Exiting the Comfort Zone

From Algorithm to Interaction in the Early Work of Simon Biggs

SIMON BIGGS

The 1970s and early 1980s saw the emergence of the microcomputer and the domain of personal computing. Within that context, some artists were working with such digital systems, contributing to these developments in various ways. This article reflects upon one such artist's involvement in these developments and how his initial interest in computational processes allowed him to explore a series of formal concerns, and how this then evolved into an engagement with more conceptual and philosophical concerns around the ontology of people and technology. The article also considers the value of undertaking creative work in interdisciplinary research environments.

ALGORITHM

As a young artist in the 1970s I employed systematic and algorithmic processes in making paintings. Not unlike the work of artists such as Sol LeWitt, these processes were premised on mathematical progressions and semirandom decision-making systems. This led to experimentation with computational methods for producing art. In the post-1960s period there was often suspicion about technology. Some artists considered choosing to work with computers transgressive. It certainly involved exiting a comfort zone to engage new disciplines, methodologies and working environments.

In 1978 my father (Alex Biggs, a computer scientist) introduced me to an early computer graphics system at what was then the Weapons Research Establishment (Adelaide, South Australia). Transgressing my own (and bureaucratic) boundaries, I gained access to the low-security sections of the facility to work with an IBM 360 mainframe computer, at that time already a venerable machine. This was a large computer sprawling across multiple rooms, served by numerous white-coated technicians. Interaction with the IBM occurred via a golf ball–teletype unit using the Fortran IV programming language. There was no screen or mouse. Output was to an early version of a laser printer—the results, for a painter, reassuringly “dirty.”

The work produced (which does not survive) during this period of working with the system consisted of simple iterated patterns on A4 sheets of paper. What did survive was the realization that computer programming was an ideal method for pursuing an interest in systems-based art. Subsequently, during 1979, Alex and I developed a custom-built computer graphics system. This consisted of a Zilog 8-bit Z80A 4 MHz CPU mounted on a bespoke printed circuit board with an arithmetic and logic unit, seated in an S-100 motherboard. The casing was made of plywood. Included were additional PC boards with 16 KB of static RAM, a power supply, a digital-to-analog video converter for direct video output, a keyboard, a black-and-white monitor and a cassette recorder for saving data. I developed software to produce both still and animated imagery, initially working in machine and assembly code and later the procedural programming language Pascal. The operating system was CP/M. Video was recorded to a Sony Betamax unit.

We subsequently improved the system by fitting multiple Matrox video cards and a color monitor with 16-bit color for still and moving image at standard NTSC resolution. In 1980 we further augmented the system with an Intel 8088 16-bit CPU running asynchronously at 11 MHz with a 6 MHz Z80B and a more capable operating system (MS-DOS). Video was recorded to Sony Broadcast U-matic. For 1980 this was a capable system and it could run both new 16-bit and 8-bit legacy code. IBM released its first microcomputer in 1981; personal computer systems that featured video output, such as the Commodore 64 and Apple IIe, were not available until 1982. At this time commercially available systems such as the MITS Altair and Commodore PET did not have equivalent graphical or real-time performance capabilities.

During the period 1980–1983 I produced numerous still and moving image works employing this system, refining the graphical routines and programs in which they were used (Fig. 1 and Color Plate D). This involved experimenting with a number of approaches to software development, including periods developing with ALGOL and LISP. However, while these were fascinating languages to work with, they proved far from optimal for applications in computer graphics. Art-
Pioneers and Pathbreakers

ists who influenced my work at that time included Peter Struycken [1], Manfred Mohr [2] and Iannis Xenakis [3]. At this time I was also studying at the Electronic Music Unit (EMU) of the Elder Conservatorium of Music at the University of Adelaide, directed by composer Tristram Cary (codesigner of the EMS VCS3 and Synthi AKS synthesizers, used by progressive rock groups like Pink Floyd). The state-of-the-art New England Digital ABLE-40 minicomputer–based Synclavier system at EMU allowed the exploration of algorithmic approaches in the domain of sound. This led, in particular, to experiments with spatialization (the Synclavier was a quadraphonic system). Finding the immutable frame of the video screen constraining led to exploration of more expanded approaches to how viewers might experience the work, in the form of installations. This was concurrent with a shift away from an algorithmic focus toward a more systems-based approach, adopting the ideas of cyberneticists such as Gregory Bateson [4], Humberto Maturana and Francisco Varela [5], computer scientists like Terry Winograd [6] and artists such as Peter Campus and Agnes Denes. From this emerged an interest in software automata and closed systems.

In 1984 I was invited to curate the Adelaide Festival of Arts exhibition *Interface: A Survey of Art and Technology* with Claudio Pompili (a colleague at the Conservatorium, responsible for the Interface music program) and assisted by Francesca da Rimini (later of cyberfeminist group VNS Matrix). This exhibition presented a wide range of artists’ practices employing or addressing new technologies, including work by Stelarc, Alvin Lucier and Felix Hess. A highlight was Lucier installing his sound installation *Long Thin Wire* [7]. Through curating *Interface* I deepened my knowledge of technological arts in Australia and internationally, broadening my awareness of the context within which I was working. As part of *Interface* I presented my first installation incorporating live computation and software automata, titled *The Reproductive System* (Fig. 2).

This work incorporated a computer and video monitor as well as a rock covered in crystals, live fish in a fish tank made of mirrors and other elements. Conceptually the work sought to engage ideas around generative systems and how living and nonliving systems—whether organic, inorganic or computational—could offer insights into one another. This was an important work in the development of my practice, informed as much by philosophical and ecological concerns as ideas from the visual arts or physical sciences.

Following *Interface*, in June 1984, I took up one of the inaugural Australia Council Artist Research Fellowships at the Commonwealth Scientific and Industrial Research Organisation’s (CSIRO) National Measurement Laboratory in Sydney.

Initial experiments at the CSIRO involved working with a very large-scale Interact IV flatbed plotter. This system, based around a DEC PDP-11 computer, permitted large images to be plotted on a variety of materials employing a range of drawing implements, allowing the production of two series of works. One was a series of ink plots titled *Diagrams***Fig. 1. Black-and-white screenshot of computer-generated still image, 1979. (© Simon Biggs)*

![Fig. 1. Black-and-white screenshot of computer-generated still image, 1979. (© Simon Biggs)](http://www.mitpressjournals.org/doi/pdf/10.1162/leon_a_01483)

*Fig. 2. The Reproductive System, rubber, timber, plastic, mirror, rock, crystals, water, fish, computer, color monitor, dimensions variable, 1984. (© Simon Biggs)*

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(Fig. 3). Shortly before relocating to Sydney I had made a series of works that involved making two-dimensional designs of objects that could then be made into their three-dimensional correlates by recursively folding the printed diagram into the specified form, a little like origami. In *Diagrams* I plotted a series of graphical diagrams onto transparent sheets of acetate that were folded following the diagrammatic instructions, mounted between sheets of glass and presented as wall sculptures, where lighting caused the diagrams on the folded surfaces to cast their shadows on the wall behind, creating geometric shapes and patterns derived from the original diagrammatic inscriptions. These works were not especially original, as they transferred an existing idea into a new context. Nevertheless, it was an opportunity to gain knowledge of the PDP computer system and gain familiarity with new colleagues and the laboratory environment.

**Interaction**

The initial plan when coming to the CSIRO had been to research and develop remote visual sensing systems for application in interactive installations. The idea was to use video cameras to track people in a defined installation space to control real-time computer-generated visual elements in an artwork. I was unclear as to how to go about doing this. It soon became clear the CSIRO scientist to talk to was Zoltan Hegedus. He had been undertaking research for Australian National Railways, developing automated systems to monitor the wear of railway tracks. His solution was to use structured light and a camera. He fitted a small system to the base of a carriage of a train, projecting a band of light onto the rail track. He mounted a camera at an angle such that when it photographed the rail the band of light revealed its contour. A computer employing shape recognition software that Hegedus developed then processed the imagery.

Taking this principle as a starting point, I designed a 50 × 50 array of orthogonally opposed white lines (a grid) that was rendered onto 35 mm Kodalithographic film (a 35 mm transparency). I mounted the transparency in a precision projector and directed the light onto a variety of objects in a dark laboratory. The (half-baked) idea was that by employing a mesh of structured light to produce a replica in real space of something like the 3D wireframe graphics common at the time in commercial computer graphics, it would be possible to make real objects look like they had been drawn by a computer and that, subsequently, a computer equipped with vision capability would be able to acquire meaningful data from such images.

I built a rig consisting of the projector and structured light, a reference background plane, and a small table in front of that on which three-dimensional objects could be placed and illuminated (Fig. 4). I installed a couple of scrounged computers from other labs, specifically a Hewlett Packard minicomputer and an Apple IIe microcomputer, along with a black-and-white analog surveillance camera. The Apple IIe was hardly a high-performance computer but in 1984 it had an unusual capability: One could plug a video camera into it and get video on the computer screen and, more significantly, the associated frame buffer.

Due to the video signal being routed through the computer’s memory, it was possible to write software that could monitor the signal, process the data and output it in other forms. Knowing that the Apple would be far too slow to achieve anything approaching real-time 25-frame-per-second analysis of a video signal, I used the HP minicomputer to run the image analysis software (written in C). After some months of coding and experimenting, the system worked to a point where the system could determine where in space an object was, whether it was moving—if so, in which direction and how fast—and gain information about the volume of the object. This worked at 12 frames per second.

The output consisted of reams of numbers that, as I developed the software, evolved into graphs that could more...
readily be employed for evaluating data. Over the next few months a large volume of documentation was produced, with the knowledge that while creating a fully functional system during the period of the residency was unlikely, it would be possible, if adequately equipped with software and documentation, to do so within a reasonable subsequent time span.

At the end of the residency the outcomes consisted of a series of wall-mounted drawing-sculptures (Diagrams), some software and a substantial pile of paperwork documenting the software experiments. Recognizing that the documentation was significant in terms of medium-to-longer-term research, it nevertheless seemed a modest quantity of physical work. I decided to employ the experimental outcomes of the video-sensing experiments to produce a second series of larger ink-pen plots, using large permanent markers and archival-quality 300 GSM Fabriano artists’ paper on the Interact IV plotter. Neither of these media was meant to be used with the large-bed plotter, and this subversion of materials and tools bespoke a lack of caution.

The drawings were produced by using the vision system to track my hand movements and output the data as a series of B-spline curves. The resulting shapes were intentionally evocative of the sort of painterly gestures associated with abstract expressionist painting. This graphical data was then input into the PDP-11, tessellated as a series of inversions and translations, and the resulting series of images plotted on the Interact IV. The intention was to question the value often associated with the evidence of the “artist’s hand” in the production of an artwork by replicating the movement of the artist’s hand in a machine-like manner (Fig. 5). I produced 14 of these large images and was able to leave the CSIRO feeling that it had been a productive few months.

The final artistic outcome of the CSIRO residency was based on the software and technical development I undertook during the residency. This was an artwork titled Torso (Fig. 6), exhibited at Roslyn Oxley’s Sydney gallery in 1985 [8]. It consisted of five video monitors (two closed-circuit and one live computed), two video players, one computer, two video cameras, a slide projector and a large screen, all presented in a dark gallery space. A modified version of the 50 x 50 Kodalithographic transparency, produced at the CSIRO, was projected onto the screen, the shadow of a larger-than-life–size figure added to it. Each monitor displayed a different video sequence: a video recording from inside the body (top), a recording of a simple computer-generated animation of rising and falling “populations” of cartoon-like figures (bottom), two displaying closed-circuit video signals from the front-facing (second from top) and down-facing (second from bottom) cameras, and the central monitor displaying a live computer-generated animation produced by a simple “A-life” program that I had written. This program had, as input, the signal from the down-facing video camera, which tracked people moving about within the installation space.

The movement of viewers within the installation was processed through a relatively simple shape and motion analysis algorithm that generated output that “seeded” the “A-life” elements in the program and thus indirectly affected the behavior of the various graphical elements in the central video display. Each “A-life” element, or cell, consisted of a simple color rectangle, about 50 pixels square, containing a sequence of colored dots, each a few pixels in size. The sequence of dots was “read” by each cell as a kind of code, which determined its behavior. The mission of each cell (employing a random walk) was to find and consume colored dots that were scattered around the “environment” of the screen area, the color preference determined by the sequence of dots within the cell. If a cell found a target dot, it would consume it and
add it to its code sequence, effectively changing its behavior (color preference). If a cell could not double the number of colored dots it contained within a defined period of time (a couple of minutes) then the cell self-destructed, scattering its contents (the colored dots) around the screen, the scattering determined by recent viewer movement in the installation. Surviving cells would subsequently cannibalize these dots, extending their lives and enhancing the likelihood of their own reproduction. When a cell managed to consume enough dots to double its length of code it would divide into two separate cells, each containing half of the code of the original unit (even or odd). The system could run indefinitely, the population of cells increasing and decreasing.

**EXITING THE COMFORT ZONE**

*Torso* was the first interactive installation I produced and the beginning of a program of research and practice still in development 30 years later. The concerns explored in *Torso*, including emergent systems, surveillance and the quantified self, were a reflection of a growing interest in the writing of Michel Foucault and a number of other poststructuralist thinkers [9]. In 1984, when I started working at the CSIRO, the ideas and artistic strategies explored in *Torso* were unforeseen. Had I not had the opportunity to work in the alien environment of the CSIRO it is possible I would not have developed such a work or the works that have followed. Exiting my comfort zone at the National Measurement Laboratory was probably key to these, and subsequent, developments in my practice.

Shortly after the exhibition of *Torso* in Sydney in 1985, I left Australia for a new base in London and Europe (Amsterdam and Berlin), where I further developed an artistic practice focused upon interactive artworks exploring sociotechnical systems. At the CSIRO I had learned that creativity is often a shared activity, and invention can be found in the spaces between disciplines. As a result I have spent much of my life working in environments where creative collaboration across disciplines is valued—research laboratories and other contexts that have facilitated transgressive practice between and across domains, where one is encouraged to exit their comfort zone.

References and Notes

7. The *Interface* event also led, indirectly, to the foundation of the Australian Network for Art and Technology in 1988.

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COLOR PLATE D: EXITING THE COMFORT ZONE: FROM ALGORITHM TO INTERACTION IN THE EARLY WORK OF SIMON BIGGS

Color computer graphic, color monitor screenshot from animation, 1982.
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