

## THE ROYAL COLLEGE OF ART

*It would be fair to say that the RCA was midwife at the birth of the Computer Arts Society. Event One was staged at the end of March 1969 in The Gulbenkian Hall of the College. Though the birth was not without complications the infant was successfully delivered and for this it is grateful. In the three years since then CAS has kept up an informal contact with the College and one result of this is that RCA have offered to house and look after the CAS computer when, or if, the necessary funds become available. We thought it would be interesting to find out more about how the College uses computers; so several researchers were invited to provide short papers in their work. These form the bulk of this issue of PAGE.*

## THE COMPUTER AND THE AESTHETICS OF PROPORTION

CHRISTOPHER CORNFORD Professor of General Studies

For some years now I have been working on what I call an 'explanatory handbook' setting forth the two main systems of numerical two-dimensional proportioning that have traditionally been used by Western (and very possibly also non-Western) man. These are (a) the system referred to by one of its most distinguished 20th century exponents, Jay Hambidge, as **Dynamic Symmetry**, and (b) the system developed out of the ancient Pythagorean mystical cult of numbers by Plato in his dialogue **The Timaeus**, and much later re-formulated for architects by Alberti in his **De Re Aedificatoria** (1452) whence it conquered Renaissance Italy and soon afterwards the rest of Europe, superseding the more ancient geometrical lore. This second system I call the **Commensurable Method**, since it is based on small whole numbers, especially 1, 2, 3, 4 and their first few multiples; later also on 5 and its first few multiples. These numbers, as Pythagoras had discovered, corresponded to the relative lengths at which strings must be stopped in order to produce simple harmonies of sound like the fifth, (2:3) or the fourth (3:4). *Timaeus* built them into his account of the creation of the world.

Dynamic Symmetry, in contrast, uses quantities such as the diagonal of the square ( $\sqrt{2}$ ), and also the square roots of three and five and the Golden Section and its square root. These are quantities that result from the manipulation of dividers, rulers, compasses, etc; and frequently involve incommensurable and/or irrational numbers. The characteristic rectangular constructions in this method embody terms in geometric progressions.

If one looks, however, for linkages and similitudes between the two systems as well as for contrasts, certain significant ones declare themselves. A principle of **economy** overarches the whole endeavour: both systems agree implicitly on the desirability of minimising the variety of shapes, ratios, dimensions, angles, etc. in a design (c.f. Occam: 'it is vain to do with more what can be done with less'). This in turn involves a principle of **similarity**, since if the number of elements is kept low, the same element will tend to be repeated — there will be echoes, inversions, internal cross-references, etc. and perhaps also a principle of **simplicity**, since similarity makes for that quality (though, one hopes, not in a boring but rather in a subtle way) and also since there seems to be a perennial aesthetic preference for 'simple' shapes, e.g. the circle, the square, the double square, the equilateral triangle and a few others — several of which, such as the square, are given places of honour in **both** systems.

My own feeling is that both systems, but perhaps especially Dynamic Symmetry, represent real and perennially valid aesthetic preferences, and that they are as much applicable to design today as they were when the temple of Horus or the Parthenon or Chartres or the Villa Rotonda were built. So in my 'handbook' I seek to provide the contemporary practitioner not only with a general guide to both methods but also with all the tables of numbers and other like data he would need in order to apply them in actual art or design work. For instance, I have made an illustrated list of close on 800 rectangular formats with differing geometrical properties of 'economic' divisibility. These rectangles begin with the square and end with the quadruple square of 1:4 shape, and include all the commensurables with sides measured in up to 27 units as well as hundreds of compounds of the root rectangles and

square(s). So a host of commensurables and a host of incommensurables or irrationals are ranged together in order of magnitude interleaved as they come, and identified by the decimal number arrived at by dividing the long side by the short side, and calling the short side 1. (Thus a 3x4 rectangle is listed as 1:1.333 because  $\frac{4}{3} = 1.333$  . . .). Alongside each such ratio I list sundry other useful data, such as its reciprocal, its cotangent (angle between long side and main diagonal) and its gnomon. This last is that other rectangle which, annexed to the long side of a given rectangle, enlarges its size without altering its shape (ratio). Thus for instance if you add a square to the long side of a Golden Section (1:1.618) rectangle you get a Golden Section rectangle again, only larger; and the sides of the first and the second rectangles are terms in a geometric progression of which the constant multiplier is 1.618. So the gnomon to the Gold Section is a square. There is unexampled economy and simplicity in this arrangement — hence, no doubt, le Corbusier's choice of this ratio and its geometric progression as the essential elements in his **Modulor**.

In carrying out the many hundreds of calculations necessary for these tabulation (whose usefulness, whether for design or for analytical purposes, is already evident) I have been most generously helped by Parick Purcell and Dr. Andrzej Kociolek of the Department of Design Research at the Royal College of Art, and through them have had access to the computer facilities of the Computer-Aided Design Centre at Cambridge.

It does not seem at all impossible that, basing ourselves on the work already done, we could initiate further computer programmes that would embody and apply these traditional and well-tested criteria of proportional economy, similarity and simplicity; and would display for the consideration of architect or designer a range of possible solutions e.g. to the shapes of openings in a wall, based on this or that geometric progression, ( $\sqrt{2}$ ,  $\sqrt{3}$ ,  $\sqrt{5}$ , etc) if Dynamic Symmetry were preferred: or, if Palladian solutions were the order of the day, based on such ratios 2:3, 3:4, 4:5, 5:6 and so on. Since many solutions by either system could be canonically correct without being aesthetically agreeable, the computer could not be asked to **decide**: but its services in abbreviating the task of scanning possible decisions would be invaluable.

## COMPUTERS AND DESIGN RESEARCH

PATRICK PURCELL\*

As a formal research effort in the Department of Design Research, computer aided design began in 1967. As the title of the department might suggest the emphasis of the research is placed more on the study of the design process which the computer is to aid, rather than extending the technology of computing in CAD.

Analysis of design in this context entails the setting up of "real world" case studies — usually structured design tasks in a system building context, such as designing local authority schools, or engineering centres for the Post Office.

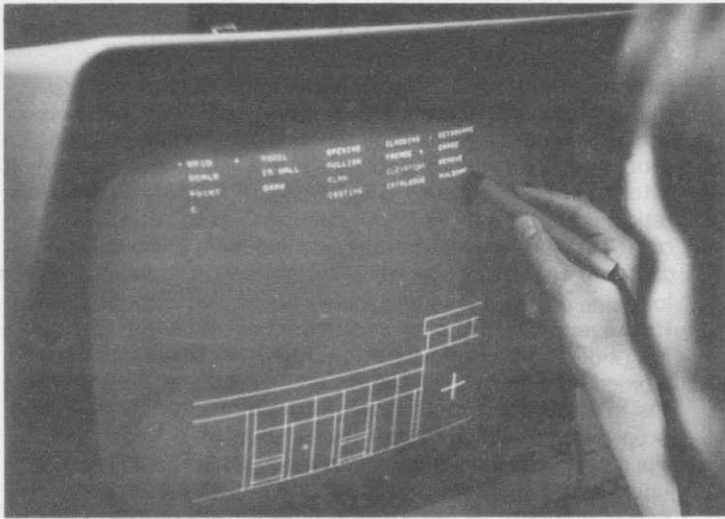
The approach of the research group is towards computer systems for evaluating the designers proposals rather than fully automatic design solutions by the machine.

However, some elements of design automation are introduced in the form of several low-level automatic procedures for detailing a steel frame or the curtain wall of building.

Facilities for issuing descriptions of the finished design also form part of the computer system — drawings, schedules, and computer tapes for automatic communication with computerized sub-contractors' systems.

The evaluative role of the computer is entirely in the quantitative aspect of the architect's function, environmental analysis, for example. Facilities for analysis of daylight levels and the thermal characteristics of the building are being incorporated into the integrated system.

The original subject areas of computer-aided design, — design analysis, system design, and system evaluation — have now grown sufficiently as to form separate but related projects in the group.



Design analysis is based on a range of live projects carried out in collaboration with design offices, both in the private and public sectors of architectural practice.

The group is currently involved with the development and implementation of two systems — one for use in local authorities and one for use by architect in the Department of the Environment — the CEDAR project. Both of these interactive systems are being developed on the Atlas 2 computer in the CAD Centre at Cambridge, using remote graphic terminals in Kensington.

The third aspect of the research — system evaluation — is the most recently developed and aims to develop techniques for evaluating the computer system in human factor terms. The techniques so developed will measure the sensitivity of the computer system to the designers requirements and assess the contribution of the computer aid in the execution of manual design tasks.

The multi-discipline approach to research in computer-aided design is reflected in the composition of the research group (about 15 strong). The team members include architects, engineers, analysts, programmers, and a strong representation from ergonomics and applied psychology.

\*Research Fellow,  
Department of Design Research.

## COMPUTER AIDED DESIGN OF TEXTILES

BOB JERRARD\*

A description of some aspects of the Computer Aided Design research being carried out at the Textile Research Unit of the Royal College of Art.

*If the designer has the opportunity of working with a computer and graphic display system there seems to be no restriction upon the ways in which a pattern represented on the CRT could be changed, and changes of scale, symmetry operations, changes of shape etc., can all be carried out with a speed and ease impossible by any other means, and the designer can be presented with an increased number of possibilities in a very short space of time.*

*The usefulness of such a design facility would depend upon both the preference of the individual designer and the production process for which he was designing. In general, subject to commercial and technical practicability, the use of a computer and graphic display system would make a worthwhile and sometimes unique contribution to the process of generating and manipulating pattern as part of the process of textile design. It is also considered that such a system would be a valuable aid in training textile designers.*

*One part of the work of the Textile Research Unit is a detailed study of the day to day activities of the designer, in particular an analysis of information requirements related to particular end products, the relationship of acquired information to the design process, and an analysis of the form which design information is both required and used by the designer.*

*This would relate existing hardware for CAD to textile design requirements, and should indicate 'ideal' input methods, the degree of inter-action required, an indication of likely software requirements, the most suitable form of output and in general terms the allocation of functions between the designer and the computer. Finally, the relationship of this CAD system of design to an existing method of manufacturing textiles — namely by weft knitting. This is at present the main area of investigation for CAD at the Textile Research Unit of the Royal College of Art, utilising the DTI Atlas at Cambridge, through their London Subcentre at the Royal College of Art. This involves both the evaluation of existing CAD systems particularly hardware, and the testing of some aspects of software development and takes place in close collaboration with the proposed project at the University of Manchester Institute of Science and Technology involving physical properties of textiles.*

*One reason for choosing weft knitting is that considerable developments have already taken place in processing existing data by electronic means, for a large range of weft knitting machinery, but so far little attempt has been made in assisting the derivation of design data for these newer methods of converting design information into machine control instructions.*

*So far, however, developments have been concerned with either speeding up or achieving more control over the processes involved in converting design information into machine control instructions and have excluded the designer or design process. There is, therefore, a real danger that computer aided textile production systems with which the designer of textiles cannot effectively communicate, will be, indeed are being, developed. The time is, therefore, particularly appropriate for research in this field.*

\*Textile Research Unit

## COLIN EMMETT\*

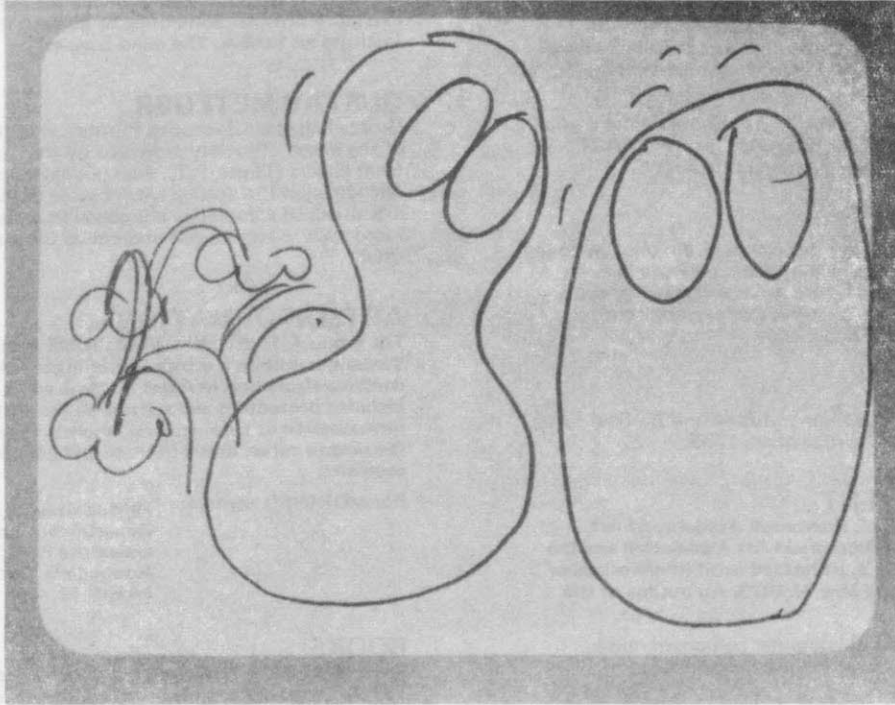
*I have been at the Royal College of Art for a year now, and I think that being in a department which is strongly design-orientated has had a directing effect on me. I have specialised in the problems of computer animation, and have been helped in this by having access to the Atlas computer at Chilton with its microfilm plotter. My first film was made at the end of my course at St. Martin's School of Art and was a demonstration of the MERGE program (see PAGE 16, June 1971). The pictures were drawn on the Tektronix storage tube display at Time Sharing Ltd and photographed frame by frame using a cine camera. It was an easy film to make since it only involved images and effects which the programs were designed to do.*

*I am now more interested in the problems of designing a film, and then using the computer to make it. In the last six months I have made a title sequence which is being used by the Open University for a series of programs on computing and a 2½ minute animated spectacular explaining a theory of how the ice ages happened, which is being used in a BBC Horizon program called "When Polar Bears Swam in the Thames".*

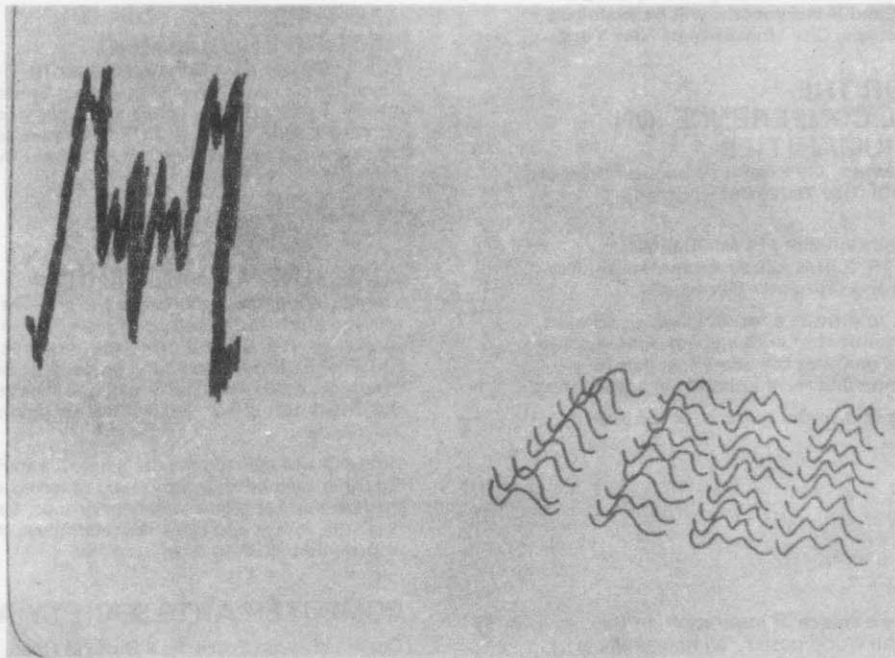
*I am currently making a humorous 3 minute film featuring the meeting of two amorous bouncing beans, which is intended as a pilot study to develop the programs for a three dimensional 6 minute frolic called "The Downfall of Count Sawtooth". I have been lucky to receive a grant from the British Film Institute to cover the film costs of this production. This will enable it to be in full colour and have a decent soundtrack. The result will be a good film which features some extraordinary animation, yet without being recognisably 'computer animated'.*

*The Fortran programs can handle a large number of parallel sequences, using a "key frame" and "inbetweening" process. Sequences of key frames can be generated by a 'do loop' expression in the data, making use of a library of characters set up in the beginning of the data. This data language will soon be usable as a version of PLAD, Roger Saunders' descriptive pictorial language. The images can be drawn to film in a wide range of colours using part of a system being developed by Alan Kitchings. Though this is a problem-orientated system it is hoped that as more films are made using it fewer extensions will be needed and it will become a fairly general system.*

\*Graphic Design



Still from storyboard of "Bean and Beane".



Still from storyboard of "The Downfall of Count Sawtooth" showing the third uprising of the town-curves with the bully Count looking on.

## COMPUTER ARTS AT THE EDINBURGH FESTIVAL

Next year an international conference is planned on Computers in the Arts to be held in Edinburgh at the time of the Festival. It is being organised jointly by the Scottish Arts Council, Computer Arts Society and Edinburgh University and will be located in the University's modern George Square complex.

At the same time a project, INTERACT, will be running as a live exposition of computers in the Arts. CAS will direct this and will seek to illustrate the basic theme of interactions amongst individuals, society and machines.

More information in the next issue of PAGE. In the meantime if you have a contribution for the conference or an idea for INTERACT write to John Lansdown 50/51 Russell Square, London WC1.

## GUSTAV PROMOTED

Gustav Metzger has edited PAGE since its beginning. No-one has done more for the Computer Arts Society. He is, sadly, now too busy to devote so much time to PAGE, and future issues will usually have a guest editor. Gustav will remain as Executive Editor, looking after policy and continuing as our social conscience.

## CHANGE OF ADDRESS

Alan Sutcliffe is leaving ICL: contact him in future at 4 Binfield Road, Wokingham, Berkshire. Telephone: Wokingham 1283.

## US BRANCH FIRST EVENT

**CIRCUIT**, a joint effort by CASUS, Cranbrook Academy of Art, Eastern Michigan University, the Bloomfield Art Association and the Michigan Council for the Arts is a multifaceted exhibiton/workshop/symposium to be held in April and May of 1973. An outline of the events is as follows:

**April 27 - May 27** the exhibition of computer composed music, literature and visual art will be shown at the Bloomfield Art Association Gallery.

**April 28 - 29** an invitational video exhibition and a series of talks will be held at Cranbrook.

**April 30 - May 4** the workshop involving music composition, visual arts and video will take place at Eastern Michigan University.

**May 5 - 6** the symposium with topics involving the computer in the arts, including graphics, sculpture, music, poetry, dance, film and video will be held at Cranbrook Academy of Art.

People interested in additional details of **CIRCUIT** or in submitting work to the exhibition portion should contact Kurt Lauckner of CASUS, Mathematics Department, Eastern Michigan University, Ypsilanti, Michigan, 48197, USA for further details regarding the nominal entry fee etc. All entries will be due January 15, 1973. The juror for visual arts is Robert Morris, Professor of Sculpture at Hunter College; music composition entries will be juried by Milton Babbitt of Princeton University, and literary works will be examined by John Hollander of Hunter College, City University of New York.

## CALL FOR PAPERS FOR THE 1973 INTERNATIONAL CONFERENCE ON COMPUTERS IN THE HUMANITIES

Conference Committee: Allen Hanson, Jay Leavitt (Computer Sciences), Larry Mitchell, Don Ross (English), Ray Wakefield (German), Robert Dilligan (English, USC).

The conference is to be held at the University of Minnesota, Friday - Sunday, July 20 - 22, 1973. It is jointly sponsored by the Departments of English, German and Computer Sciences.

The purpose of the conference is to provide a forum in which scholars with diverse interests in the Humanities but with a common interest in the use of the computer in their own fields can come together to exchange ideas and discuss problems and techniques of general interest.

Abstracts and inquiries should be sent to the conference secretary: Professor Jay Leavitt, 114 Main Engineering Building, University of Minnesota, Minneapolis, Minnesota 55455.

## IDENTIFY

\*\* writing in the October issue of \*:

"Queen's Park Rangers FC is truly a source of inspiration. In the immortal words of the News of the World poster, 'all human life is there!' Gavin Bryars and I incorporated the Rodney Chant and other 'QPR sounds' in a musical collage in a concert at the Purcell Room. The Musical Times reviewer asked relevantly, 'Did QPR really score in Cardew's Treatise, or was it a hallucination?'"

(John Tilbury, VOGUE).

The Computer Arts Society to challenge the Scrutch Orchestra to a game of football with handicaps.

## QUESTION FROM AN OXFORD UNIVERSITY APPLICATIONS FORM

"Will you be available for interview in Oxford at any time, and if so when?"

Give at least two answers, and comment. Be logical.

## ARS TECHNICA 1

Bob Mallary is director of a new centre at the University of Massachusetts called ARS TECHNICA: Interdisciplinary Center for Art and Technology. Its aim is to assist in obtaining funding for computer oriented projects.

## ARS TECHNICA 2

We hear a project has been founded for the photography of human excretory orifices! Something to do with the British Standards Institute we believe. The mind boggles!

## GUSTAV METZGER

Gustav Metzger's Executive Profile Exhibition is an analysis in depth of the image of society projected by the City Pages of the establishment papers (Times, F.T., etc.). He says "I am hostile to the phenomenon I'm dealing with, hostile to the system itself, and to the executives so completely enmeshed in supporting and upholding it. I also wish to expose and undermine the media which present that totality."

## ARTSINFORMATION

The group ART ET INFORMATIQUE at the University of Paris at Vincennes publish a substantial bulletin ARTINFO/MUSINFO. This contains algorithms in Algol, Fortran and Lisp. Recent issues have included procedures and articles on the analysis of harmonic relations, formalisation of colours, a minimum graphics language, generation of the dragon curve, music printing and a bibliography of physiological acoustics.

For MORINFO contact: Patrick Greusay, Department d'Informatique, Université Paris VIII, Route de la Tarrelle, PARIS 12.

## BOOKS

Knut Wiggen: *De Tva Musik Kulturerna* (published by Swedish Radio 1972). The social and historical context of electronic music is presented and Stockholm's computer controlled music studio, of which the author is director, is described. Wiggen has kept this studio in the forefront of developments in music synthesis since its inception some ten years ago.

Terry Winograd: *Understanding Natural Language* (published by Edinburgh University Press, £4). This book describes a computer approach to the understanding of English. It is part of a newly developing paradigm for looking at human behaviour, which has grown up from working with computers. When faced with highly complex and organised behaviour like language, we ask "What kind of process could be going in to produce that behaviour?" The system described in very sophisticated and is the result of many years of work in Minsky's Artificial Intelligence laboratory at M.I.T. Nature said "Required reading for any self-respecting student of Human Nature." We agree.

## PICTURE PROCESSING

IEEE Transactions in Computers July 1972 is a special issue on Two Dimensional Digital Signal Processing. There are nearly 200 pages on Image Filtering, Enhancement and Coding, an Image Feature Extraction and Classification. Subjects include Coding Colour Information, Texture Measures, Edge and Curve detection, Cloud Tracking.

## AIMS AND MEMBERSHIP

The Society aims to encourage the creative use of computers in the arts and allow the exchange of information in this area. Membership is open to all at £1 or \$3 per year, students half price. Members receive PAGE eight times a year, and reduced prices for the Society's public meetings and events. The Society has the status of a specialist group of the British Computer Society, but membership of the two societies is independent.

Libraries and institutions can subscribe to PAGE for £1 or \$3 per year. No other membership rights are conferred and there is no form of membership for organisations or groups. Membership and subscriptions run from January to December. On these matters and for other information write to Alan Sutcliffe.

## COMPUTER ARTS SOCIETY ADDRESSES

Chairman: Alan Sutcliffe, 4 Binfield Road, Wokingham, Berkshire, Eng. Telephone: Wokingham 1283.

Secretary: John Lansdown, 50/50 Russel Square, London WC1.  
Editor of PAGE: Gustav Metzger, BM/Box 151, London WC1.  
Dutch Branch (CASH): Leo Geurts and Lambert Meertens, Mathematisch Centrum, Tweede Boerhaavestraat 49, Amsterdam, Holland.  
US Branch (CASUS): Kurt Lauckner, Mathematics Department, Eastern Michigan University, Ypsilanti, Michigan, 48197, USA.

## EDITOR

This issue of PAGE has been edited by George Mallen.