Process, Chance, and Serendipity: Art that Makes Itself
Paul Brown discovered digital computers as a creative medium after seeing the Cybernetic Serendipity exhibition at the Institute of Contemporary Arts in London in 1968. Early in his career he began developing processed-based methods for generating images and time-based artworks as an alternative to the then common approach to art making as a form of self-expression.

Brown designs computer programs – sets of instructions – and when they execute, the ongoing process exhibits emergent properties, which comprise the artworks. He emphasizes that the art is not embedded in the programs by intention but instead emerges autonomously from the execution of the programs. Together with his son Daniel, who is also an artist, they have described this methodology as “art that makes itself.”

Art Concret, a 1930s movement championing geometric abstract art, and the Systems Art movement were major influences as his practice matured in the 1960s. His work creating lightshows for some of the major musicians and groups of the period including Pink Floyd, Meredith Monk and Musica Elettronica Viva was another important inspiration. He is one of the pioneers of the field of Generative and Computational Art and is also recognized for his early work in Artificial Life “A-Life” Art.

Brown’s work has been exhibited internationally at venues including the Tate and the Victoria & Albert Museum and is also in major public and private collections around the world. He maintains studios in London and Ocean Shores, Australia. Since 2000, he has been an Honorary Visiting Professor and Artist-in-Residence in the department of Informatics at the University of Sussex in England. Paul Brown has produced a number of real-time generative artworks that he calls kinetic paintings.

From Time-Based Art to Kinetic Paintings

In the late 1960s and early 1970s, he made them with light show equipment and analogue video synthesizers that he built with the musician Mike Trim and engineer Les Dean. The first digital work was a commission from the UK’s Confederation of British Industry for the North West Export Award (fig. 1) completed in 1977. The sculpture contained a backlit display of 32 triangular elements in a square configuration. Three adjacent elements lit up to form a ‘worm’ that moved in a hesitant, random, and non-repetitive way around the display under the control of a dedicated digital circuit (figs. 2 & 3) that the artist built with the help of a local electronics company.

Builder/Eater (fig. 4) was made at the Slade School of Art in 1978. An assembler program running on the Slade’s Nova 2 computer (fig. 5) drove a custom frame-store designed by Julian Sullivan. Two concurrent processes, one turning pixels ON and the other turning them OFF, competed for possession of the screen. It was recreated in 2014 for the Digital Archaeology section of the Digital Revolution show at London’s Barbican Centre. In 1979, Brown made a second version using a single-board 8085 microprocessor system driving a custom LED display (fig. 6) – possibly the first artwork to have a dedicated embedded microprocessor. An early part of the program for this work was written in hexadecimal machine code and hand-punched on paper tape.

During the 1990s and 2000s, Brown made a number of kinetic paintings using Apple Macintosh systems programmed in Lingo using Macromedia Director. These works include Infinite Permutations V1, 1992 (fig. 7), Infinite Permutations V2, 1994 (fig. 8) and Sand Lines, 1998 (fig. 9). More recently, he has used the Processing App to create high-definition works like the public artwork Four Dragons, 2012 (fig.10) and Dragon, 2012 which is in this exhibition.

This exhibition was organized by Cultural Programs of the National Academy of Sciences in celebration of the 50th anniversary of the exhibition Cybernetic Serendipity.

#ArtMakesItself | @CPNAS
**Untitled, Computer Assisted Drawing**  
1975/2017  
Giclée print made from the original in the Victoria & Albert Collection: E.961-2008

This early plotter drawing, made with a special printer for vector graphics, is composed of a matrix of 16 x 16 squares populated by three tiles that were placed and rotated using a random process. The program that generated the work was written in FORTRAN (Formula Translation), a programming language developed for scientists and engineers, and ran off of punched cards on an ICL 1903A mainframe computer in batch processing mode. The output was a paper tape that was transferred to an offline Calcomp Drum Plotter which took several hours to create the drawing.

**Untitled Gouache**  
1968/2016  
Original lost, recreated as a giclée print

After reading Anton Ehrenzweig’s *The Hidden Order of Art*, Paul Brown wanted to create a content and context free system or process to make something that looked intriguing. He rotated an octagonal tile and placed it in a 12 x 8 matrix. Brown calculated the rotations by thumbing through Ehrenzweig’s book and using the last digit of the page number where he randomly stopped. During the same year, Brown visited the Cybernetic Serendipity exhibition in London and was profoundly influenced by many of the works on show. He subsequently studied symbolic logic and George Spencer-Brown’s *Laws of Form* and began to investigate how he could employ logical and digital systems in his own work.
BIGDIM / 0 1 0 0 0 0 200, 120 / 11,969
1979/2017
Giclée print made from the original in the Victoria & Albert Collection: E.131-2008

The BIGDIM (Big Dimension) drawings show the behavior of a 3-D cellular automaton where a small number of simple rules determine the growth of a form in space. Made using a matrix of 16 x 16 x 16 cubic cells, this drawing shows nine successive time slices where the form grows and cycles between over- and under-population. The work was programmed in FORTRAN and Assembler on a Data General Nova 2 minicomputer and output directly to a custom built flatbed plotter at the Slade School of Fine Art, University College London. The Slade was one of the art schools that pioneered the development of digital art and where the artist undertook post-graduate research.

Reconfigurable Painting
1977/2015
Original lost, recreated as a giclée print

Several of Paul Brown’s early works could be reconfigured when exhibited and sometimes even rearranged by the visitors themselves – an early form of interaction that predates the computational sense of the term. This work originally consisted of six triangular canvases that were exhibited in various configurations determined by the artist prior to hanging. Each canvas is composed of nine triangles that have one vertex colored differently than the base. The work was one of several that developed the artist’s interest in permutative sets – a concept that has dominated his later practice.
Long Loop
2000
Giclée print

In the 1990s, personal computers became powerful enough to be used for real-time generative artwork production and exhibition. However they were not fast enough to do all of the necessary calculation in real-time. To get around this problem, Paul Brown pre-compiled graphic sprites (2-D bitmaps) that could then be played back, like a multipage flip-book, under the control of the generative program. These sprites are interesting in their own right and Brown subsequently made several serendipitous artworks that use them, in addition to the time-based pieces for which they were originally intended. This print is one, and another is *The Book of Transformations*, also in this show.

---

Dragon
2012
Kinetic painting: HD real-time computational and generative artwork

Paul Brown’s major career output has been the production of a small number of complex, real-time, computational and generative artworks that began with The North West Export Award in 1976/77. In recent years he has described them as “kinetic paintings” in homage to the art, science, and technology pioneer Frank Malina who also used the term to describe his own work (it is believed to have been originated by another great pioneer, Nicolas Schöffer). The early works are recognized as important roots of the scientific discipline of artificial life and are a good example of how art influenced the development of a new scientific discipline (another example would be weaving). Dragon was created for the *Intuition and Ingenuity* exhibition that toured the UK to celebrate the centenary of the birth of the British computer pioneer Alan Turing and pays homage to Turing’s late work on morphogenesis.
Ceiling Detail from The House of Signs
1996
Giclée print

The development of high resolution, high fidelity, archival inkjet printing – so called giclée prints – in the 1990s created an opportunity for working on much higher resolution artworks than the then-limited screen resolutions available. This advancement enabled Brown to experiment with a much wider range of output styles. These prints should be seen as single frames of possible time-based artwork and share many of the same generative production methodologies. This print was the first digital print to win Australia’s most prestigious prize for work on paper – The Freemantle Print Award – in 1996 and earned the artist an unexpected reputation as one of Australia’s leading printmakers. The title is a reference to the artist’s long-standing interest in semiotics and cognitive emergence.

Wrapping Paper
2017
Giclée print

Paul Brown works slowly and experimentally, developing themes over many years and even decades, putting them aside and then revisiting them until they form a consolidated body of work that is often expressed across different media including still images, 3-D, time-based and other serial forms like books. Wrapping Paper is from one of several currently unfinished works in progress and was initially made as an investigation of different color combinations using a single tile in a 2 x 2 matrix.
Swimming Pool
1996
Giclée print

Early in his career, Brown rejected naming his artworks, preferring to draw attention to their concrete forms. It was a popular approach in the modernist 1960s when his professional practice matured. In the 1990s, his attitude changed. He became interested in the way forms and colors that emerged in his artwork affected how spectators interpreted them. Since the 1990s, many of his works have investigated this phenomenon. The interlocking sinusoidal shapes that emerge from this matrix containing variations on three tiles reminded him of the swimming pool paintings by artist David Hockney. Several of his works from this period pay homage to other artist’s work – Leonardo da Vinci and Vincent van Gogh are examples – and consolidate his modernist belief that he is working in the traditions of art and not, as some of the younger generation of post-modern artists believe, doing something completely new and a-historical.

Gymnasts
1997
Giclée print

This 8 x 6 matrix work is populated using a single tile that employs both rotational and reflected symmetry. The flowing black forms that emerge are strongly reminiscent of the movement of gymnasts or dancers wearing leotards and implicitly reference past artists like Degas and Rodin. Brown was influenced by the dancer and choreographer Bill Harpe and they worked closely together when he was artist-in-residence at the Black-e (the Great Georges Community Cultural Centre in Liverpool, England that Harpe founded) in the late 1960s. Harpe encouraged his engagement with the serendipity of emergence using random and chance procedures and also gave him the opportunity to develop his practice using new media formats like video.
The Book of Transformations
2017
Book

The Book of Transformations was originally a portfolio of eight large freestanding prints made in 2000. It is one of the works, like Long Loop, that reuses sprites that were originally pre-compiled for a kinetic painting called Cromos also made in 2000 that is not in this show. The book shows each of the eight prints together with the in-betweening procedure that created them from rotations and reflection of a single asymmetric tile.

The Complete Grammar
2015
Book

The Complete Grammar is one of many manifestations of a work in progress that the artist has engaged with for almost two decades. Other outputs of the process include two kinetic paintings, a series of prints, 3-D sculptures, and even a Rubik’s Cube! The grammar is created by permutating three basic tiles to make 81 instances that are then culled to give the 21 unique symbols. There is an implicit and unmentioned reference to Sol Lewitt’s Incomplete Open Cubes (1974) – a work that has had a major influence on the artist. The work also references the artist’s long-standing interest in the mathematical and logical structure of an ancient Chinese text known as The I Ching or Book of Changes – a book that also inspired Gottfried Wilhelm Leibniz to develop the binary notation that forms the fundamental building block of all digital systems.
Process, Chance, and Serendipity:
Art that Makes Itself
Process, Chance, and Serendipity:
Art that Makes Itself