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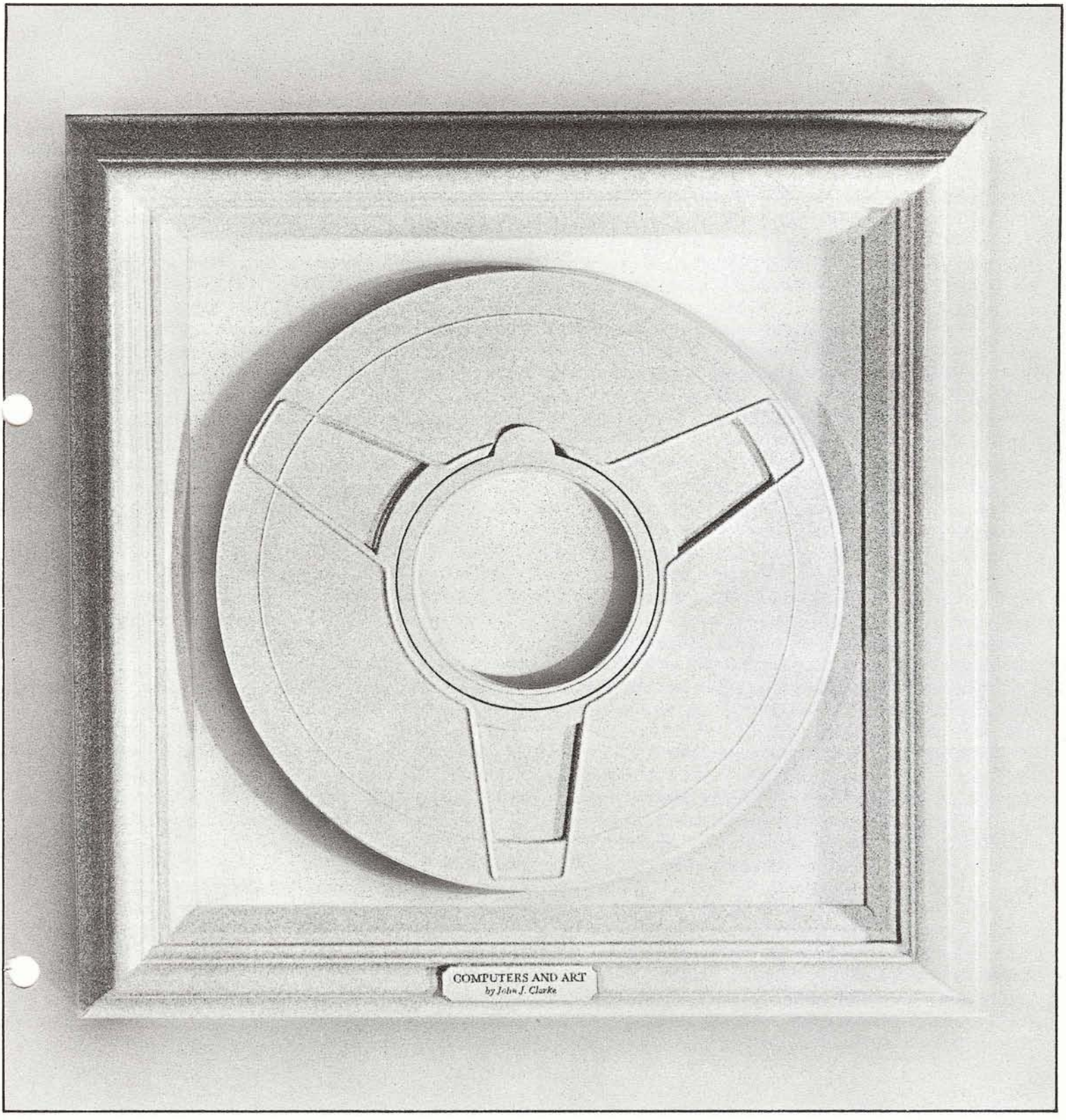

COMPUTERS AND ART

by John J. Clarke

Take a wheel.

When it was first fashioned — probably out of stone — it was kind of homely and somewhat practical. Gradually, the wheel took on a more finished shape and its uses for hauling building materials, weapons, grain or people revolutionized the history of man.

But the creative mind that formed the wheel had other needs — needs for sport, diversion, art. The ox-cart wheel may have come first, but today you're more likely to think of wheels as something under a sleek sports car or stubby wheels to convey a golfcart around a green; maybe even roulette wheels.

Sure it's farfetched. Wheels are still basically used to lighten man's load — but as technology moves many people out of the grind of continuous labor, man's load becomes less a physical thing than an excess of leisure time.

That's about the way it is with computers. Basically the computer was designed to process data rapidly and retrieve information. And the early vacuum tube computers — with memories literally the size of a small room — did just that. Today's solid state, silicon chipped, fully compiled computers do it even better. In the essential areas of food and industrial production, in education, defense, medicine, banking, and communications, the electronic computer is the heart of contemporary systems.

But there's a lighter side to the computer's role of late, a side that's a far cry from the popular view of an omniscient, frigid, calculating machine — it's the creative computer.

Well, not really. But in fields as diverse as cartoons and the classics, music and photography, the computer is playing a new role and, from all reports, enjoying it.

MECHANICAL-ANGELO — THE VISUAL COMPUTER

What happens when you weld the current state of electronic art with traditional art forms? The sounds of progress, widely popularized by the Beatles **Sergeant Pepper,** come screaming, whining, whinnying, and growling out of car radios, transistors, juke boxes and home stereo systems. Join the electronic sound to strobe and black lights, random projected light, light boxes, etc. — and you've got the elements of the psychedelic scene now common throughout the United States, Europe and parts of the East.

Experiments in art and technology seemed a solid enough idea to generate an organization called, aptly enough, Experiments in Art and Technology, Inc. (EAT), formed jointly by artist Robert Rauschenberg and Bell Labs physicist Dr. William Kluver.

The organization put on a show late last year, featuring films covering the computer potential in theater and engineering, a host of sculpture and audio productions in which technology guided the artist's hand, and a computer drawing of a nude. The prospect of mating art and technology has gotten the blessings of the New York State Council on the Arts ($8,000) and $1,000 annual contributions each from industrial patrons such as IBM, ATT, Atlantic Richfield, AFL-CIO, the National Maritime Union, Transport Workers, and Essex Wire.

INSTANT ARCHIVES

The museums have been quick to see the computer's potential usage. Fifteen New York City Museums, along with Washington's National Gallery have just launched the Museum Computer Network. The Network is scheduled, within three years, to bank all data from museums in the Northeastern United States — at a cost of $4 million. This central file for art — similar to the Library of Congress file for books — will be, according to Everett Ellin, project director, an indepth archive . . . listing artists, titles, descriptions, and bibliographic references.

"All a teacher lecturing on Greek sculpture would have to do," says Ellin, "is go to a console, dial a code number and have pictures and an arsenal of information about Greek sculpture available the instant it's needed."

Jack Heller, director of New York University's Institute for Computer Research in the Humanities, is supervising the technical end of the project. Heller thinks that computers will produce new Renaissance people. Ever since the Industrial Age began, we have been fragmenting our knowledge in specialized fields. "Once we have worked computers into all fields of the humanities and sciences," he says, "people will have an immense new variety of knowledge, and this will lead

to new correlations and new concepts."

The Metropolitan Museum of Art has a number of different computer uses on stream currently. Computers are used to classify Egyptian pottery, make chronological tables of an artist's work based on evolutionary developments in his style and have even invaded the medieval quiet of the Cloisters to develop a computer program covering all available data on the 12th century Bury St. Edmunds Cross, one of the greatest Romanesque ivories in the world.

In fact, the use of the computer in the art world was the subject of a conference held last month at the Museum, sponsored jointly with IBM. Several applications in this field were discussed at the meeting. In one experiment, computers are being used to classify and compare sets of coded marks that appear in the patterns of Sevres, an 18th Century French porcelain that is commonly forged.

A new computer system is also being used to study aerial photos of Southeastern Utah to help plot potential archaeological excavation sites and spot previously overlooked pattern relationships. Information about the artifacts found in the excavations is input to the computer for classification, analysis and retrieval.

Leslie Mezei, an associate professor at the University of Toronto, described how the computer can be programmed to produce art in various forms — realism, impressionism, expressionism — via a graphic plotter.

GRAPHICS

The presence of a gentle computer "hand" on the drawing-board has led to some pretty way out graphics. William A. Fetter, director of Computer Graphics at Boeing,described a process whereby views from a cockpit at varying distances, from say a refueling approach or an airfield, can be drawn by a computer program. In itself, the computer pictures are fairly amazing in detail and perspective. Even more amazing, is the fact that these cockpit views were constructed for an airplane that has yet to be built.

One application of this computer graphics system is to display landing approaches on a screen in the cockpit during flight. These images would permit visual landings in poor weather, faster than direct observation through the cockpit window.

The visual computers are also designing magazine covers, (Fortune, Data Processing Magazine, Print), setting type, proofreading, designing buildings, and visualizing complex physical phenomena.

SNOOPY vs THE RED BARON

But the visual computer has been turned to less artistic projects — as Snoopy may discover in his next raid on the Red Baron. Computer Animation is rapidly being adopted by industrial and educational cartoonists. The computer developed animation replaces a lengthy hand process by fixing a stop-action animation camera shutter on a cathode ray tube. Film advance controls are connected electrically to the computer. Cost of the computer produced animation strip, according to Dr. Douglas A. East, Director of Research for Joseph Kaye & Co., is usually far less than hand animation, depending on the complexity of the material to be animated. Costs range from $400 per minute of finished film up to $2000 per minute for very complex work.

It's probably fair to say that years from now art historians will look at this time as the renaissance period of computer graphics—replacing the primitive period in which typewriter designs made of X's and O's crudely pictured figures and shapes.

And instead of the DeMedici's, this renaissance has Experiments in Art & Technology, Inc. EAT is currently offering $3,000 for the best contribution by an engineer to a work of art produced in collaboration with an artist. Two second prizes of $1,000 will be given and the selected works will be included in an exhibition "The Machine" to be held at the Museum of Modern Art in New York this fall. The real hitch may be in finding an artist to work with.

An intermedia group, called 212, in upstate New York is currently experimenting with computer graphics under the general direction of Robert Liikala. They have artists and need programmers and engineers.

Maybe a computer dating service would do the trick.

COMPUTER AIDED DESIGN

Application of the computer's artistic talents to commercial and industrial uses is inevitable—like the Computer Aided Design (CAD) services offered by CUC.

CAD ranges from semi-automated systems to a fully integrated design automation system, capable of taking schematic drawings and producing production-ready camera-ready designs.

One of the most significant areas of application for CAD is the design of printed circuit boards—although CUC's computer aided design systems are also used in circuit validation, engineering documentation, and have designed products that are driving plotters, drills, wire-wrapping equipment and circuit testers.

Printed circuit boards are the things that make so many miniaturized items possible—TV sets, record players, transistor radios, space ships and, of course, more and more powerful computers using less and less space.

BACH, BEETHOVEN AND BUGS

It's possible, by searching around a bit, to place computer music before the classical epoch by fixing on Athanasius Kirchner, a 17th century German mathematician. Kirchner, an amateur musicologist, built a composing machine with numerical combinations that could dictate varieties of pitch, rhythm and tempo.

Contemporary computer composer-musicians (compusicians) do much the same thing. Compusicians feed instructions to the computer referring to various parameters of a musical tone—pitch, duration, timbre. These instructions are transformed into a series of numbers which become electrical impulses generated by the computer.

Composer Vladimir Ussachevsky believes, ". . . the computer has wonderful potential as a total music production tool. The music can be composed by computer—the University of Illinois has done much work in that area—and its sound production synthesized by computer—Princeton, along with Bell Labs has concentrated its efforts in this area. There are still a lot of bugs in the system, of course. After all, there are still bugs in Lord and Taylor's billing. . . ."

In another direction, Jean Claude Risset, a young French physicist/composer at Bell Labs, is turning the computer's virtuoso capabilities to the duplication of traditional instruments. Risset reportedly created a computer trumpet sound that professional musicians could not distinguish from an actual horn. The possibilities in this kind of application are endless for the composer. He can write impossibly difficult passages for instruments that, until the advent of computer usage, would never be heard. The normal instrumental limitations would be overcome—by a computer programmer.

There is no reason, however, for musicians to despair. At $645 an hour—plus sophisticated programming and operational support—the computer is hardly forcing musicians to welfare rolls.

Sound-producing computer programs—as much of compumusic—started at the Bell Telephone Laboratories. The original programs, under the direction of Max Mathews, were in the direction of engineering accomplishments—rather than fugues and cantatas. The first computer sounds reached the general public about five years ago via a record, **Music from Mathematics.** Original Bell Lab music programs handled an enormous output. Even using the powerful IBM 7090 computer, each second of music generated required 10 seconds of computer time.

A NOTE ON COMPUTER MUSIC

The only notes J. S. Bach had to worry about were on a staff. Today's computer composer has to worry about the form and structure of music—along with a host of technical notes pertaining to kilocycles, cutoffs, sampling rates, filters, etc. Normal computer output is in digital form, a string of binary numbers that has to be converted into voltage values. This is done through a digital-to-analog conversion—much as traditional composers would transpose music from one key to another, or rewrite a piece for different instrumentation.

A hint as to future directions to be taken by the artist-programmer may have been revealed at a recent exhibit at the IBM Gallery in New York. There, the "look" of sound was revealed through film and photograph. Based on the work of Dr. Hans Jenny of Switzerland, the exhibit bridged music and design as the patterns of sound were displayed on a host of different materials.

Musical tones drove viscous liquids on vibrating membranes upward into surrealistic figures, and dyes in liquid formed rotating whirlpools in response to musical vibrations. The intermedia computer—experimenting and synthesizing—is just a step away for the long-haired programmer.

THE LONG SHORT CUT

The **Long Short Cut,** a novel by Andrew Garve, is reportedly the first work of fiction to be set in type by computer. Published by Harper & Row, the book carries this colophon:

> The text is set in 10 point Videocomp Janson, using the RCA Videocomp and computer system. The type was composed in completed page forms, written with an electronic beam on the face of a high resolution cathode ray tube at speeds of up to 600 characters per second.

Prior to the introduction of computer typesetting, the fastest book composition, according to Peter Mollman, trade production manager of Harper & Row, was about 10 characters a second.

Here's how it worked: Harper & Row editors marked the Garve manuscript with traditional copy signs and directions. This annotated manuscript was transcribed on tape which was run through the Videocomp. The Videocomp read the tape and produced the resulting characters with an electronic beam on a cathrode ray tube and exposed them onto a sensitized film.

Corrections were punched on cards and automatically merged into the original tape. According to Mollman, it was less than 10 minutes from the time the first punched tape was fed into the computer until the first page was produced. Continuous pages were produced at less than 10-second intervals.

One of the benefits of the system is the relatively easy and inexpensive means of changing copy that has already been set. **The Long Short Cut** was first set with fewer pages than anticipated. Harper and Row reduced the line length and reset the entire book, a procedure that would have been unthinkable in normal book production.

In addition to typesetting, the literary computer is active in preparing glossaries, translating books, cross-referencing literary research, and aiding in the seemingly endless battle of controlling the information explosion facing the Nation's libraries.

For many years CUC's technical assistance has ameliorated the increasing cataloguing problem presented by the vast amounts of literary and scientific data amassed by our libraries. Working with both industrial and Government clients in this area, CUC is simplifying the operation of libraries and making their resources more easily accessible through automatic processing and maintenance.

DIVINE COMEDY — NOT SO FUNNY

The problems faced by literary researchers are also becoming simplified by computer usage. Take a classic poem that has over 101,000 words and 14,233 lines. Then run it through some 300 versions and try to figure out which version is most nearly correct.

That has been the problem plaguing students of Dante's **Divine Comedy.** The literary sleuths now have a formidable ally. The National Electronic Computer Center at Italy's Pisa University has broken down the poem with the help of computer usage. The result is a volume "about the size of the Manhattan telephone book" containing tables that list each word's location in the poem.

Other tables include an alphabetical arrangement of each word used to start a line, a reverse dictionary in which each word is listed by its last letter first, and a rhyme glossary containing every word that ends a line.

With this tool, literary scholars can now apply sophisticated internal linguistic techniques to come up with the version Dante himself wrote.

The future of the computer in art is boundless. At the beginning today, right now, the computer is proving to be a revolutionary tool to the graphic designer, artists, the composer, and men of letters. Just as the computer becomes the subject itself in a bestseller like John Barth's **Giles Goat Boy,** the computer is determining directions taken by artists in diverse areas.

Maybe the avant garde of the "Seventies" will be more likely found in the antiseptic, air-conditioned halls of computer rooms than the cafes of the Left Bank or Greenwich Village. That time has passed and a new time, matched by the new technology, is creating new art forms.

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