From Thought-Forms to Art Concret

Tracey M. Benson Interviews Paul Brown

PAUL BROWN AND **TRACEY M. BENSON**

ABSTRACT

In this interview computational and generative artist Paul Brown discusses his early work of the 1960s and 1970s. He also describes his influences along with observations about how this early work directed his later career. The interviewer, artist Tracey M. Benson, practices in the art, science, and technology field and is a longtime friend and mentee. The two share many similar interests that are revealed in their conversation.

This interview is the result of numerous informal discussions spanning nearly three decades, which culminated in two formal transcribed conversations in late 2022. It is an edited composite of an ongoing dialogue between friends, or between a mentor and mentee, as Paul was very encouraging and supportive of Tracey's digital art practice in the mid-1990s when she started to experiment with the World Wide Web and animation as creative mediums. What has kept this conversation engaging and fresh is the vastly different perspectives they bring to the world: Paul with his strong foundation in the Constructivist tradition and Tracey's interest in hybridity. They both challenge what actually constitutes art, and neither sits neatly in the discursive field of fine arts, albeit for very different reasons. Paul's work is rooted in the application of logic and digital systems, artificial intelligence, and generative and emergent processes, while Tracey has delved into the worlds of cosmology, animism, Jungian archetypes, and art as activism.

TMB: Paul, I am curious to learn more about your early days as an artist, in particular about your rejection of self-expression and how that was the foundation for your exploration of systems and procedural art.

PB: At high school my art education was poor and I was unaware of many twentieth-century art theories and movements before going to art school in 1965. What I found was a fairly conservative institution with strict discipline boundaries: painting, sculpture, or printmaking. There were rumors that other genres had been adopted elsewhere but I knew very little about them.

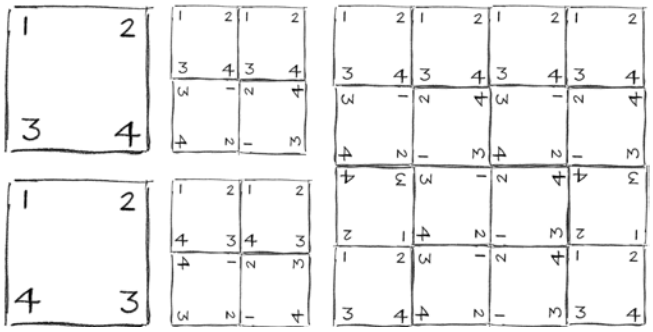

Fig. 1. Paul Brown, *Untitled Drawing*, 1967 (recreated 2015), paper and pencil, dimensions variable. (© Paul Brown)

I wasn't happy for a number of reasons. I wanted to experiment with alternative media like film, photography, projections, installations, and performance, but I was especially unsure of my right to impose my opinions on others—what you might call "self-expression." In my fourth year I produced a drawing and in it I heard my own voice as an artist for the first time (Fig. 1). It's a symbolic diagram which demonstrates a procedure that turns one square arrangement of numbers into another. What was especially important to me was the insight that the identical procedure, when applied to the latter arrangement, would turn it back into the former. So, the process undid itself every second iteration. This fascinated me and later I would discover a similar process—the Exclusive-OR logical function which was used in the early days of computer graphics systems to display a cursor non-destructively over an image. It is also possible to expand the process repeatedly, and instances of the original reappear at different scales and new emergent arrangements are generated. Over a decade later I was introduced to the work of Benoit Mandelbrot [1] and discovered terms like "fractal" and

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"self-similar" and realized that my artwork was a part of an ongoing field of research in the arts and sciences.

Not long after I created the drawing, we had the annual critique where each student had 15 minutes to defend their work in front of their peers and mentors. They were usually pretty rowdy events where everybody wanted to participate and have their say. I spoke enthusiastically about this new drawing and afterwards there was complete silence until the Head of Year spoke up and suggested that I wasn't cut out for a career in the fine arts. So, I dropped out of art school and joined a friend, Jim MacRitchie, in forming a lightshow called *Nova Express* (named after the Burroughs novel [2]).

Working with the lightshow was a revelation, thanks to the tight integration of visuals and sound together with the demands of live performance. I began to understand how to manipulate physical processes like turbulence as well as exploit chance occurrences.

We moved to Liverpool's Black-E—the UK's first community arts center—as artists-in-residence. It was there that we began to work alongside contemporary artists like the choreographer Bill Harpe, who became a major mentor; John "Hoppy" Hopkins and his Fantasy Factory introduced me to video; and groups like Meredith Monk and the House Company and Frederic Rzewski's Musica Electronica Viva. I began to create much more experimental and tightly integrated work than what was possible with the more commercially oriented rock music scene.

TMB: So, what were your next steps towards experimenting with computers and the influence of systems of logic?

PB: In 1968 I visited the exhibition *Cybernetic Serendipity* at London's Institute of Contemporary Art (ICA). The experience convinced me that the algorithmic/electronic/digital domain was something that I needed to engage with. The following year, 1969, Mary Martin won Liverpool's John Moore's Prize with her construction *Cross*. The exhibition was at the Walker Art Gallery, just a short walk from my home and I visited several times. Her artwork reassured me to pursue the direction my own work was taking despite the rejection it had received at college.

I began producing systematic, generative artworks by hand using dice to create unpredictable sequences. Around this time, I showed the work to some friends—the artist Fanchon Fröhlich and her physicist husband Herbert. They encouraged me to learn about computers and to return to university to study programming and digital systems. They also recommended George Spencer Brown's *Laws of Form* [3]. It's full of challenging symbols, so I studied symbolic logic so I could better comprehend his methodology, and as a consequence logic became a foundation for much of my future work. *Laws of Form* is a boundary grammar consisting of a distinction together with a method for crossing that boundary—these are the two basic operators in the language. It was another revelation for me: the ability to engage with logical processes to create visual phenomena and to construct sophisticated and complex images and concepts from extremely simple elements. In 1969, I also discovered John Conway's *Game of Life*. It's an early artificial life (A-Life) system where a simple cellular automaton generates unpredictable and non-repetitive patterns reminiscent of bacteria growing in a Petri dish. Another major influence at that time was Anton Ehrenzweig's *Hidden Order of Art* where he psychoanalyses creative method [4]. Ehrenzweig—a Freudian analyst—proposed a three-stage act of creation. The first is chaotic emergence which is followed by a subconscious, egoless engagement with the work as an act of cognition and comprehension. In the final stage that understanding is reified into consciousness.

Then, around 1972 I took some very pure LSD and my "trip" started by exploring my body: bones, muscles, blood flow, and so on. Then I entered my spinal cord and travelled up into my brain. I was in awe—it was like being in a vast cavern filled with different frequencies. The following morning, I knew with absolute certainty that I had to learn more about computing and Artificial Intelligence (AI) because they were the only things I was aware of that could provide models to enable me to conceptualize and understand that profound experience.

TMB: Speaking of things profound, one of the topics we have discussed over the years is sacred geometry. Tell me how sacred geometry, Celtic, and Islamic art have influenced your work.

PB: I'm not a spiritual person and I don't have any sympathy for organized religion. But I've had an interest in Chan Buddhism (the precursor of Zen) since my mid-teens. Through this I discovered Taoism and the *I Ching or Book of Changes* [5]. The combinatorial structures of the I Ching were another source of inspiration for me and these structures provided content for my undergraduate dissertation. This study resulted in an invitation to join the Research Into Lost Knowledge Organisation (RILKO) where I met other artists interested in a variety of sacred structures and geometries. I was also aware of the influence of theosophy on Kandinsky's work, and in particular, Annie Besant and Charles Leadbeater's illustrations in the book *Thought Forms* [6] and became interested in this relationship between sacred geometry and nonrepresentational art. I was especially interested in how artists use geometry to draw people into different mind frames. For example, many plants obey the Fibonacci series. It's embedded in the way the sunflower seeds are arranged and the way that the leaves emerge from stems. It's also embedded in the divine ratio: Phi or golden rectangle which appears in artworks since time immemorial. I once speculated that this aesthetic ratio is a legacy of our DNA—something we inherit from our plant ancestors—although geneticists have questioned my claims!

Other related major influences from the 1960s include Celtic and Islamic art and the work of Buckminster Fuller and a fellow RILKO member, Keith Critchlow [7]. Later, much later, I coined the term the Geometric Sublime to describe my own work.

TMB: Your early days exploring computing were informed by technology as well as some fascinating theories. Can you tell me more?

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PB: In the late 1960s and early 1970s, the UK government created the Polytechnics by amalgamating independent urban colleges like Engineering, Printing, Art and Design, etc., into single administrative entities. As Catherine Mason [8] has documented, several artists, like myself, discovered we could enroll in the art department and then ask the science faculties to teach us about computers and computing. In 1974, I returned as a mature student to Liverpool Polytechnic (now John Moores University) as a painting undergraduate. I soon discovered that the sculptors, who were into making things, were more sympathetic to computers, so I moved over and somewhat ironically, considering that most of my work is 2D, ended up being awarded a First-Class Honours degree in sculpture! Most of my three years there were spent in the Engineering Department learning how to design and build digital systems and programming their PDP-8 minicomputer, and also in the Maths Department, who hosted the Poly's central computer system, an ICL 1903A mainframe which I learned how to program in FORTRAN using punched cards. Remember, this was a time when most universities only had one central computer!

Since that time almost everything I've done has involved a digital process at some point: a computer or an analog system or a homebrewed circuit. I first used digital systems as productivity enhancers but soon realized that they had a much more substantial role as collaborators and contributors. This was my first experience of developing A-Life and AI processes. One of my best-known works from this period, *Computer Aided Drawing* (1975) (Fig. 2) is in the Patric Prince Collection at the Victoria and Albert Museum and has been widely exhibited and reproduced. It explored my growing interest in using collections of simple elements to create a more complex image that has emergent properties. Another, now sadly lost, is the *North West Export Award* (1977)—a real-time A-life work that

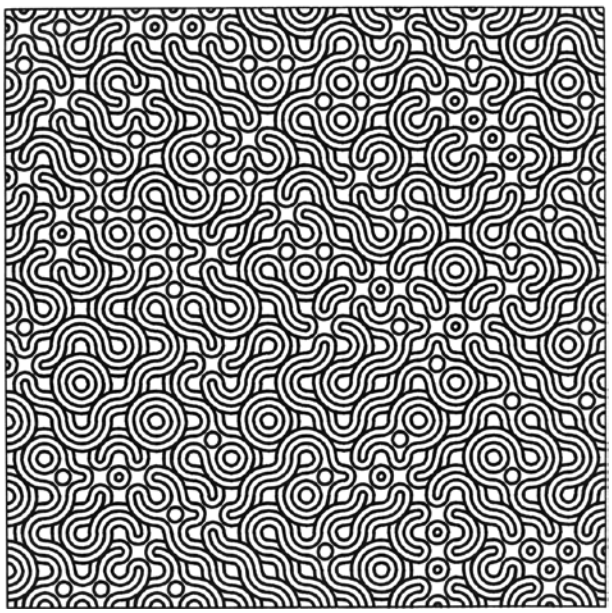

Fig. 2. Paul Brown, *Untitled Computer Aided Drawing*, 1975, plotter drawing, 32 × 32 cm. (© Paul Brown. Courtesy of Patric Prince Collection, Victoria and Albert Museum, accession # E.961-2008)

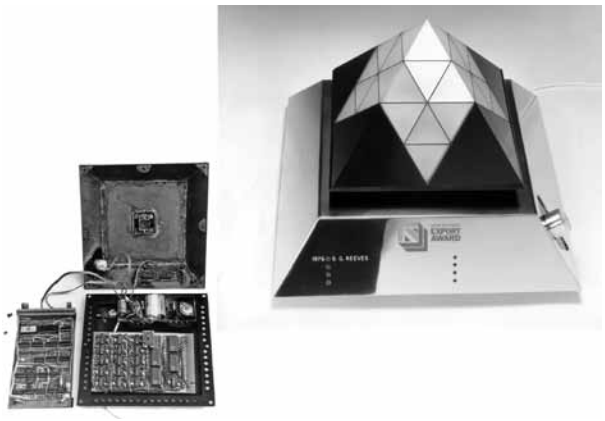

Fig. 3. Paul Brown, *CBI North West Export Award*, 1977, stainless steel, plastic, electronics, 25 × 20 × 25 cm. (© Paul Brown)

used a dedicated digital circuit and may have been one of the first real-time generative artworks (Fig. 3) [9]. The display consists of 32 triangular elements where a three-segment "worm" takes a random walk by making left or right decisions. Thanks to a few pseudo-random generators and out-of-phase clocks, the worm should never display long-term repetitive behavior.

In 1977, I began two years of postgraduate research in the Experimental and Computing Department of the Slade School of Art at University College London (UCL). They had a powerful (for its day) Data General Nova 2 minicomputer and we had access to the University of London supercomputers and UCL mainframe. It was here I first met and befriended pioneers like Harold Cohen, Ed Ihnatowicz, Chris Briscoe, Peter Beyls, and Ernest Edmonds and also began to play a role in the Computer Arts Society (CAS) where I curated several of their exhibitions. Harold's engagement with expert systems and Ed's pioneering work in cognitive interactionism were both major influences.

I was familiar with René Thom's catastrophe theory [10] and a visiting Polish mathematician called Andre Lissowski introduced me to Benoit Mandelbrot's work on fractals [11] and also took me to clandestine meetings in back rooms where renegade researchers from a variety of disciplines discussed their work into nonlinear and unpredictable deterministic systems. It was an area then frowned upon by the academic hierarchy that later emerged and was adopted as Chaos Theory and A-Life. It was a rich intellectual environment and my work and ideas blossomed.

Malcolm Hughes was the head of the Postgraduate School at the Slade and was a member of the UK's Systems Group, and they were regular visitors. From them and CAS I learned more about the pan-European systems movement as well as the USA's conceptual artists like Sol LeWitt and Dan Flavin. Their origins were in Constructivism, De Stijl, and especially Art Concret. Max Bill refined Theo van Doesburg's original 1930 "Manifesto of Art Concret" [12] confirming that it was neither representational nor an abstraction from reality but rather a "thing in itself"—an autonomous, self-referential formal analysis/expression of its own internal being. "It is by means of concrete painting and sculpture that those achieve-

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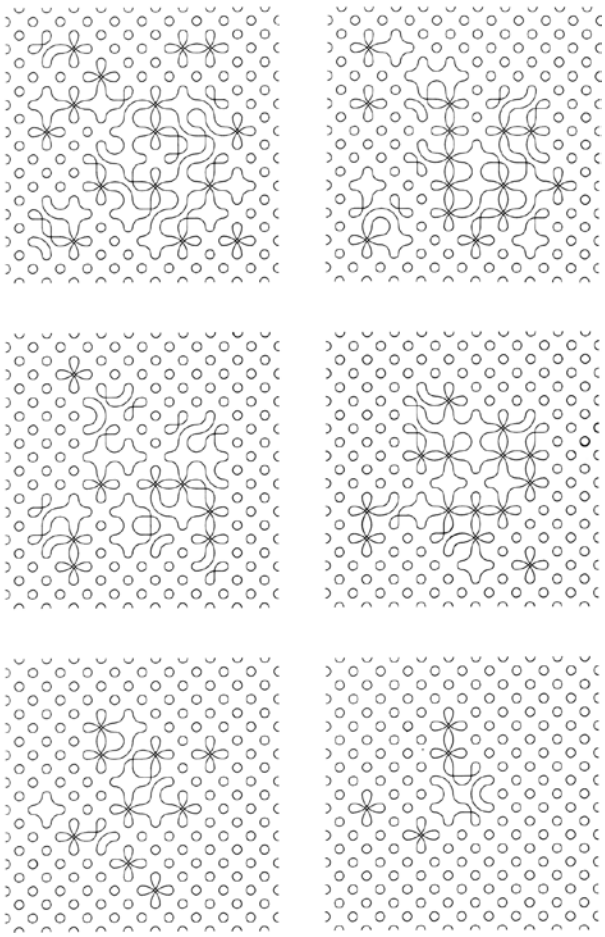

Fig. 4. Paul Brown, *LifeMods*, 1978, six sequential plotter drawings, 20 × 20 cm each. (© Paul Brown)

ments which permit visual perception materialize" [13]. For me, attempting to overcome the myth of self-expression, Bill's words were pure magic!

Another major influence was Charles Biederman's *Art as the Evolution of Visual Knowledge* [14] and his concept of art's role in cognitive evolution. Biederman was, however, committed to the idea that all art was an abstraction from something outside of itself in contrast to the self-referential aesthetic of the Art Concret and Systems movements that attracted me more.

At the Slade I began to integrate cellular automata (CAs) into my work by producing sequences of drawings where each iteration is based on the previous one according to the automaton's rules. This was the beginning of a process that has dominated my practice ever since. One of the first was *LifeMods* (1978) (Fig. 4) and a later, more complex one was the three-dimensional *Big Dim* series (1979) (Fig. 5). In *LifeMods* I used Conway's *Game of Life* rules and integrated two iterations to give a two-bit state value for each cell: 00, 01, 10 and 11. These can be interpreted as 00—no activity (void); 01—coming into existence (birth); 10—ceasing existence (death) and 11—continuing existence (life). Most of the artists at the Slade did not anthropomorphize their work so the terms like 'birth,' 'life,' and 'death' whilst useful for explaining the concepts are not terms we would have employed at that time. These four states map onto a different square tile which is placed in the corresponding cell to create the final graphic image. *LifeMods* shows six successive frames from this sequence.

The *Big Dim* plot shows nine successive frames of a developing three-dimensional cellular automaton. Due to memory limitations the cellular array was a cube of 16 × 16 × 16 single bits that could be occupied—1—or empty—0. The array was constructed from 16 × 16 = 256 16-bit words of memory and assembler routines were created to store, retrieve, and interrogate individual cells. Each cell looked at its neighbors across the six faces of the cubic cell. The automaton was probabilistic and was driven by the parameters following the drawing's name. I no longer remember the purpose of precise values! This particular drawing is one of a series and demonstrates a typical behavior of CAs (and of life itself) where they oscillate between successive states of over- and under-population. My ambition in this work (which I never achieved) was to discover a set of parameters that would enable a long-term consistent but variable spatial volume to emerge. With hindsight I suspect I would have had more success had I employed a trainable neural network as the automaton rule-base.

TMB: I have heard you talk about an early work, *Builder/Eater*, can you tell me more about this project?

PB: One of the early real-time computational and generative pieces I created was *Builder/Eater* (1978) (Fig. 6). It used a frame buffer made by the electrical engineer-turned-artist Julian Sullivan, which enabled a dynamic display that was 96 × 96 pixels by 1-bit deep. In these days of 4- and 8K full-color screens, it's difficult to appreciate how excited we were by such a low-resolution display.

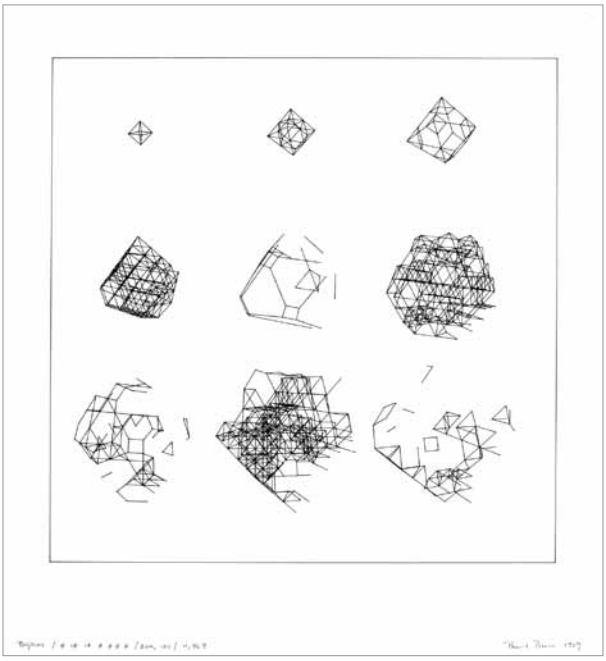

Fig. 5. Paul Brown, *Big Dim / 0 10 10 0 0 0 / 200,120 / 11,969*, 1979, plotter drawing, 65 × 65 cm. (© Paul Brown. Courtesy of Computer Arts Society Collection, Victoria and Albert Museum, accession # E.132-2008.)

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Fig. 6. Paul Brown, *Builder/Eater*, 1978, real-time computational and generative artwork, dimensions variable. Original lost, recreated 2014 using a Raspberry Pi. (© Paul Brown)

Builder/Eater consisted of two identical concurrent processes. Both were pixels taking a random walk—one looking for pixels that were OFF to turn ON and the other seeking ON pixels to turn OFF. They were mutually incompatible and competed endlessly for possession of the screen. It was written in assembler and took about three months to create. The work could only run on the Nova and was exhibited twice.

In 2014, Jim Boulton commissioned me to create a facsimile of *Builder/Eater* for his *Digital Archaeology* section of *Digital Revolution*—a major survey of digital arts and entertainment exhibited at London's Barbican Centre, which then toured internationally until 2019. I bought some vintage nine-inch monitors on eBay and completed the work in just two weeks using the then-new Raspberry Pi, programmed using Processing.

Back in the 1970s, there was no color output so I began to produce color works utilizing a Liquitex acrylic range that

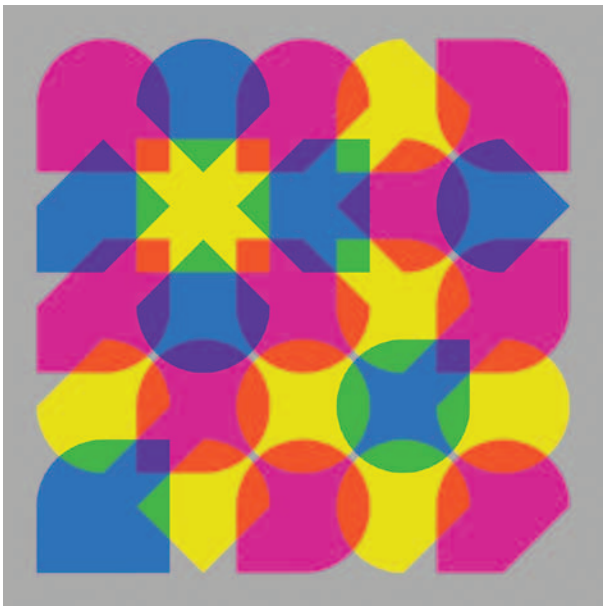

Fig. 7. Paul Brown, *Untitled Computer Assisted Painting*, 1978, acrylic on cotton, 145 × 147 cm. (© Paul Brown. Courtesy of the Collection E. St. John.)

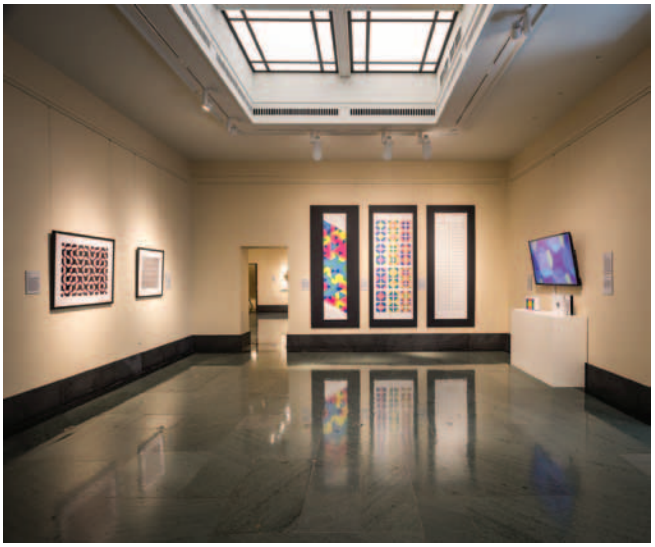

Fig. 8. Installation photograph of *Process, Chance, and Serendipity: Art that Makes Itself*, of Paul Brown's 50-year retrospective at the National Academy of Sciences, Washington, DC, 20 February–15 July 2018. (Artworks © Paul Brown. Photo by Kevin Allen, courtesy of Cultural Programs of the NAS © 2018.)

used Munsell classifications [15]. My program would create a monochrome drawing with associated Munsell color data and I would transfer the image to canvas completing the work by hand using traditional art materials like pencil, straight edge, compass, masking tape, paint, and brushes (Fig. 7).

I completed my postgraduate degree from the Slade in 1979 and not long afterwards began to design the software for the Aesthedes—the first dedicated graphic design workstation. In 1981 Chris Briscoe and I co-founded Digital Pictures as the UK's first dedicated computer special effects companies. Following that, in 1985 I founded the UK's National Centre for Computer Aided Art and Design with government funding at Middlesex Polytechnic (now University) where I also established one of the first MA programs in the computational arts. But that, as they say, is another story!

TMB: Such a rich exploration of ideas and technologies! Tell me about how you came to be part of the 50-year retrospective US National Academy of Sciences as part of Leonardo's 50th anniversary of Cybernetic Serendipity.

PB: In 2017 the Cultural Programs of the National Academy of Sciences in Washington, DC (CPNAS), together with Leonardo/ISAST, were planning a 50-year celebration of Cybernetic Serendipity (CS) to take place the following year. Their director, J. D. Talasek, emailed me. He was looking for an artist who had seen CS during their formative years and who was still practicing in the field. It was a great honor for me to be selected for such a prestigious event and I was happy to be involved. Together with J. D. we selected 12 of my artworks to form a retrospective spanning 50 years of my career (Fig. 8). The show was well received and generated supportive reviews in *Studio International* [16] and elsewhere.

Its title, *Process, Chance and Serendipity: Art That Makes Itself* reflects my lifelong ambition of making AI/A-Life agents that are capable of creating artworks independently, without the need for human intervention. I have not succeeded in this aim and now leave it to future generations to fulfill its

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promise. AI is not yet capable of creating truly autonomous art, although with the escalating rate of change in the field I now think it won't be long before we see independent intelligence and cognitive agency emerge.

TMB: In conclusion Paul, please tell me about your term the Geometric Sublime.

PB: Some years ago I first used the term "The Geometric Sublime" to describe my work. I based this on Jon McCormack and Alan Dorin's paper, "Art, Emergence, and the Computational Sublime" [17]. They illustrate their idea using Pi—the ratio between the diameter and circumference of a circle. Because it is irrational, its decimal expansion is infinite and non-repeating. By converting individual digits to colors and using them to populate successive frames, it's possible to generate an infinite sequence that will include every image that has ever been (or ever will be) made. All movies are in there too, as well as the winning values for next week's lottery. The problem is that this is infinite and we don't know where to look. This theme was explored by Darren Aronofsky in his 1998 movie *Pi* [18]. Although the processes I create are based on simple structures, their emergent and iterative properties are also potentially infinite and it is this potential that invokes sublimity: whole universes of discourse contained in just a few simple marks.

It also relates to my long-term interest in the I Ching. The book begins with the single unitary One or Taijitu which divides into the two primary principles: yin and yang. These combine in sets of three to form the eight trigrams which also define the eight extents of the three-dimensional world. The trigrams permutate with each other to form the 64 archetypes or hexagrams that govern the universe, and these in turn mutate into each other to form the 4,096 changes to which the title of the book refers. On one level the book is a symbolic cosmology that describes how the world we experience emerges from the first unitary principle. The process is echoed in Lao Tzu's *Tao Te Ching*: "The way begets one; one begets two; two begets three; three begets the myriad creatures" [19].

In my mind this is not so different to the contemporary scientific interpretation of how our universe came to be: the big bang, inflation, plasma condensing into hydrogen, gravity forming the first stars which forge the elements, the stars explode distributing the elements, and so on. . . .

My work explores a graphic universe: it takes simple units and combines them to create emergent phenomena—new universes of image and thought. It doesn't represent the universe and neither does it abstract from the universe. It creates its own universe—one that has metaphorical parallels with all other universes.

TMB: What a wonderful concept. It makes me think of how all life on Earth has evolved from a single cell in the early prehistory of our planet. Infinite possibility from the timeless space of the void. Thank you, Paul, for sharing your insights!

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