The Personalised Surface
New Approaches to Digital Printmaking

Victoria & Albert Museum, 3 April 2009

A Computer in the Art Room: Towards a history of the digital print in Britain to 1980

The CACHe (Computer Arts, Contexts, Histories, etc.) project at Birkbeck, University of London completed 2005, of which I was a member, traced the inception, growth and development of British computer arts from its origins in the 1960s to the beginning of the 1980s. The overriding aim of CACHe was to show how closely this movement was connected to the major cultural and artistic currents of its time.[1] The goal was to construct a framework of both historical and aesthetic criteria into which digital arts could be positioned. This was achieved by locating this practice in art academies where much early work took place. In the days before proprietary software, the pioneers of computer graphics had to gain access to rare mainframes and learn programming from the ground up. At this time the complexity and rarity of computers meant that any art form based around them was bound to be a specialised branch of art, highly dependent upon support and funding to exist, not least because of the expensive, large-scale nature of much early equipment and the resulting technical expertise required to operate it. Working with digital technology at a time when the computer itself was at a formative stage in its development was a difficult task requiring long hours, dedication and a particular type of mind-set. Much of this activity was produced in a collaborative and conversational manner and could be experimental in nature where the process was given equal or greater prominence than finished product or object. Notwithstanding these challenges the result was highly productive cross-disciplinary working relationships within institutions and art schools.

This essay is a brief introduction to the origins of digital plotter drawings and prints within British art schools and will consider how the unique character of early “computer arts” (if it can be considered a movement as such) was defined by its position within educational establishments. It will introduce a number of practitioners who were among those who forged alliances with scientists and engineers, learned to write code, adapted or built their own hardware and discovered imaginative ways to bend the available technology to suit their creative requirements.

[1] The findings of this research are published in *A Computer in the Art Room: The Origins of British Computer Arts 1950-80* (JJG, 2008) by the author and *White Heat Cold Logic: British Computer Art 1960-1980* (Cambridge, Mass: MIT Press, 2008), edited by Brown, Gere, Lambert & Mason

The history of making prints and plotter drawings using digital technology goes back over forty years. Using technology originally designed for completely different purposes, artists began to experiment with computer-generated imagery almost simultaneously in Germany and the United States. Among the first was Herbert Franke in Germany in the early 1960s who produced abstract monochrome algorithmically generated computer graphics - a term that had been coined by the American designer William Fetter of Boeing Aircraft Company in 1959-60. Fetter was the first to draw and the animate the human figure using a computer. By the middle 1960s computer drawings were being produced by Georg Nees, Frieder Nake and A Michael Noll. In the United States Bell Telephone Laboratories was a leading centre for research into computer graphics and animation. Ken Knowlton and Leon Harmon's *Studies in Perception* (1966), a large plotter print of a nude constructed from the alphanumeric characters of an ASCII printer, was produced there. Lillian Schwartz was another who collaborated with Knowlton from the late 1960s. Other early graphics pioneers include Charles Csuri working at the Ohio State University from the middle 1960s and Manfred Mohr.[2] Nake organized the first computer art exhibition in 1965 at the Technische Hochschule in Stuttgart. The Howard Wise Gallery in New York also showed computer graphics in that year. Thereafter several early exhibitions of computer art took place in the United States, Germany, Zagreb and London.

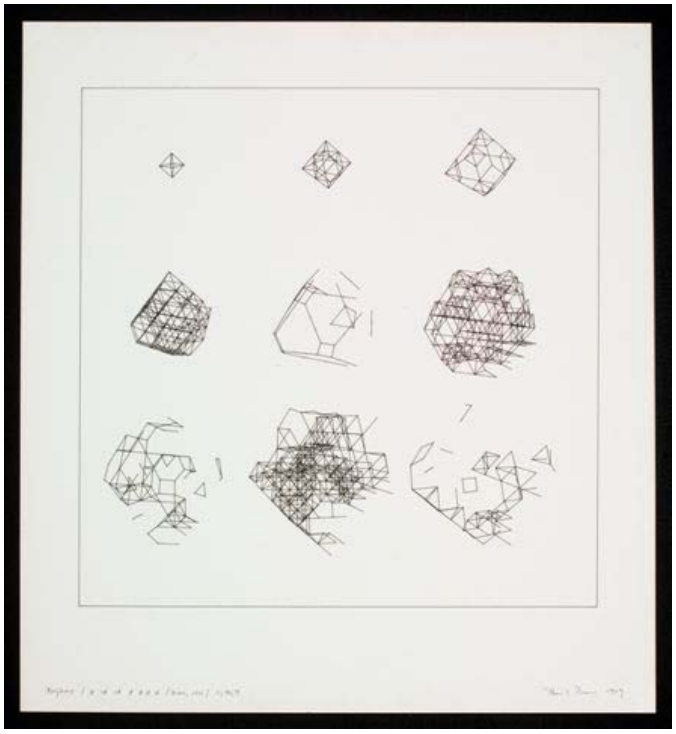
The development of computer graphics was led by the United States partly because they realised the value of computer-aided-design (CAD) programs in the 1950s and also because an infrastructure, including systems, software and output was in place earlier with corporations large enough to sustain it. In Britain the history of computer use by artists followed a somewhat different path, focused instead upon public sector funding bodies, the opportunities within education and the role played by artist-led initiatives such at the Computer Arts Society (CAS). International developments had an impact on British artists.

The basis of CACHe was the archive and collection of the British Computer Arts Society, conceived in 1968 and officially founded in 1969. This practitioner-led society was founded to encourage the creative use of computers in the arts and allow exchange of information in this area. It received support from the British Computer Society.[3] For computer artists whose work was variously ignored or misunderstood, it was of crucial importance to have a supportive network. CAS acted as a catalyst organising exhibitions, workshops, publications, occasionally funding and, invaluably, opportunities to meet like-minded and skilled individuals. CAS was also a node for a dispersed international membership and published a bulletin, *PAGE*. Although not all artists who used the digital medium joined CAS-

[2] Many others are featured in Leavitt, Ruth (ed), *Artist and Computer* (New Jersey: Creative Computing Press & New York: Harmony Books, 1976), which is an invaluable resource of early digital prints and computer art in general.

[3] CAS was re-formed and continues today, see: http://www.computer-arts-society.org/

its approach was not to everyone's taste and there were debates over terminology and approaches, it nonetheless made a major contribution to the continued development of the nascent field of computer arts in this country as well as having an impact abroad.



Paul Brown, *BIGDIM / 0 10 10 0 0 0 0 / 200, 120 / 11, 969*, plotter drawing, 1979. 51.9 x 47.7 cm
 E.131-2008

Over the years the Society had amassed some two hundred art works, mostly on paper, including plotter drawings and prints, as well as documents and ephemera. This collection is representative of CAS's international remit with works by Europeans, Americans, Japanese and others, many of whom visited CAS in the UK to give a talk or contribute to an exhibition during the period it was active (1969 to the mid-1980s). A permanent home for this collection was found when these works were transferred to the Victoria and Albert Museum (V&A) in London, becoming part of the Word and Image Department. This Department includes in its remit responsibility for paintings, drawings, photographs, designs and prints, as well the holdings of the National Art Library. The CAS collection joined the Patric Prince Collection of over two hundred art works, mostly on paper, and archive of related materials. The research continues with the Computer Art and Technocultures project, based at the Museum and at Birkbeck, which is charting the development of computer-based art from the late 1970s to

the 1990s, funded by the AHRC.[4] The V&A now holds the national collection of computer art – a first for a nationally-funded museum in the UK. Given the history of the V&A it could be said that computer prints and graphics found a natural home there.

Modern public art education in Britain can be traced back to the founding of the Government School of Design created in 1837 - the ancestor of the Royal College of Art and the V&A. As opposed to the previous private academies or drawing clubs, the School of Design was the first state supported art school in England. Subsequently, branch schools were established, so that by 1851, seventeen provincial institutions were in existence. The schools taught both art (based on the "high" art of figure drawing) and design (using the latest technology) in one place.[5] The branch schools, spread throughout the country with their emphasis on fine art *and* craft, were to feed into the creation of the polytechnic institutions some one hundred years later.

In the post-Second World War period a sympathetic political climate coincided with a reform of the education system and an openness towards experimentation with media outside of the traditional art forms of painting and sculpture enabled computer arts to flourish. Digital technologies (many made possible by wartime research and development) were linked to notions of progress and for a brief time there was belief in a great technological future possible for all – epitomized by Harold Wilson's "White Heat" government. Although initially there were no computers available to artists, there was a wealth of conceptual thinking, informed by cybernetics. Reinvented in the Twentieth century by the MIT mathematician Norbert Wiener, cybernetics, the study of how machine, social, and biological systems behave, offered a means of constructing a framework for art production in which artists could consider new technologies and their impact on life. Foremost among the pedagogic changes was the instigation of Foundation courses to replace the outdated National Diploma in Design with the new Diploma in Art and Design (known as the Dip.AD). By raising the standards of art to those of other university-level courses, the way was paved for the eventual introduction of degree-level (BA) fine art courses. One of the first Foundation courses was informed by the principles of cybernetics - Roy Ascott's Groundcourse at Ealing Art School (from 1961). This course took the concepts of behaviour and process as models, stressing media dexterity, interdependence, co-operation and adaptability - art as a *system* which involved feedback between creator and audience. Staff and students here worked in programmatic ways using analogue devices to construct sets of instructions to inform art practice. Teachers and graduates alike (including Stroud Cornock, Brian Eno, Stephen Willats and others) spread Ascott's radical ideas regarding art practice to other

[4] See: http://www.technocultures.org.uk/

[5] Frayling, C., *The Royal College of Art: One Hundred & Fifty Years of Art & Design*, (London: Barrie & Jenkins, 1987), p.9.

institutions including Ipswich Civic College, Trent Polytechnic Nottingham and City of Leicester Polytechnic.

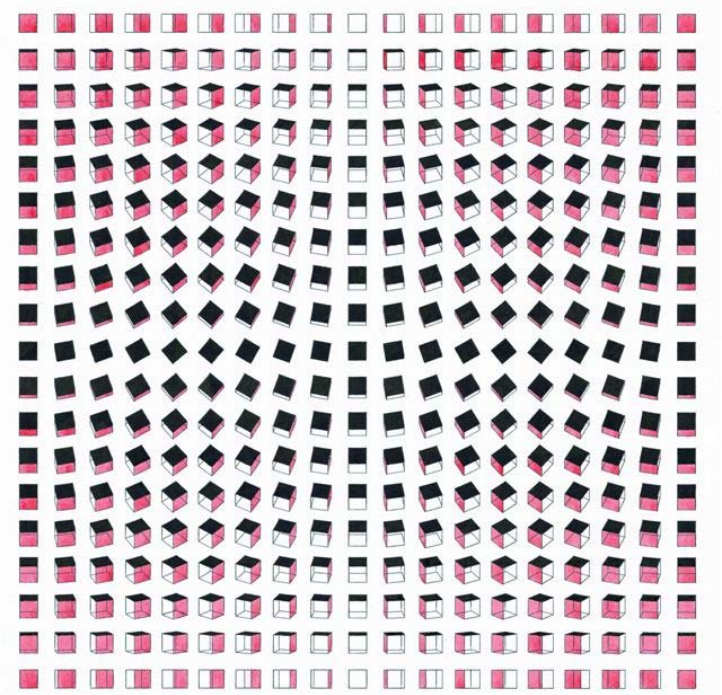
The great interest in cybernetics and art in Britain culminated in the exhibition *Cybernetic Serendipity* at the Institute of Contemporary Arts, London in 1968. It is still considered to be the benchmark "computer art" exhibition for its influence on many pioneers as well as introducing the subject to a wider audience. Curated by Jasia Reichardt, it was the first gallery show of its type and certainly the first of its kind in Britain. It drew together leading artists from around the world - 325 participants and covered a wide range of disciplines including painting, plotter output, dance, music, animation, poetry, film and sculpture.
One visitor/participant said 'It demonstrated how cross-disciplinary stimulation could encourage exciting innovation.' [6] Of crucial importance was that work by non-art school educated practitioners was shown alongside that of more traditional artists. This was controversial then and continues to lie at the centre of the debate surrounding what computer art is or might be. Nonetheless one of the aims of *Cybernetic Serendipity* was to show the scope of what was possible, emphasising the optimistic and celebratory nature of the undertaking. A set of prints aimed at collectors was produced by Motif Editions in London. Included in the set of seven was a version of Csuri's *Random War 1967*, a comment on the Vietnam War featuring graphics depicting toy soldiers.[7]

The next generation of students growing up in the climate of optimism culminating in *Cybernetic Serendipity,* started coming through the art school system in the mid-1970s. One of the main characteristics of British computer arts at this point was that it involved artists who either learned to program and write code themselves or built up a working relationship with engineers or technicians. With advances in technology and particularly the formation of the polytechnics, computers became more widely available to artists. The creation of polytechnics concentrated expensive resources into fewer, but larger multi-disciplinary centres. The first ones were designated in 1967 and many art schools were amalgamated into them.[8] In a few institutions, at least, the result was that artists had the opportunity to access expensive and specialist computer equipment and technical expertise (generally belonging to science or maths departments) for the first time. A limited number of artists took up computing as a tool, working method or metaphor for practice. Thus, at the polytechnic, it was theoretically possible to study art and craft (technology) together again, as in the first public art schools opened in the Nineteenth century. They provided not only education and training but, in some cases, career incubation, employment,

[6] Edmonds, E., "Constructive Computation", *White Heat Cold Logic: British Computer Art 1960-1980*, (Cambridge, Mass: MIT Press, 2008), p.345
[7] A set was purchased by the Victoria & Albert Museum and acquisitioned in November 1969.
[8] Government White Paper "Plan for Polytechnics and other Colleges: Higher Education in the Further Education System", 1966, quoted in Strand, R., *A Good Deal of Freedom,* (London, Council for National Academic Awards: 1987), p.54.

research facilities and networking opportunities. Important centres for computer graphics developed at Leicester, Coventry and Middlesex.

At Coventry School of Art (then in the process of becoming Lanchester Polytechnic) Clive Richards, a technical illustrator, worked with Ron Johnson, Head of Computer Science, on an Elliott 803 machine. Writing in Algol (a scientific language not designed for drawing) Richards learned to produce line drawings and output them using a Benson-Lehner twelve-inch drum plotter. In 1970 he finished *Spinning Gazebo,* a three-dimensional wire frame representation of a gazebo rotating in space and the first computer animation produced in a British art school. Computer drawing was included on the graphic design course and more powerful technology including an ICL mainframe was acquired. However writing code was slow and hard work - leading Richards and Johnson to create the PICTURES and CACTI (Computer-Aided Construction of Technical Illustrations) software packages to aid designers and artists. By the early 1980s Coventry had a digital studio consisting of individual pc workstations for each student (a groundbreaking concept at this date), and a frame store which revolutionised the production and output of work. Large groups of students could work on (relatively) affordable computer hardware, producing graphics to at least television standard. In 1986 it instigated the first full-time postgraduate Master of Fine Arts course in computer graphics in Europe. [9]



Clive Richards, *361 Cubes,* hand-coloured plotter drawing, 1973 © Clive Richards. Reproduced courtesy of the artist

[9] Richards, C., interview with author 22/07/03

Middlesex Polytechnic incorporated Hornsey School of Art and Enfield and Hendon Colleges of Technology. Using a Honeywell 200 mainframe computer (with a 24-k memory) and a Calcomp 565 plotter, John Vince, a programmer and lecturer in data processing, taught computer languages and technology to students studying a wide variety of courses. Realising that artists and designers were interested in this device, but recognising that they did not necessarily want to write high level programming, he developed another of the first packages for artists - PICASO (Picture Computer Algorithms Subroutine Orientated) written in Fortran. During this period, Vince would visit Hornsey's Cat Hill campus, writing PICASO on a blackboard with chalk and teach students how they could control the size and position of their images and the nature of the shading effect. They, in turn, would copy down the program, including their own modifications, onto coding sheets, which he then took back and fed into the computer. A week or so later the art students would get back the results, although, in the nature of hand coding, they often contained errors. Artists who worked with Vince at Hornsey include Darrell Viner and Julian Sullivan (both of whom who later joined the Slade). In the late 1970s Vince and his colleagues ran popular fee-paying short training courses aimed at the television industry, which attracted artists too.[10] Middlesex Polytechnic developed into an important centre for computer animation becoming the National Centre for Computer Aided Art and Design (in 1984) and running two early Masters courses in computing for art and design (from 1987). In 1988, the Centre was headed by R John Lansdown, an architect by profession and one of the founder members of the Computer Arts Society.

Among those art schools not amalgamated into polytechnics, The Royal College of Art (RCA) and The Slade School of Art both developed a strong presence in computer arts.

At the RCA Computer Aided Design began 1967 under the patronage of Patrick Purcell, advocate of interdisciplinary work and early member of CAS, who had been at the RCA since 1964. In the early 1970s, Purcell was a Senior Research Fellow in the Industrial Design Department, running Science Research Council funded projects.

Students Alan Kitching and Colin Emmett's collaboration with the Atlas Lab led to some groundbreaking computer animated films and the creation of computer software systems of use for the animation industry. Established in 1961 as part of the UK Atomic Energy Authority, the Atlas Computer Laboratory was run by the Science Research Council and had a positive attitude to the granting of discretionary use of the facilities by students. Under Bob Hopgood, the Associate Director for Computing, the Lab played a crucial role in the development of animation in the UK. Before joining the RCA Emmett came to computers whilst an undergraduate at St Martins School of Art (c.1968). He

[10] Vince, J., interview with author 05/06/03

learnt programming at introductory weekend workshops run by CAS. The results formed at his final degree show at St Martins in 1971. The pen plotted drawings, as well as the code and plots showing various experimental stages, were exhibited together to show the entire creative process. Emmett also exhibited a teletype connected to a remote mainframe running a few simple programs which visitors could interact with.[11] At the RCA Emmett studied for a Degree by Project on Computer Animation within the Graphic Design department. He was assigned a tutor from Brunel University and made use of the "cafeteria" service at Imperial College of Science and Technology, where he would hand over the program on punched cards, the program would be run and a line-printer printout delivered half an hour later (the line-printer used by him to simulate a graphics screen). Such were the challenges of pre-WYSIWYG ("what you see is what you get") technology.

Kitching, who had a background in architecture, graphic design and traditional animation, collaborated with Emmett on several projects. At this time the facilities at the Lab included an ICL1906A computer with input from a D-Mac digitiser and output to the SC-4020 - a microfilm recorder. The D-Mac digitizer allowed freely-drawn images to be fed into the computer 'albeit rather slowly and clumsily.' [12] The equipment in use at this scientific research Lab was never designed for this type of application - the artists pushed it to its limits. One of the most aesthetically impressive images produced by Emmett and Kitching is *The Rainbows Egg*, a limited edition print of 1974 (illustrated below). It is a clever use of the in-betweening technique, as Emmett explained:

> The patterns on the snake were produced from the twelve month names by transforming, or in-betweening, one name into the next so that, for instance, "January" transforms to "February" in 31 steps, or days. Each day was fitted into its appropriate day division on the original circular area, and transformed into its position on the egg shaped area. The whole image was then scanned and output to the plotter.[13]

Colour was added during the silk screening process, printed onto gold paper, so that areas not printed on, show up as gold, creating a spectacular effect, seen here. Sold as limited edition prints, this image was also made into a colour postcard and sold at the Science Museum.

[11] Emmett, C., interview with author 13/04/05
[12] Kitching, A., interview with author 20/02/04
[13] Emmett quoted by Lansdown, J., "Not quite computing – almost art" *The Computer Bulletin* Series 2, No., March 1975, p.19 – the image is also reproduced in b/w on the front cover of this issue.

Colin Emmett & Alan Kitching, *The Rainbow's Egg*, silk-screen print from an original black and white computer output, 1974. 75.0 x 61.9 cm. Image courtesy of V&A images Victoria & Albert Museum London. E.125-2008. Reproduced courtesy of the artists

Circa 1974 the Design Research Department at the RCA was created by Purcell who assembled a team interested in ideas from systems theory and cybernetics which included George Mallen (co-founder of CAS). This multi-disciplinary department included staff and students from philosophy, psychology, product and graphic design, architecture, computer science and others. Emmett and Brian Wyvill worked on animation projects there. Mallen set up a Computer Activities Unit. This unit employed Brian Reffin Smith (who had completed an MA there) as College Tutor in Computers in Art and Design; the studio was equipped with micro-computers.[14] They ran courses for students from outside including, for example, from the London College of Printing. However, with changes in institutional priorities, Design Research was closed down in 1985.[15]

[14] Reffin Smith, B., "From 0 to 1", *White Heat Cold Logic: British Computer Art 1960-1980* (Cambridge, Mass: MIT Press, 2009), p.377

[15] For the further history of this see, Gardiner, J., "The Aftermath of Early Computer Art: A Painter's Odyssey" in *White Heat Cold Logic: British Computer Art 1960-1980* (Cambridge, Mass: MIT Press, 2009), p.389

At the Slade the Experimental Department[16] was set up by Malcolm Hughes, Head of Post-Graduate, in 1973. This was a pioneering computing curriculum integrated into the programme and profile of the postgraduate school, making the Slade the only art school in the world then offering this kind of opportunity to its students. As co-founder of the Systems group, Hughes employed various kinds of frequently mathematical systems to provide ordering and structural principles to his work, predominately realised in painting.[17] Although not a producer of computer-generated work, Hughes was a strong advocate and facilitated the acquisition of equipment.

The first student to do computational work at the Slade was Stephen Scrivener in 1972 (joining the postgraduate school before the Department was officially set up), initially using the IBM mainframe at University College London, to produce graph plotter drawings, based on cybernetic ideas of self-regulating systems. Scrivener built his own hardware for his degree show which consisted of an interactive machine based on a homeostatic system.

A customised computing suite to suit the needs of artists was created within the School. Chris Briscoe, the highly skilled engineer/demonstrator to the Experimental Department (and later Head of the Department) facilitated its purchase and customised the equipment and taught programming. From 1974 equipment in the studio included a Data General Nova II, (among the first minicomputers produced for the market with a 16-bit memory) with input and output boards onto which other devices could be built and attached, a custom-converted Benson flat-bed four by four foot plotter, a hard disk and a storage oscilloscope (preview green screen). Drawings were written in Fortran code and images could be plotted using mapping pens and brushes. The illustration below shows student Dominic Boreham previewing an image on the screen. Later the process was made easier with the larger screen and built-in keyboard of the Tektronix 4016 green-screen vector graphics console acquired by the Department after 1978 and the AED 512 colour frame-store - one of the first commercially available colour graphics displays in the UK.

[16] Also known by a variety of different names over the years including the Department of Experimental and Electronic Art.
[17] Scrivener, S., communication with author 10/04

Dominic Boreham in the Slade Computer Studio with IM drawing on the oscilloscope screen, 1977. © Dominic Boreham. Reproduced courtesy of the artist

Artists who studied in this Department during the 1970s producing prints include Paul Brown, Dominic Boreham, Stephen Bell, Carole Gray and Peter Beyls. Many in the Department saw the act of writing code to produce lines on a screen as drawing ('taking a line for a walk' as Paul Klee wrote[18]), albeit via a machine. In this respect the use of computers was not such a radical departure from the Slade's historic emphasis on drawing, although not one the first Slade Professor, Edward Poynter, could have envisaged in 1871. Julian Sullivan, a technician and later a lecturer in the Department, typifies the interest among students in computational and generative methodologies, based on the idea of cellular automata – a form of artificial life. This approach was influenced in part by John Horton Conway's *Game of Life* (1970) popularised by Martin Gardner's column 'Mathematical Recreations' in *Scientific American* and gives the work of students in the Department at this time a recognizable aesthetic. Sullivan described his work throughout this period as an attempt to portray adaptive behaviour by examining four qualities in relation to each other – shape, structure, space and behaviour. He also designed a system (called the ANCAM) consisting of a movie camera interfaced to the computer as a way to output work from the cathode ray tube. This was a crucial means of enabling work produced from code (and therefore existing only on the CRT) to be output or "preserved", and was particularly useful for animated pieces and works which due to their generative nature were different every time the program was run. Prior to this one of the main outputs, other than the plotter, was to photograph the CRT using an SLR camera.

[18] Paul Klee, *Pedagogical Sketchbook*, (London: Faber & Faber, 1968), p.16

Also working in the digital sphere at the Slade was John (at that time known as Chris) Crabtree. A student in the Etching department from 1972 (later a technician and teaching assistant) he constructed a large XY plotter and turned it into a drawing machine on which he made paintings. These were in his words, an 'attempt to bridge the digital and materials of this world'.[19] Darrell Viner, although in the sculpture department, was a regular visitor. Looking back on his time there he described in 1980 how over the years his programs had become more expressive, 'I am basically programming myself into the computer in that the programs are very much about the images I react to and which excite me.' [20] The fact that, as with many plotter drawings, his do not show the process of production or any of the alternatives possible within the program's perimeters is unimportant – it was the final image that had the greatest importance for the artist. These drawings demonstrate his synergistic relationship with the computer, but are left to exist within their own right. Another frequent visitor to the Slade was Edward Ihnatowicz, the cybernetic sculptor who had exhibited in *Cybernetic Serendipity* and whose *Senster* was on view in Holland from 1971. Ihnatowicz, working nearby at UCL Department of Mechanical Engineering, taught electronics, brought items of hardware and generally shared specialist skills and ideas with Slade students. Harold Cohen visited whenever he was over from Stanford University's Artificial Intelligence Laboratory in California and demonstrated his early work with AARON - a program that he has described as a model of art making.[21]

The Department published two important works dealing with printmaking, which included the digital medium. *Working Information 3* (1978) was a limited edition soft cover book illustrated with prints by many of the staff and students. The same year a fine print portfolio (1978) was produced to celebrate the one hundred and fiftieth anniversary of UCL and presented to the Queen Mother, as Chancellor of the Slade. The edition of fifty consisted of Imperial sized original limited edition prints by twenty-nine artists who taught regularly at the Slade between 1975 and 1978. The wide variety of artists incorporated into the folio demonstrates the diversity of approaches and styles taught at the Slade during this fertile period. These included members of the Systems group - among them Hughes, Tess Jaray and Noel Foster, as well as more traditionally figurative artists such as Rodrigo Moynihan and Reg Butler. Three artists working with computers - Briscoe, Sullivan and Crabtree, each contributed a photo-lithograph printed at the studio of the Curwen Press. The title pages in the portfolio state, 'The work of artists using new techniques and media has also proved amenable to presentation in this form.' [22] This indicates there was cohesion of thought at

[19] Crabtree, J., interview with author 12/11/03
[20] Viner, D., "Statement", *Computer-Assisted Art* exhibition catalogue, organised by Brown, P., for Computer Arts Society, at *Computer Graphics 80,* Brighton, 10-15/08/80
[21] Cohen, H., interview with author 28/07/03
[22] *UCL 150th Anniversary 1828-1978, print portfolio*, 4th page, UCL Art Collections, Strang Print Room

the Slade at that point which dictated that the portfolio should be representative of the wide range of work being created at the School at that time. One technique did not appear to hold precedence over another.

However internal politics at the Slade and the coming postmodern sensibility within the art world, coinciding with a Government reduction in higher education funding, was to have a negative impact and the Experimental Department was closed in 1981.

By 1980 the field was growing commercially. Graphics and animation were in high demand from advertising and television. As the educational institutions had the equipment and the practitioners within had the expertise, some took on modest commercial work. Artists had transferable skills and many found a means of beating the reduction in public spending by creating or working for companies producing computerised special effects, particularly animation. However, even from within the safe position of an art school, most pioneers of digital art were forced to exist largely outside what may be considered the mainstream art world of dealer/gallery networks. Enterprising artists had to find their own approach and venues for practice and exhibition including, for example, the Association of Computer Machinery's Special Interest Group Graphics (ACM SIGGRAPH) annual conference and art exhibition in the United States (from 1981).

The period of early computer arts was a time symbolic of social change, transition and new discoveries in technology that created radically different ways to view and produce art. Art schools acted as the greatest incubator of computer arts in Britain throughout the 1960s and 70s. Their innovations including cross-disciplinary collaboration and the relationship between artist and audience and material and environment has proved of lasting impact on arts education. Many graduates of the courses discussed here remain involved with multi-media art practice and continue to influence and inspire others through the digital medium. With its emphasis on specificity of material, technique and process computer arts can be seen as a crucial part of the transition from late modernism to postmodernism. This is not to forget, however, that computer use in art then occupied and continues to occupy an ambiguous position within the art world.