pictorially and verbally. This series of postcards reproduces landscript drawings in Xu Bing's sketchbooks made during a trip to the Himalayan mountains outside of Katmandu. The postcards were sold as part of the artist's effort to raise funds for the poor he encountered in Nepal.

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## David Byrne

born 1952, Dumbarton,  
Scotland, United Kingdom  
active United States

### Winnebago Trainspotters in the Universe, 2002

pencil on paper  
Museum purchase: Lucy Shaw Schultz Fund,  
2009.0016

David Byrne noted in 2005 that his wonderfully playful explorations of diagrams started “a few years ago as instructions to myself in a little notebook—‘draw an evolutionary tree on pleasure,’ or ‘draw a Venn diagram about relationships...’” The full body of nearly 100 drawings was published as a book in 2006 under the title *Arboretum*. In each of these drawings, Byrne explores unanticipated connections between things and/or ideas.

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## David Byrne

born 1952, Dumbarton,  
Scotland, United Kingdom  
active United States

### *The Evolution of Category*, 2003

pencil on paper

Museum purchase: Lucy Shaw Schultz Fund,  
2009.0017

The artist explains:

In the Borges story "The Analytical Language of John Wilkins" he describes a Chinese system of categorization that breaks down the world into Things The Emperor Owns and Everything Else. Claude Lévi-Strauss claimed that one of the most basic categories we humans have is "Can I eat it?" and then, "Do I like to eat it?" The way we categorize and perceive the world is sometimes based on what seem like arbitrary criteria.

For example, there could be intersecting layers of categories: brown things, brown things that are alive, brown things that will hurt me, brown things that make nice pants material. One imagines a kind of plaid semi-translucent three-dimensional Venn diagram representing these categories and their intersections. The number of categories in the world is, therefore, larger than the number of things in the world.

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## Butt Johnson

born 1979, Suffern, New York

### *Study for Untitled (Eh Feck)*, 2009

lithograph

Anonymous gift, 2010.0019

Russian scientist Alexey Pajitnov used a rack-mounted 64 kb Elektronika 60 computer to develop the electronic tile game Tetris® in Moscow in 1984. For a person well-versed in the game this is not a random pattern but a pattern created by the seven shapes known as Tetriminos (shapes formed by four, connected squares). The player lost the game when the Tetriminos were falling too fast for the player to keep up and move them into a proper, densely packed, winning position.

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## Paul Noble

born 1963, Dilston, Northumberland,  
England, United Kingdom

A, 2002

Paul's Place, 2002

etchings

Museum purchase: R. Charles and  
Mary Margaret Clevenger Art  
Acquisition Fund, 2009.0173-74

For much of his career Paul Noble has been at work on an expansive and detailed visualization of his fantastic and personal city, Nobson Newtown, which the artist described as “town planning as self-portraiture.” In some passages of the enormous drawings that form part of this effort, the individual structures take the form of letters allowing words to be teased out of clusters of buildings. The artist described this wordplay as “the painstaking design of a special font based on the forms of classic modernist architecture.”

The two prints exhibited here form a contiguous landscape that features the letter “A” and “Paul’s Place,” the artist’s private domain with an outdoor sculpture studio and a spindly jungle gym that may be inhabited by an encrypted message.

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## Glen Baldrige

born 1977, Nashville, Tennessee

Double D's, 2009

lithograph, screenprint, woodcut,  
gold leaf on paper

Museum purchase: Museum of Art  
Acquisition Fund, 2010.0015.a,b

Baldrige’s *Double D's* demonstrates that the same letters can have radically different meanings especially when tied to other visual clues, such as color, font, and additional characters (“&,” in this case) and the viewer’s awareness of visual culture. One person’s Dunkin’ Donuts is another’s game of Dungeons & Dragons.

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## Rohini Devasher

born 1978, New Delhi, India  
active India

### Bloodlines, 2009

single-channel video, inkjet print,  
projection panel mounted on aluminum,  
two DVDs, Sony Beta archival tape  
Museum purchase: Helen Foresman Spencer  
Art Acquisition Fund, 2010.0066

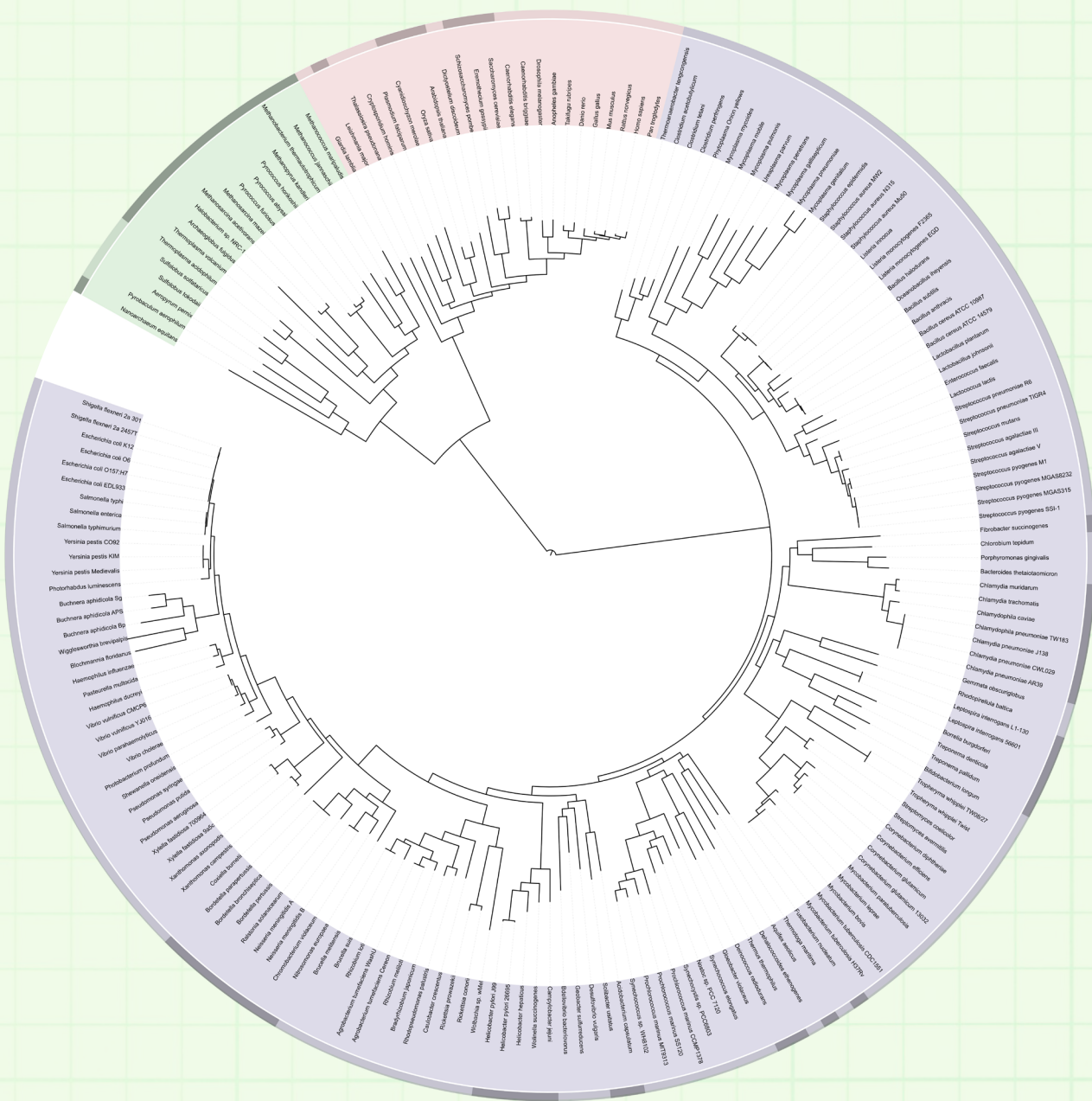
*In the scientific realm, as the rate  
of genetic modification accelerates,  
the boundary of form and function  
blurs and these chimera become more  
of a possibility of what could be.*

—Rohini Devasher

Using mirrors and video feedback, Devasher created seven “mother” creatures (seen in the center of the composition) that were in turn used to spawn related families of biomorphic creatures. This large digital print charts these relationships. In the accompanying video, each creature is projected with a radioactive glow on a black field. Devasher has been consumed with fashioning a universe of biomorphic entities in her prints and large-scale drawings. She calls the work “a warehouse full of impossible monsters,” an idea derived from evolutionary biologist Richard Dawkins (*The Blind Watchmaker*). In this work, Devasher dares to imagine a world of possibilities that may or may not exist, providing a genetic sequence through her artistic practice.

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The light radiating lines seen in the background of Devasher's print describe a circular rendition of the "three-domain system" that organizes the evolutionary tree of life into three kingdoms on the basis of genetic similarities and the sophistication of cellular structure. The rendering of the three-domain system seen below is taken from the Interactive Tree of Life website: <http://itol.embl.de/>



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## Charles Maurin

born 1856, Le Puy, France  
died 1914, Grasse, France

### Le Géomètre, circa 1900

etching

Museum purchase: Letha Churchill Walker  
Memorial Art Fund, 2011.0057

This print is probably a portrait of François-Rupert Carabin (1862–1932), a friend of the artist who was best known as an art nouveau furniture designer. The complex form in the foreground is the carved back of the sitter's chair.

The geometric diagram that the sitter (Carabin) contemplates is probably an inexpertly drawn "golden triangle" or "sublime triangle," an isosceles triangle in which the ratio of the hypotenuse to the base is equal to the "golden ratio," for which please see the adjacent pair of works by Dan Massad.

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## Saul Chernick

born 1975, New York, New York

*Book of Windows*, 2011

*Panagea*, 2011

relief prints, screen prints

Museum purchase: Elmer F. Pierson Fund,  
2011.0073–74

In these works, Saul Chernick considers the impermanence and mutability of meanings that are invested in icons and symbols. He incorporates imagery drawn from woodcuts created in 15th- and 16th-century Northern Europe, along with aspects of the visual languages of computing. In Chernick's own words, these images seek to "merge the conventional idea of an icon as a representation of the sacred, with the modern-day, technological conception as an image that represents a specific file, directory, window, option, or program." Through his juxtaposition of these two forms of visual communication, the artist reveals each as a cryptic system whose significance is determined, in part, by the experiences of its viewers and its participation in a broader web of meanings.

Chernick suggests that the iconography of computing as we know it, with its windows, toolbars, and drop-down menus, will someday fall into obscurity, just as the symbolic implications of Renaissance imagery have become confused with time. However, by juxtaposing these visual means of transmitting information, the artist also foregrounds formal and conceptual continuities that seem to bridge temporal boundaries that separate past from present. Thus, *Book of Windows* and *Pangea* demonstrate the compelling allure and weight of symbols, even in the absence of their original contexts.

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Wilhelm (Willi) Geißler

born 1895, Hamm, Germany

died 1977, Wuppertal, Germany

Der Musiker (The Musician)

Der Arbeiter (The Worker)

Der Dichter (The Poet)

from *Der künstliche Mensch / Zehn Blätter  
der Anklage* (The Artificial Man / Ten

pages for the prosecution), circa 1925

from *Kunst der Jugend* (Art of Youth) no. 7

woodcut

Museum purchase: Elmer F. Pierson Fund,

2011.0075.06, 08, 11

Alan Turing would have been eight years old when the word “robot” first appeared shortly after World War I, in Karel Capek’s play of 1920, *R.U.R. (Rossum’s Universal Robots)*. Only a few years later Geißler produced a remarkable series of woodcuts showing mechanical people busy at their professions: soldier, mathematician, musician, dancer, bureaucrat, king, poet, schoolmaster, gymnast, and worker. The War brought horrendous damage by new machines of war, and left many people dependent upon mechanical prosthetic devices. In its aftermath, Geißler—who had served as a soldier from 1916–1918—created this series satirizing a world populated with electro-mechanical humanoids. The musician, for example, sits at the piano playing “The Soul of Music,” and the author of the short preface to the portfolio, Dr. Oswald Schmitt, wrote that the mechanical man is the “trench-cross” [burial ground] of Europe. Turing, however, was instrumental in moving us rapidly from a mechanical to an electronic age; from his theoretical “Turing machine” to the real world of computing and all its progeny.

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## Hausa-Fulbe peoples

Fulbe, Sahelian

### woven food cover, 1982

plant fiber, coiling, dyeing

Gift of Professor Beverly Mack, 2011.0199

The food covers made by the Hausa-Fulbe peoples of northern Nigeria incorporate woven “signature” patterns that identify the village in which the food cover was made. While the Hausa-Fulbe peoples can identify where a food cover was made on the basis of its pattern there appears to be no published resource with this information.

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## Nolan Lem

born 1986, Kansas City, Missouri

### metaWebern no. 2, 2011

graphic rendering, inkjet printing,  
digitally adapted music

Loan from the artist

The artist explains:

*metaWebern* is a series of audio-visual compositions that utilize a computer program that performs different-processed based operations onto written scores and their complementary sound recordings. This selection uses the music and scores of the Viennese composer, Anton Webern (1883–1945)

These graphic renderings depict a non-linear process whereby the pixel width of each page in the score is arranged side-by-side along with the other pages in the score. Upon each iteration, the width of each score “snippet” is widened at a rate that doubles each time ( $2^n$ ).

The subtle variations of the individual scores’ parameters—alignment, margins, notehead, articulation markings, fonts—unwind to reveal iterative textures. Ultimately these renderings depict the repetitive deconstructions of the scores’ notational elements, forming a visual representation of the notations as they emerge from the score.

To hear the composition, use your cell phone to dial 785-338-9467 and enter 86#

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Alex Dodge

born 1977, Denver, Colorado

*Everything Appears as it is:*

*Infinite*, 2002-2007

Six-color thermographic UV screen print  
on two-ply museum board  
Museum purchase: Letha Churchill Walker  
Memorial Art Fund, 2012.0008

The title for this work is taken from a passage in William Blake's *The Marriage of Heaven and Hell*, "If the doors of perception were cleansed every thing would appear to man as it is, infinite." For Dodge, the swimming pool encapsulates a similar dichotomy by invoking the systematic, gridded geometry of the tiled pool, as well as a chaotic system of turbulent waveforms that suggests a human or, in his terms, an organic presence. In the artist's own words, "these images [of swimming pools] engaged an ordered logic represented by architectural form and digital space being uprooted by the chaos of complex and organic systems."

*Everything Appears as it is: Infinite* was modeled in 3ds Max, a 3D computer graphics program. The pool and the waveforms were created separately, and Dodge photographed puddled ink to create the liquid border-contours of the layers.

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## Alex Dodge

born 1977, Denver, Colorado, United States

### *The Legendary Coelecanth*, 2007

computer numerical controlled dry point  
engraving on hand antiqued paper with  
coelacanth computer virus executable  
file on EPROM memory chip

Museum purchase: Letha Churchill Walker  
Memorial Art Fund, 2012.0009

In *The Legendary Coelecanth*, Dodge provides us with a provocative juxtaposition of biological and technological evolution; of genetic code and computer code. The woman in a fetal position, in the same briny world as the coelacanth, puts humanity in direct contact with both biological and electronic realms. Asked about this, the artist expanded:

The extended systems of communication that are nested in the work are genetic across multiple species, to more higher-level human systems of language and printing, and eventually non-human systems, but each intertwined with each other.

The memory chip is an AMD Am27C020 chip with ultraviolet 2 Mbit erasable, programmable, read-only memory (EPROM). The artist explains:

I don't usually have the opportunity to explain the memory chip in detail. I chose this version of memory chip for a few reasons. On one hand the clear window allows the viewer to see the actual etched silicone semiconductor inside. This I thought was a wonderful way of revealing the extension from the seemingly antiquated and traditional printmaking process of engraving that the image on paper is made with... because the process of making integrated circuits is really just another form of printmaking itself. All modern chips are simply made with photo lithography ...very very small photo lithography, but in principle the same photo and acid resist techniques used to print all information since Guttenberg. The other reason I wanted to use this chip is that it is ultraviolet light erasable: that is, you can clear the chip's memory by exposing it to extreme ultraviolet light. I thought that it was a wonderful sort of symmetry that even the virus contained on the chip could be vulnerable like all other life.

The virus itself is a real but harmless computer virus, a modified form of NRLG or NuKE's Random Life Generator. The modified version that I made and dubbed the "coelacanth virus" doesn't have a destructive payload...and wouldn't even be able to run on/infect most of the computers on the net today.

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Coelacanth at the KU  
Natural History Museum

*Latimeria chalumnae*,

972mm total length. Weight 13.5kg.  
Captured on island of Grand Comore  
in the Comore Islands in 1986 by  
a local fisherman.

KU 22082

(may be seen by request—contact  
Ichthyology Collection Manager)

Coelacanths are known from the fossil  
record from as far back as 65 million  
years ago. All were thought to be extinct  
until December 1938, when Marjorie  
Courtenay-Latimer, curator at the museum  
in East London, South Africa, found a



strange fish in a pile brought in by a  
trawler to the harbor. There are now five  
known populations of coelacanth (Sodwana  
Bay, South Africa; Madagascar; Kenya; the  
Comore Islands; and Sulawesi, Indonesia)  
and two distinct species. Little is known  
of coelacanth biology or ecology. They  
are known to live between 150–200 meters  
down and migrate closer to the surface  
at night to feed. They are slow growing  
and give birth to live young from eggs  
larger than a softball. They selectively  
live in volcanic cave-type environments,  
hence their patchy distribution. The  
largest population is thought to be in  
the Comores, a small island group off  
the western coast of Africa, and number  
approximately 500 individuals which can be  
identified by the white spotted pattern on  
their bodies, much like whales tails are  
used to identify individual whales.

Coelacanths are classified as severely  
endangered and threatened species due  
to extremely small population sizes, slow  
growth and reproduction and relatively  
high incidental bycatch by local fishermen  
(10–15 per year). Every coelacanth in a  
museum has a Coelacanth Conservation Council  
(CCC) number. This one is number 140.

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## Brion Gysin

born 1916, Taplow, England, United Kingdom  
died 1986, Paris, France

### untitled strip painting

(I Am That I Am), 1961

watercolor, acrylic on paper  
Loaned by the Estate of  
William S. Burroughs, L1990.001

Brion Gysin, an experimental artist, poet and inventor of the “cut up” technique made famous by his collaborator William S. Burroughs (1914–1997), was quick to investigate the ways computing might serve the arts. Gysin had been captivated by the Old Testament phrase “I am that I am” (God’s answer to Moses’ question about God’s name-Exodus 3:14). Noticing that the phrase lacked symmetry, Gysin observed “all I had to do was to switch the last two words and it asked a question: ‘I Am That, Am I?’” In 1960, Cambridge-educated mathematician and technician Ian Somerville collaborated with Gysin by producing a computer algorithm that created and randomized all of the permutations of the five-word passage.

Parts of the poem appear in the strip painting exhibited here, and the entire permutation poem can also be seen nearby.

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## Brion Gysin

born 1916, Taplow, England, United Kingdom;  
died 1986, Paris, France

I am that I am, 1959

permutation poem  
transcribed from *Back in  
No Time: The Brion Gysin Reader*,  
ed. Jason Weiss (Middletown:  
Wesleyan University Press, 2001).

See also Brion Gysin’s horizontal painting on the same theme exhibited nearby.

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## Brion Gysin

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Daniel Massad

born 1946, Oklahoma City, Oklahoma

Pears, 1991

pastel on paper

Private Collection

preliminary drawing

for Pears, 1991

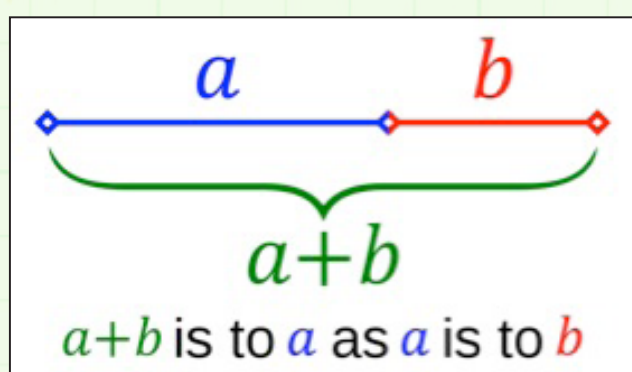
pastel on paper

Private Collection

In the preliminary drawing for *Pears*, Massad shows his calculation of the golden ratio, in order to construct a golden rectangle that he then uses to lay out his composition. The golden ratio, which has many applications in many fields of endeavor, is defined as:

the division of a line so that the whole is to the greater part as that part is to the smaller part (i.e., in a ratio of 1 to  $1/2(\sqrt{5} + 1)$ ), a proportion that is considered to be particularly pleasing to the eye.

Or, expressed graphically:



This ratio (approximately, 1.6180339887498948482) appears in art, architecture, and book design; in fractal geometry and crystal formation; it is also closely related to the Fibonacci sequence that, in turn, can be observed in many naturally occurring forms.

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Jan Wierix

1549–after 1615

*Melencolia I (after  
Albrecht Dürer)*, 1602

engraving

Museum purchase: Mark and Bette Morris  
Family Foundation, 1999.0087

Attempts to interpret this composition, conceived by the German renaissance artist and humanist, Albrecht Dürer (and seen here in an excellent copy of the print by Jan Wierix) have generated vast amounts of scholarly discussion. In the mid-20th century, German art historian Erwin Panofsky called it “in a sense a spiritual self-portrait” of Dürer. Indeed, the interests and practices of the original engraver invite such a reading. As both an artist and mathematician, Dürer produced work that was informed by his belief that beauty was dependent on a system of measurement. He wrote that “the measurements of the earth, the waters, and the stars have come to be understood through painting.” The ancient concept of ideal proportions relates to the modern field of mathematical biology, where mathematical tools aid the understanding of non-linear biological mechanisms. Just before engraving *Melencolia I*, however, Dürer conceded that no mathematical system could sufficiently define beauty. Panofsky states that, like the personification of Geometry with her tools of measurement, Dürer reached a melancholic state because he suffered from the limits of the human mind. He yearned for a mathematical theory that would overcome the shortcomings of his own intellect. Despite numerous attempts at identifying the key to unlocking its meaning, the work remains enigmatic.

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## Oswald Mathias Ungers

born 1926, Kaisersesch, Germany  
died 2007, Cologne, Germany

### Morphologie:

#### City Metaphors, 1982

offset lithograph

Museum purchase: Elmer F. Pierson Fund,  
2012.0005

In this small volume, architect, artist, and theorist Oswald Mathias Ungers engages with morphology, the biological study of the internal and external forms of life, which focuses particularly on structures and patterns. Rather than limiting his scope to the natural world, Ungers playfully explores the morphology of his entire visual universe, incorporating prints, drawings, photographs, and diagrams from a range of sources and time periods. He narrates this exploration through single words, iterated in English and German, alluding to the morphologies of language as well as form. Ungers creates a dialogue between the micro and the macro through the juxtaposition of maps, city plans, and architectural diagrams with representations of human figures, plants, animals, and even cell structures.

In the introduction to his artistic inquiry Ungers states: "This book shows the most transcendental aspect, the underlying perception that goes beyond actual design. In other terms, it shows the common design principle which is similar in dissimilar conditions. There are three levels of reality: the factual reality-the object; the perceptual reality-the analogy; and conceptual reality-the the idea, shown as the plan-the image-the word."

## Karen Hanmer

born 1961, active Chicago, Illinois

### BEAUT.E(CODE), 2002

ink, punching, rubber band

Museum purchase: Elmer F. Pierson Fund,  
2012.0004

*BEAUT.E(CODE)* is a book made up of 36 keypunched computer cards. Created by book artist Karen Hanmer in collaboration with computer professionals, each page bares a personal statement about what these individuals find beautiful, compelling, or imaginative about the act of programming. The cards themselves represent an analog method of storing and transmitting computer code that, while obsolete, was the primary support for data from the advent of the jacquard loom in the 19th century through the 1980s. Standard cards such as these were designed at the IBM Corporation in 1928, and contain 80 columns, each with 10 numerical positions. The contributing writers of *BEAUT.E(CODE)* limited their statements to less than 80 characters (the maximum content of any single punched card), demonstrating an elegant concision that echoes their individual statements about the refinement and grace of well-written code.



KU's Nichols Hall, home of the Information and Telecommunication Technology Center (ITTC), was designed to resemble a keypunch computer card.

## Michael Winkler

born 1952, Lima, Ohio

### Ligns, 2006

offset lithograph

Museum purchase: Elmer F. Pierson Fund,  
2012.0006

*"Language is curled and bent to replicate an intuitive process"*

In this statement, pulled from the idiogrammatic text of *Ligns*, the author/artist reveals how his work conflates word and image by creating linear ciphers that correspond to words by connecting letters arranged in circular diagrams. The artist calls these signs "spelled forms," a term that seems to link the process of spelling to the fabrication of forms through drawing or sculpture. While Winkler uses these ciphers throughout many of his artworks, *Ligns* functions as a kind of manifesto, articulating the artist's thoughts about the intersections of visual and written communication and their confluence in codes and symbols.

## Andrew McLaren

active Calgary, Alberta

### Annual Report, 2006

inkjet printing, lamination, matches,  
two pence coin

Museum purchase: Elmer F. Pierson Fund,  
2012.0007

McLaren has worked for many years on an "object-based calendar system" utilizing hand-made dice (six-sided for the standard year, eight-sided for leap years). Finding physical installations of his "time machines" to be difficult to maintain, McLaren chose the book format to explore his ideas about time calculation.

## Hiroshi Kawano

born 1925 in Fushun, China, active Japan

### Simulated Color Mosaic, 1973,

Showa period (1926–1989)

from *SDL Portfolio*

computer-aided screen print

Gift of Norton and Irene Starr, 1999.0131.07

Philosopher Hiroshi Kawano, who has just enjoyed a major retrospective at ZKM (Center for Art and Culture, Karlsruhe, Germany), has been involved with computers as art makers (he does not like the term “computer artist”) since 1964. He participated in two early portfolios of computer-generated art, *Art Ex Machina* of 1972 (seen here) and the *SDL Portfolio* of 1973 (seen here) and *Art Ex Machina* of 1972 (in the adjacent case) Both portfolios were published by Gilles Gheerbrant in Montréal, and both include an artist’s statement to accompany each print. The *SDL Portfolio* also includes biographies and a description and/or a schematic diagram describing the program used by each artist. By necessity these early computer graphics were output to paper, presumably with analog plotters, and then reproduced as screen prints. The other participants in the *SDL Portfolio* are: Manuel Barbadillo, Ken Knowlton, Manfred Mohr, Georg Nees, John Roy, Zdeněk Skora, Roger Vilder, and Edward Zajek.

## Hiroshi Kawano

born 1925 in Fushun, China, active Japan

### untitled, 1972, Showa period (1926–1989)

from *Art Ex Machina*

computer-aided screen print

Gift of Norton and Irene Starr, 1999.0132.11

Philosopher Hiroshi Kawano, who has just enjoyed a major retrospective at ZKM (Center for Art and Culture, Karlsruhe, Germany) has been involved with computers as art makers (he does not like the term “computer artist”) since 1964. He participated in two early portfolios of computer-generated art, *Art Ex Machina* of 1972 (seen here) and the *SDL Portfolio* of 1973 (seen in the adjacent case). Both portfolios were published by Gilles Gheerbrant in Montréal, and both include an artist’s statement to accompany each print. The *SDL Portfolio* also includes biographies and a description and/or a schematic diagram describing the program used by each artist. By necessity these early computer graphics were output to paper, presumably with analog plotters, and then reproduced as screen prints. The other participants in the *Art Ex Machina* portfolio are: Manuel Barbadillo, Ken Knowlton, Manfred Mohr, Frieder Nake, and Georg Nees.

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## Hannah Weiner

born 1928, Providence, Rhode Island  
died 1997, New York, New York

### Signal Flag Poems, 1968

from *SMS Portfolio*

offset lithograph

Museum purchase: Letha Churchill Walker  
Memorial Art Fund and Gift of Mr. and Mrs.  
William Shearburn, 1994.0027.25

As the artist states in her concise introduction, these poems are both drawn from and transformed into the signals set forth in *The International Code of Signals for the Use of All Nations*. Conceived in 1855, this code facilitated communication between ships at sea. These three-letter alphabetic ciphers could be created visually by flags and later combinations of lights, or sonically by Morse code. This system not only allowed sailors to communicate across wide swathes of ocean, but also functioned as a kind of common language that could be understood regardless of linguistic or national affiliation. Therefore, like mathematics and art, this code transcends verbal barriers. Furthermore, Weiner's use of *The International Code of Signals* allowed the poet/artist to navigate fluidly between visual, written, and spoken expression.

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