

FROM MIND TO MACHINE: COMPUTER DRAWING IN ART HISTORY

The computer like any tool or machine, extends human capabilities. But it is unique in that it extends the power of the mind as well as the hand.

Robert Mallary ¹

This exhibition presents three major pioneers of computer art - Waldemar Cordeiro, Robert Mallary and Vera Molnár, from three different corners of the globe - South America, the United States and Europe. Although each has an original style and distinctive approach, with these works can be seen a similar modernist aesthetic and common interest in exploiting the unique capabilities inherent in the computer. It is evident that complex and visually arresting imagery can arise from relatively simple sets of instructions.

Before the onset of personal computers, propriety software and the Internet, artists had to learn to programme, work with scientists and technicians and often construct or adapt hardware in order to create their work. It required a leap of faith to use a system and equipment not originally designed for artistic purposes. Artists have always been early adopters of new technology, but the complexity and rarity of computers meant that any art form based around them was bound to be a particularly specialised branch of modernism. This was not least because of the expensive, large-scale nature of much early equipment and the resulting technical expertise required to operate it. Today, we daily carry around with us technology with thousands of times more processing power than the machines of fifty years ago. It is hard to imagine what a challenging task it must have been for artists working with computers at a time when the technology itself was at a formative stage - it involved long hours, dedication and a particular type of mind-set.

Computer art is an historical term to describe work made with or through the agency of a digital computer predominately as a tool but also as a material, method or concept from around the early-1960s onward, when such technology began to become available to artists. The writing of an algorithm, a step-by-step procedure fed into the computer on punched cards or paper tape would produce lines (visible on an oscilloscope or CRT screen if one was available), which could be output to a plotter. Plotters conveyed the image direct to paper via a moving pen, felt-tip or pencil. Due to their very nature, plotter drawings from this pioneering period are fairly rare today. Therefore it is especially good to see works from these three gathered together at the Mayor Gallery.

Constructing rules or sets of pre-determined instructions to produce art, has precedents within art history. Influenced by aspects of Constructivism, Op Art, Systems Art and Conceptualism and Concrete art, methodologies were discovered that laid a foundation for computer arts to develop and provided an inspiration to artists working in a programmatic way. Further, this approach had relevance to the times - Cordeiro wrote that Concrete art and Constructivism were movements that "helped create a 'machine language' appropriate to the communications systems of the urban and industrial society."²

These artists were thinking about a systematic way of working before they had access to computers. Molnár's speaks of a "machine imaginaire," her name for her method of conceptualising a system to dictate the drawing, without having access to digital technology.

Paul Klee's process driven approach to drawing - "an active line on a walk..."³ was also an inspiration to pioneers who found a parallel with the crafting of code to draw lines on a screen.

Partly a response to the overt subjectivity of Abstract Expressionism, in the 1960s Sol LeWitt's work was about generating forms through rules that someone else carried out: "The idea becomes a machine that makes the art".⁴ Although LeWitt's machine was metaphorical rather than literal, nevertheless this radical concept raised questions about art process and creative behaviour.

The coming together of Cordeiro, Mallary and Molnár at the Mayor Gallery is particularly apt in this year of the 50th anniversary celebrations of *Cybernetic Serendipity*. This now legendary exhibition of 1968 at London's Institute of Contemporary Arts featured work by Mallary.

Cybernetic Serendipity was the first comprehensive international exhibition in Britain devoted to exploring the relationship between new computing technology and the arts. Ambitious in scope and scale the exhibition involved over 300 people - artists, designers and practitioners from around the world and encompassed corporations, such as Boeing and General Motors, and research institutes, including Bell Telephone Labs and the National Physical Laboratory. The breaking down of barriers between the disciplines of art and science was an important factor. The latest computer models from IBM were shown alongside sculptures, robots, plotter drawings, animated films, poetry and computer-generated music. Not everything was technological - Bridget

Riley's painted abstraction was exhibited alongside computer-generated work, to draw attention to their similar geometric aesthetic. No differentiation was made between object, process, material or method, nor between the background of makers, whether art school educated or scientist-engineers. As the curator Jasia Reichardt wrote in her introduction to the *Studio International* accompanying publication, the exhibition showed "...artists' involvement with science, and the scientists' involvement with the arts..[and] the links between the random systems employed by artists, composers and poets, and those involved with the making and the use of cybernetic devices."⁵

Cybernetics, the study of how machine, social, and biological systems behave had by this time penetrated almost every aspect of technical culture. Of enormous influence was Norbert Wiener's 1948 book *Cybernetics, or Control and Communication in the Animal and the Machine*. According to Wiener, at a basic level, cybernetics refers to "the set of problems centred about communication, control and statistical mechanics, whether in the machine or in living tissue".⁶ Wiener's concept was that the behaviour of all organisms, machines and other physical systems is controlled by their communication structures both within themselves and in relation to their environment.

Serendipity was about discovering the 'happy accident' and Reichardt was inspired by Horace Walpole's retelling of the ancient story of the three princes of Serendip who travel the world, "making discoveries, by accidents and sagacity, of things they were not in quest of..."⁷ Accidents and the role of chance (even fabricated ones - what Duchamp called "canned chance"⁸) have been a key component in modern art, at least since Dadaism. Later, artists became fascinated with the computer's capability for producing random events; random number generators can be introduced into the program to produce unexpected elements within a planned structure.

The optimistic and celebratory nature of the project is indicated by the ICA's press release which promised "A gallery full of tame wonders which look as if they've come straight out of a science museum for the year 2000."⁹ Although its subject matter was avant-garde, presenting a type and style of artwork that was outside the mainstream of British art at this time, *Cybernetic Serendipity* was facilitated and inspired by a post-war spirit of optimism in the positive power of new technologies.



Installation shots of *Cybernetic Serendipity* at the ICA, London
© *Cybernetic Serendipity*, 1968



Why this ground-breaking exhibition found a natural home at the ICA is indicated by the institution's history. Founded in 1946 by prominent individuals among them surrealist Sir Roland Penrose and poet and critic Sir Herbert Read, the ICA was conceived to be an alternative to the conventionality of the Royal Academy. Their first show was held in 1948 and displayed some 83 artists, the roster of which would be the envy of any museum line-up today: Bacon, Brancusi, Freud, Klee, Matisse, Picasso and so on. It was a repast to the conservatism of Post-war culture in Britain more used to seeing old masters in galleries. The ICA also gave Jackson Pollock his first London showing before international fame beckoned (1953).

Throughout the 1950s the ICA became famous for avant-garde exhibitions such as Richard Hamilton's *On Growth & Form* (1951) and an association with proto-pop artists including Eduardo Paolozzi and the Independent Group. This group of radical thinkers - the ICA's younger members, included architects, visual artists, theorists and critics interested in new ways of looking at the world. Inspired by *Scientific American*, Cybernetics, Claude von Shannon's Information Theory, von Neumann's Game Theory and D'Arcy Wentworth Thompson, they considered what implications science, new technology and the mass media might have for art and society. The Group's best-remembered show *This is Tomorrow* (1956) held at the Whitechapel Gallery was a model of collaborative, inter-disciplinary art practice. The catalogue contains the first British published reference to the possible use of computers in art as well as marking the beginnings of Pop Art.

Cybernetic Serendipity was the first show from the ICA's new premises in the Mall. It was the German philosopher Max Bense (1910-90) who inspired Reichardt to consider computers. Bense's interest in information theory, semiotics and cybernetics led to the foundation, with engineer-philosopher Abraham Moles, of Information Aesthetics: "Being opposed to emotion-based value judgments, [Bense] considered any artifact as an object open for aesthetic analysis and mathematical evaluation."¹⁰ They saw aesthetic information as part of human communication and computers given the rules for generating aesthetic information, could produce aesthetic objects.¹¹ Bense had a great impact on the nascent field of computer-generated art, exhibiting work first by Georg Nees and then Frieder Nake in Stuttgart in 1965, now recognised as the first ever shows of computer art.¹²

Recalling the exhibition Reichardt has spoken about the power of the 'new': "People wanted to be a part of it; it was so exciting - you walked in and got a shiver down your spine."¹³ Princess Margaret and Lord Snowdon attended and saw Bruce Lacey's robots *ROSA BOSOM* (Radio Operated Simulated Actress - Battery Or Standby Operated Mains) and 'her' companion the interactive *MATE*, which followed *ROSA* around. They also listened to computer-generated music whilst sitting in a large pod.¹⁴ Avant-garde and experimental music by John Cage, Iannis Xenakis and others featured in the show.

Three-dimensional work was an important part of the exhibition and as well as a robot by Nam June Paik, Nicholas Schöffer's interactive cybernetic tower and Jean Tinguely's kinetic sculpture made from recycled

machine parts, visitors saw Robert Mallery's sculpture *Quad I*. Probably the first sculpture modelled with plotter print-outs of drawings created via computer, this first iteration was made in plastic. About this *QUAD* series of sculptures, the artist later wrote that if at first they, "appear to be rather conventional examples of abstract volumetric sculpture [...] rest assured, [the computer] did play a role at the design stage, even though its contribution is not apparent." He goes on to state that what is missing, "is an output medium that matches the computer in its contemporaneity [...]. In fact, I am still looking for that medium..."¹⁵ It is interesting to ponder what Mallery would have made of the 3-D printing processes available today, perhaps a perfect output for his ideas of 50 years ago. The artist's fascination with using code to define geometric shapes - ellipses, arcs, curves is evident also in his *Incremental* series drawings on view in the present exhibition.



Princess Margaret and Lord Snowdon pictured attending *Cybernetic Serendipity* © Keystone Pictures USA

Drawing via computer enables exploration of calculations that would be mentally impossible. It provides the artist with the possibility of producing sequences through iteration, the repetition of sets of instructions that can be adjusted so that each version is slightly different. Thus families of images can be created through the manipulation of parameters in the program. Mallery wrote about using random number subroutines to generate "variety-within-specified-limits"¹⁶ In fact, for these artists using code to draw was really about an exploration of the nature and practice of drawing itself. Thus allowing, as Molnár said in 1980, "the painter to clear his brain of mental/cultural ready-mades and in enabling him to produce combinations of forms never seen before, either in nature, or in museums, to create unimaginable images."¹⁷

Cybernetic Serendipity has become the benchmark computer art show not least for its influence upon subsequent generations. A scaled-down version travelled to the Smithsonian in Washington DC and the Exploratorium in San Francisco. Thus a younger generation of artists was introduced to the positive power of computing for artistic purposes. This generation subsequently laid the foundation for decades of advancement in the arenas of digital image-making, animation, interactivity, intermedia and cross-disciplinary collaboration in the arts which is a feature of much art today, not to mention the digital special effects movie and gaming industries.

The same year as *Cybernetic Serendipity*, Cordeiro began working with the computer in Brazil, experimenting with an IBM 360/44, in collaboration with the physicist Giorgio Moscati. These are considered Brazil's first computer drawings. Cordeiro foresaw great possibilities for computers and communication in Brazil and believed the computer could be an agent for positive social change and even lead to greater democratisation of art. He identified a crisis in contemporary art as a result of "two variables: the inadequacy of traditional art media to transmit information, and the inefficiency of the information they carry in regards to language, thought and action." He called for the creation of interdisciplinary artworks, "taking advantage of scientific research and discoveries" to help counter this.¹⁸

A year after *Cybernetic Serendipity*, the major exhibition *Tendencies 4: computers and visual research* (1969) took place in the Gallery of Contemporary Art, Zagreb with both Cordeiro and Mallery participating. The New Tendencies movement emerged in the early 1960s,

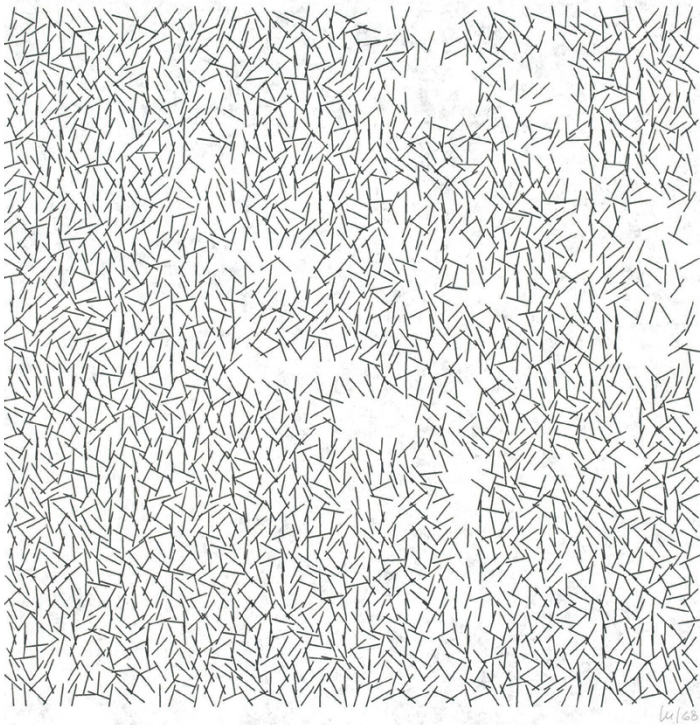
initially dedicated to Concrete and Constructivist art, Op and Kinetic art and included intellectuals and artists from across Europe; members of GRAV (Groupe de Recherche d'Art Visuel) and Umberto Eco were associated with them as were Bense and Moles.

On view was Mallery's drawing, *TRAN 2*, similar to the coloured plotter drawings in the present exhibition. The third variation of his QUAD series - *QUAD III*, 1969, made from laminated plywood was also on view in Zagreb. As in the other versions, the form of this work was dictated by parameters set by the artist's program. Plotter print-outs were then used as templates to cut the plywood, which was layered together and finally polished.



Installation views showing work by Mallery (top on back wall) and Cordeiro (below on left) © *New Tendencies 4*, 1969





Vera Molnar, *Interruptions*, 1969, Plotter drawing, 35 x 33 cm
© Victoria and Albert Museum, London

This early period of computer art has been somewhat neglected by art history. However in recent years there has been interest in rediscovering hitherto overlooked aspects of modernism. Increasingly, exhibitions featuring digital art are being mounted at major institutions around the world. At MOMA New York this year *Thinking Machines: Art and Design in the Computer Age, 1959-1989*, included work by Cordeiro and Molnár. The Whitechapel's *Electronic Superhighway* (2016) featured Molnár among displays of early pioneers. There is a forthcoming major show at Los Angeles County Museum of Art, LACMA. In July this year the Victoria & Albert Museum opens *Chance and Control: Art in the Age of Computers*, to celebrate both their collection and the anniversary of *Cybernetic Serendipity*, featuring Cordeiro and Molnár works from the permanent collection. The V&A acquired its first work in 1969, following *Cybernetic Serendipity* - a folio of the limited edition prints published by Motif to coincide with the ICA exhibition. The significant holdings of the Department of Computer Art at the V&A consist of the archives of the Computer Arts Society and the large collection of works on paper amassed by the American art historian and curator Patric Prince as well as further donations

and recent acquisitions.

The desire for audiences to understand the history of our now pervasive digital world continues to grow. The work of early innovators such as these collected together by the Mayor Gallery deserves to be and is now becoming more widely known. This art remains as visually stimulating and its processes and methods as intriguing today, as it was in the 1960s.

Catherine Mason, April 2018

(ENDNOTES)

- 1 Ruth Leavitt (ed) *Artist and Computer*, NJ: Creative Computing Press/NY: Harmony Books, 1976, p. 5
- 2 Waldemar Cordeiro *Manifest Arteônica*, 1971
- 3 Paul Klee *Pedagogical Sketchbook*, London: Faber & Faber, 1968, p. 16
- 4 Sol Le Witt "Paragraphs on Conceptual Art" in *Artforum* Summer 1967
- 5 Jasia Reichardt *Cybernetic Serendipity: The Computer and the Arts: A Studio International Special Issue* London: Studio International, 1968
- 6 Norbert Wiener *Cybernetics, or Control and Communication in the Animal and the Machine*, Cambridge: MIT Press, 1948
- 7 Horace Walpole letter to Sir Horace Mann 28 January 1754
- 8 Michel Sanouillet and Elmer Peterson (eds) *Salt Seller: the Writings of Marcel Duchamp (Marchand du Sel)* New York: Oxford University Press, 1973, p. 33
- 9 Cybernetic Serendipity exhibition press release, Tate Britain Archive (VA PUB 179)
- 10 With thanks to compArt database of Digital Art: <http://dada.compart-bremen.de/item/agent/209>
- 11 Max Bense *Der Spiegel* Nr. 18/1965 S. 151f with thanks to Christoph Klütsch
http://www.computerkunst.org/Praesentation_London/body.html
- 12 Slightly later that year the Howard Wise Gallery, NY exhibited work by Bela Julesz and Michael Noll, one of the very first showings of computer art in the United States
- 13 Jasia Reichardt conversation with author 6 July 2016
- 14 Reported in the *Daily Mirror* 24 September 1968
- 15 Ruth Leavitt (ed) *Artist and Computer*, NJ: Creative Computing Press/NY: Harmony Books, 1976, p. 7
- 16 *ibid*, p. 6
- 17 Vera Molnár, *Minimal* exhibition at the DAM Gallery, 2017
- 18 Waldemar Cordeiro (ed) *Arteônica* São Paulo: Editora das Americas, 1972, p. 3-4 translated by Eduardo Kac With thanks to Annateresa Fabris *Waldemar Cordeiro: Computer Art Pioneer* Leonardo Volume 30, No. 1 February 1997

BIOGRAPHY – CATHERINE MASON

Catherine Mason has been researching computer art since 2002 and is a board member of the Computer Arts Society. She is the author of *A Computer in the Art Room, the origins of British Computer Arts 1950-1980* (JJG: 2008) and co-editor of *White Heat, Cold Logic* (MIT: 2009). She curated *Bits in Motion*, a screening of pioneering computer animation at the National Film Theatre, 2006.