

# ARCHITECTURE MACHINATIONS

A weekly newsletter of the Architecture Machine Group, Department of Architecture, M.I.T., Room 9-518, Lee Nason, editor.

Vol. II., No. 28.

July 11, 1976

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## COMPUTER ANIMATION: SIGGRAPH '76 by Paul Pangaro

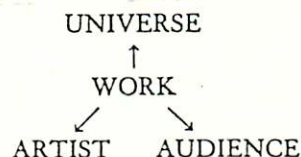
The following is the basic text from which my talk at the SIGGRAPH conference in Philadelphia will be taken. Visual sequences which correspond to subjects from the text are here replaced by figures where practical, but more often are omitted. The structure of the talk, however, remains the same.

I would like to speak in a series of "nested contexts" and ultimately to return to an initial context with one motion.

### ART and CRITICISM

Art criticism has been pursued with equal vigor as art itself for the history of man. Though not art, the criticism of art serves as a position of language and context which helps to objectify art and aesthetics.

M. H. Abrams, in the book, The Mirror and the Lamp, discusses what he calls "some coordinates" of art criticism which are capsulized in the relations in this diagram:



Almost all theories of criticism exhibit a discernable orientation toward only one relation. The classical, or mimetic, tradition views art essentially as an imitation of aspects of the universe -- hence the metaphor of art as "mirror". The pragmatic theory deals with the practical need to achieve certain effects in an audience. The act of making the internal external operates in the expressive

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theory; this results from a creative process operating under the impulse of feelings and embodying the combined product of the poet's perceptions, thoughts, and feelings. In this "romantic" view, the artist becomes a contributor to the universe through his creativity -- hence the metaphor of art as "lamp".

A fourth view, the objective theory, considers the work in isolation from all these external points of reference and relations: the work of art is judged solely by criteria intrinsic to its own mode of being. I am fond of the MacLeish quote "A poem should not mean but be."

I offer this context in lieu of some attempt at criterion or description of art or aesthetics. These require elaborate language and logic systems. Yet I feel that the history of art and its criticism offers a supporting context. This is not to judge all new art by old contexts, but to construct new contexts based on intrinsic and singular aspects of the new art using self-consistent critical foundations of previous art media.

I would like to add more informally, yet importantly, the universal criterion within art that the form of the work bear relation to its content, for the benefit of the work. In the general realm of modern visual media, this is not to require that trivial distinctions between, say, film and video be rationalized: photons versus electrons or parallel versus serial. Resolution is a more serious consideration, perhaps, even into the context of "hot versus cool" media in the McLuhan sense? But the important realm remains vision, in time and space, and this is our primary concern.

## COMPUTER ART

Moving into the context of computers and art, I will mention only briefly an implicit first principle which I think we all share and, indeed, relish and enmesh ourselves in: that computers are a valid medium for art. I think that we can argue persuasively from an analytical standpoint to satisfy the critic that this is so, beyond mechanical, repetitive, tool-like uses into instrument-like or medium-like extensions of man. There can hardly be a more elegant and first level confirmation than Ken Knowlton's remark, "We are obliged to try to use at least part of the new machinery deliberately to make our

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environment more beautiful."

Yet, the meaning of the phrase "computer art" needs to be further distinguished, in my context, from "art made by computer". I do not often see the distinction made between "art made by man using the computer" and "machine-made art". From my point of view, and from the point of view of a substantial portion of the history of criticism, the latter is a contradiction in terms. To make this distinction requires a reevaluation of theories of aesthetics, such as work toward exact aesthetics and experimental aesthetics which is now being done. These new tools of critical evaluation will advance us that much further. My bias, however, is strongly toward art as expression and toward clarity of intent, namely the artists' intent. I do not agree with those who write of computer art as "the simulation of an artistic process" and who suggest the modelling of artistic intuition by random-number generators.

John Whitney expresses this notion in these terms: "Anything that goes with random-numbers is art; and anything that has to be worked out carefully so that this goes here and this has got to go there, that's not art, that's science. But for my money it is more important and difficult to get this here and that there in the area of art, because it involves much more than just counting numbers and making it mathematically sound; it has got to be intensely and intuitively sound. That's what I'm searching for. That's what I mean by structure."

Given that context, if we now apply the critical theories to existing computer film, we find clear analogs.

The classical, or mimetic, tradition is very strong in computer animation, encompassing many of what are sometimes called "educational films". These often have as topics a concern for reflecting the physical universe, often in scientific and mathematical terms (e.g., Zajec's "Simulation of a Two-gyro, Gravity Gradient Attitude Control"). The concern for ideal situations and descriptions distinguish these films somewhat from "visual representational" films, which try more, as described in the expressive theory, to make the internal external (e.g., "Structure of Proteins", J. deRosnay). These too are often considered to be exclusively educational films, and both these classes

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(the mimetic and the expressive) are most strongly inhabited by "non-artist" individuals.

The pragmatic tradition encompasses most of the "artist-produced" films which often arise from collaborations (Foldes' "Hunger").

Of course the application of these critical contexts is not always clear-cut, and overlaps occur frequently (Ron Hays' "Visualization" of Wagner's music falls somewhere between the artist's internal-made-external and audience-response concerns).

## TOOL versus MEDIUM

There is an interesting dividing line which arises between those films produced by people who fully understand computers and can program and those films produced by artists of other fields who enter this domain and who "collaborate". My assertion is that those who understand the medium from within can produce works which exist fully inside the medium, and that collaborative efforts are frequently outside this domain.

As the literature is beginning to notice, "In some ways this makes certain of the films made by mathematicians and scientists more interesting than the artist's films." This remark comes from a monograph entitled "Computer film as computer art", by Malcolm LeGrice. He elaborates that "the need to produce a program as a means to achieving a work of art imposes one very significant kind of process on that artist, that of some kind of analysis on the component factors of his image (or output), plus an analysis of the kind of principles by which these components are brought together." He realizes that "the events which take place within the program become an integral aspect of the meaning of the product, work", but does not state the simple logical extension of these ideas. That is, utilizing this intrinsic aspect of the medium to advantage, to amplify and resonate the form and content relationships within the processes of the work, makes for the most effective use of the computer in art. The very ability of the machine to embody and express process makes it unique. The examination of analytical procedures and conceptions which programming requires is a constraint analogous to the usage of words in poetry. It is the constraint of form which liberates the artist to create within the medium. As the impedance match between

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man and machine, conceptualization and execution improve with increasing understanding of software and power in hardware; the intervention of the intermediate step of translation in the generation of code will become unnecessary.

Furthermore, we must realize that this application of the medium is not purely cold and "educational" and "analytical", for there exist very broad classes of "process" subjects. There is a continuum from the most classical, mathematical-physical realm to the most subjective, expressive and romantic. From films about vector kinematics to films about "visual harmonies", from quantum mechanics to feedback and hysteresis, from sphere eversion to catastrophe-theory based sociological models of behavior, from abstract films based on eastern religions and symbologies to a film called, simply, "Fate" (a film which would embody expressively the very core of the motion of Fate, without reference to particular persons or cultures, but only to states of being and processes).

If art is process, and strong form-content relationships support what are considered attributes in art, the computer as an art medium becomes, not just by intuitive insight, but by specific critical contexts and definitions, an ultimately "pure" art form.

## INSTRUMENT and IMPEDANCE MATCH

The "programming" aspect poses another problem. The long feedback loops created by having to express ideas in language far removed from conceptual space compromise us and restrict access for us all, especially for those who cannot program. The long and well-known history of collaboration in computer animation confuses us into thinking that the medium of expression in these situations is the computer, while I cannot help but feel that the creative conceptual space exists between the individuals involved. It is limited by their mutual understanding and is reflected in the resultant programming. Recent complex and expensive systems offer certain specific capabilities, e.g., the key frame systems which are receiving a great deal of attention now. These too will serve to confuse and tempt artists, especially into representational and "cartoon-like" computer-generated sequences, which are completely outside the realm of pure computer

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art. (I am reminded of Norman McLaren's remark, "Animation is not the art of DRAWINGS-that-move, but the art of MOVEMENTS-that-are-drawn. What happens between each frame is more important than what exists on each frame." Key frame systems help do the former; they will be a rich tool when they help do the latter.)

### VISUAL and PROCESS SPACES

One way of viewing the problem of "interaction" with a machine is the model of a continuum of all possible descriptions of one particular thing. One could ludicrously begin animating a sequence by describing the molecular structure of film; charge packets moving in integrated circuits; to the PL/1 and LISP code which we now must write; to the diagrams and scribbles which are references to our conceptual ideas and intuitions; and so on to the end description, the product, the work itself. This whole range defines and determines that with which we are most concerned.

Now in animating, I need to choose clearly the level on which I think, feel, and work. In an effort to amplify the visual-conceptual, process-product relationships of the kind I am concerned with, I am designing preliminary experiments leading toward the development of a system which will allow manipulations on and feedback between two of the stages available in the continuum of description: (1) the visual space itself, using graphical-input techniques and inference-making tools under development in our research group; and (2) process descriptions which, at their present primitive level, appear similar to high level flow charts.

The essence of the system, though, lies in its interactive qualities. Specification of a sequence in the visual space yields a machine-generated description in the process space. This can be manipulated, changing connectivities, relationships, functionalities. These changes can then be viewed in the visual space; further changes can be made; and so on. Inferences about related processes which the machine can attempt to draw will remain primitive for some time, but the attempt itself will afford a juxtaposition of artistic conception with another way of looking at relationships in the processes involved. If assumptions about the nature of the richness of the computer pallet are correct, this fast iteration between cause and effect, process and product, and form and content will afford an incredible learning

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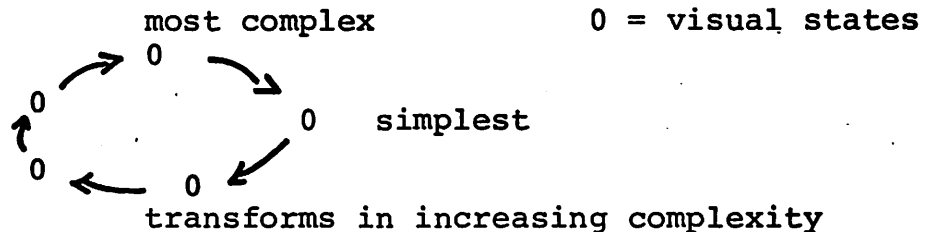
## COMPUTER ANIMATION: SIGGRAPH '76 continued

experience within a self-teaching, all-user-contributing environment.

### AN EXAMPLE

Ah, but short of all those man-years of effort in research and development, and the inevitable re-evaluations and new understandings, I am left with a raster scan machine, PL/1, and my thoughts. Though I would like to work toward a film called "Fate", and many more capricious ones before that, I can for the moment, with the tools I have, offer simple examples of a pure process visualization, which will serve to complete the structure of this presentation itself.

Imagine a class of problems of the following type:



The diagram indicates a series of states, which I wish to constrain in the following way:

First, let us agree that there is one state which is the simplest in some domain. We choose the visual domain.

Second, let there be a clear series of transforms from one state to the next, completing a circular structure. And third, let these transforms be in some clear order of increasing complexity. This leads to a tension and release at one particular stage, the stage at which the most complex and most simple are adjacent. Thus, we have here a primitive expression of the idea that the simplest and most complex things are nearby and closely related, and, in fact, that each is simply a stage in a continuum.

On the following three pages is a spatial embodiment of this example.

Here, in the color domain, is a similar exploration.



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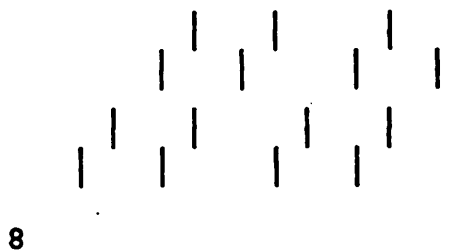
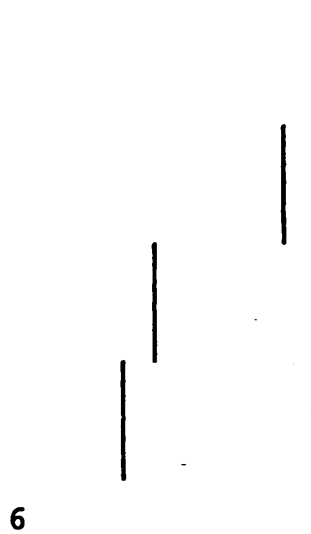
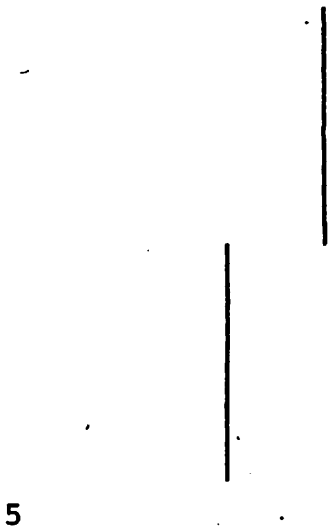
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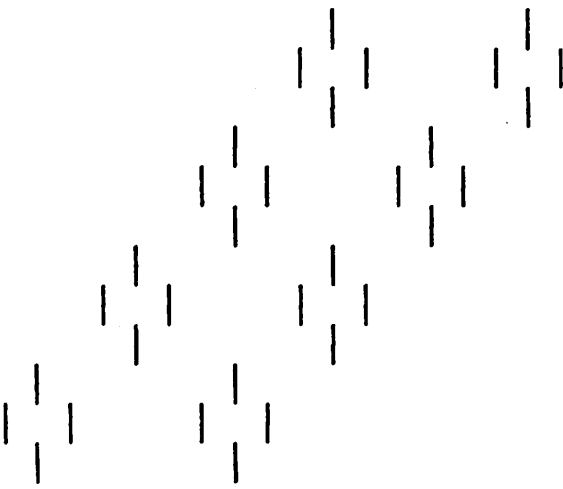
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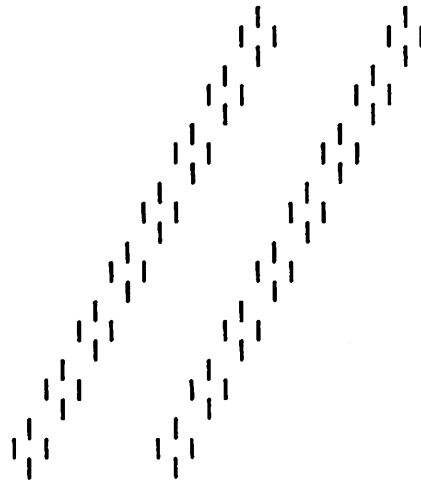
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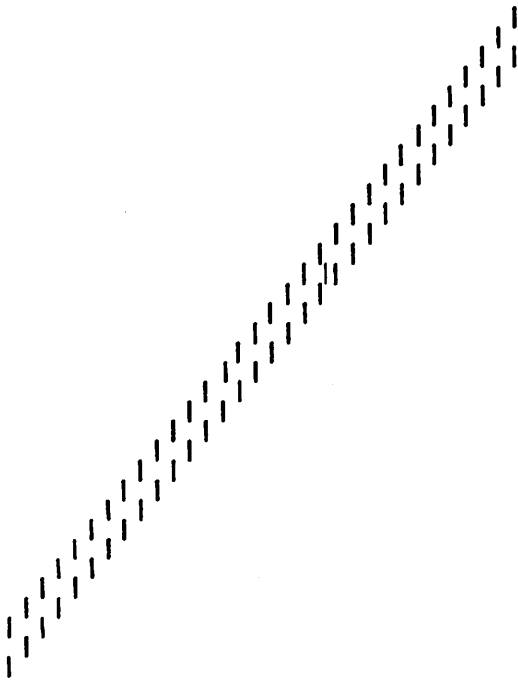
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As it turned out, when I proposed this simple class of problems to Seth Steinberg, a researcher in our group, the very next day I found some listings and a note containing an analytical expression and the quietly triumphant remark: "They are the same program." As well they better be.

The expressed domain in the second example is deeper into a three-dimensionality of the intensity, hue, and saturation/metric space of color, based on work by Chuck Libby, also of our group. The abstraction here is greater, and is tied less, both in execution and in one's experience of the piece, to the earlier diagram and verbalizations. In fact, we are almost forced into judging it, in the objective theory of art, for what it is alone: an expression of pure, if obscure, process.

But here is the enormous pitfall of the modernist view, and we must be careful, particularly with what the popular press calls "de-humanizing machines", to preserve the human celebration that art is.

### RETURN

We return to the widest context. In using computers to make art we use a medium with the validity of language art, fine art, and performing art, for the breadth of these generic types is the appropriate scale for the computer medium.

In their anthology "The History of Aesthetics", Gilbert and Kuhn ask, "What then do art and beauty mean? After submitting to the discipline of history the authors must say: Their meaning is not within the four corners of any one or two propositions, but is that fullness of significance which distills from the long sustained process of all the definings. Who today would say where beauty lies? It is neither in Athens nor Strassburg, but in all the places where there has been an objective counterpart of an authentic esthetic feeling. The meaning of art and the meaning of beauty are similarly within the dialectic of the whole manifold of philosophical systems and styles."

My thanks to all the members of the Architecture Machine Group, especially Seth Steinberg, Chuck Libby, Larry Stewart, Andy Lippman, and Nicholas Negroponte.

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## SOFTWARE NOTES -- NEW BICENTENNIAL MAGIC by Seth Steinberg

The new MAGIC is MAGIC4.3a. It fixes a good number of bugs and adds a small number of new features. It should be noted that

- a) the SNAIL and GUARD commands have been merged with the PROFILE command;
- b) the PROFILE command has a few new options including
  - i) IMAGEIO or II, which allows real image I/O to the paper tape devices, and
  - ii) BOMBOUT or BO which bombs you out of an exec on a bad command so that you don't have to look at screens full of "?2.3.,.?4.7 a" and the like when a program runs awry;
- c) the "mapping" hack works on the 85 and the new 7/32;
- d) on the fixed head disk there is an experimental MAIL command which uses the MAIL.directory; documentation for the MAIL command is in EXL.; MAIL. will be kept on the fixed head disks because they are always mounted; the current MAIL command has many crocks, but JRD will fix many of them shortly;
- e) TINT, for TINT IS NOT TECO, is up in a very primitive form; contact me for documentation; TINT is an experimental subset of TECO with a few small differences so far; it may be risky to use; if you know TECO you may want to try it; remember that backslash is used instead of altmode;
- f) a lot more of PL/1 works; you may no longer have to declare builtins; I have done some more testing and it seems to be fixed, I'll stay tuned for a relapse;
- g) TV users should no longer have to type FIXTV, but check with BM about this before you rush ahead; -REGS n on the newproc line does set the value;
- h) there is a new file system error which will attempt to catch bashed-in core file system data bases; if you get an AFCB system error, give up; you shouldn't be able to SuperClose, and may not be able to NEWPROC, but at least the disk may not be bashed; and
- i) PLOD works better, but .0 only takes primary names; on the other side, it's much harder to confuse.

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## SOFTWARE NOTES -- NEW BICENTENNIAL MAGIC continued

Coding for MAGIC 6 is now mainly in PL/1 and a good number of 32 bit code generation gritchies have been resolved. The file system is being typed in and modularly being debugged and designed. It may be usable in September, but no one wants to promise anything.

Also, this week an unnamed party, noted for complaints that no one knows what is going on with the system, expressed surprise about the existence of the NEWS command. The NEWS command has been around for at least four years now. Systems people and people who notice problems should update it and the message referring to it. Contact me if you have questions.

## TSD NOTES by Steve Lang

The TSD (Touch Sensitive Degitizer) is up and running these days. For the present it is attached to Imlac 3C. The control function for the device is implemented in software in the form of an interrupt-driven program, (TSD.SGIM) which, once started, runs continuously in the background. This program takes care of catering to all the idiosyncracies of the TSD and makes available to the graphics software an x-y-z-coordinate set, similar to the Summagraphics tablets. The use of software to control the device, besides making it easier to build, also allows us to experiment with the control algorithm without unwrapping and rewiring the control board each time. Our version of the TSD hardware also has some features that the Instronics hardware did not. For example, it returns the locations of the first four echoes rather than just that of the first. Hopefully, this along with some sophisticated software, will make it possible to solve the multiple finger problem.

In the future we plan to expand the hardware associated with the TSD by adding a microprocessor controller to take the place of the TSD.SGIM. This scheme will retain the advantage of an easily changed control algorithm (by giving the central processor direct access to the microprocessor's memory) while having the added advantage of taking the interrupt load off the central processor (about two thousand interrupts per second).

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## TSD NOTES continued

When this microprocessor is installed we plan to add to its duties the task of operating the head positioning gear. This device works by having the operator wear a headband with an ultrasonic transducer attached, which is continuously sending out ultrasonic pulses. There are three receivers consisting of microphone, filter, and amplifier, which pick up the transmitted pulses. The position of the transmitter is determined from the time delays between the transmitted and received pulses. We hope to give the microprocessor the jobs of controlling the device and of transforming the data into a more usable system of coordinates.

## FILMFEST by Paul Pangaro

In recognition of our imminent departure for the SIGGRAPH conference in Philadelphia, on Monday, July 12 at 4 P.M., we will show

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per mu ta tions

Matrix

Matrix III

by John Whitney

Yantra

Lapis

by James Whitney

Binary Bit Patterns

Yin Hsien

by Michael Whitney

John and James are brothers; Michael is John's son. All but two of these films are computer-generated (analogue and digital) and many are considered important films in the history of computer and abstract film. The atmosphere will be charged with phrases like "polygraphic phenomena", "scientist of the soul", and "cybernetic art"; but it will be interesting anyway. Location is tentative; check outside Anne's office for a notice of place. Come!

## QUOTE OF THE WEEK by Seth Steinberg

"Unfortunately the 85's memory is not what it was five minutes ago."