NEWS

AARON, the Robotic Artist Premieres in Color

I**t's taken me 20 years to teach AARON how to draw. How can I possibly teach it to color before I die?**

—**Harold Cohen, 1989**

In his studio at the University of California, San Diego, Cohen tests his painting machine. On the wall is a portrait drawn by AARON and hand-colored by Cohen.

Remarkably, Cohen has—and only six years later—accomplished the task, at the University of California, San Diego, where he directs the Center for Research in Computing and the Arts. "AARON," an expert system with its own painting machine, built by the celebrated artist, premieres at the Museum on April 1.

Every day until May 29, the computer-driven robot controlled by AARON will create a painting.

Each morning, Cohen will review the drawings composed during the night on a Silicon Graphics workstation, and choose one for the day's work. The file containing the chosen image will then be sent to a 486 computer controlling the painting machine, a flatbed device that moves a small robot arm around a 8-ft. x 6-ft. table and is equipped with an array of different-sized "brushes," bottles of dye and mixing cups.

The machine will mix the colors from a palette of selected hues that can be diluted to achieve desired luminosities. Grabbing a cup, AARON places it under a bottle, opens and closes the dye tap, puts the cup in a holder, picks up a brush, dips it in dye, and paints. Over three or four hours, a 25-sq.-ft. colored image will emerge. These paintings mostly depict imagined people—"sometimes looking remarkably like people I know," said Cohen.

Dialogue: Cohen and Computer

"Harold explores creativity as no one else has—by programming a computer to create a model of art-making that proves itself by making art," said Pamela McCorduck, author of *AARON'S CODE: Meta-Art, Artificial Intelligence, and the Work of Harold Cohen.*

AARON represents "the most intimate, sustained dialogue any single human being has ever had with a computer," said McCorduck. This dialogue started in 1973, when Professor Ed Feigenbaum invited Cohen to Stanford's AI Lab. He stayed two years, probing the question: What is the minimum condition under which a set of marks acts as an image? His explorations led to the birth of AARON. Embodying ideas from AI and rules derived from Cohen's experience as an artist, AARON has evolved from a few rules generating simple shapes to composing complex figures, requiring detailed knowledge, both of its subject matter and of the methods of visual representation. The program draws autonomously, relying on its own knowledge, on a branching structure of rules and on feedback paths from what it has done to determine how to proceed.
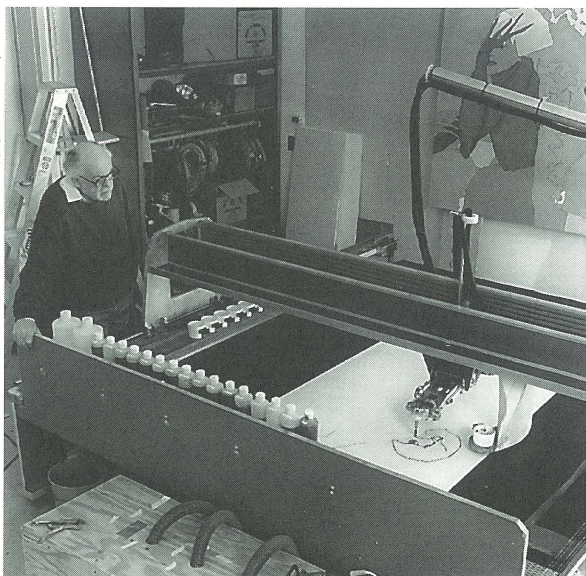
Cohen began writing the program in C, running it first on a DEC PDP-11/45, later on a VAX 750. By 1985, when he moved to a MicroVAX-2, AARON had drawn its first human figure.
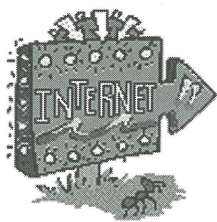
Challenge of Color

It troubled Cohen that a program smart enough to create original drawings could

NSF Grant Spurs Development of On-Line Museum

I am delighted to announce that the Museum is moving forward at full speed to integrate computer networks into our education services. A two-year $419,402 grant from the National Science Foundation will be used both to implement our plans for an electronic presence and to explore new territory.

In Phase One, the Museum will provide on-line access to selected exhibits such as the Internet Sampler, which includes pages on a host of Internet issues such as privacy and access. The historical timelines in both *ROBOTS & Other Smart Machines* ™ and *The Networked Planet*™ will be available. The Museum will post the catalog of the historical collection and a selection of the documents collection. Press releases, news, announcements of events, membership and visitor services and full administrative information about the Museum will also be on-line. Tap in by pointing to: http://www.net.org/

The Museum will launch a second experimental phase by convening a distinguished group of advisors drawn from industry and academic institutions. The goal is to determine how networks can effectively extend the Museum's educational mission to the ever-increasing millions of people and institutions with Internet access. The challenge is to develop compelling interactive experiences that exploit the special nature of networks and the Museum's unique approach to exhibits. This phase will last two years and culminate in the opening of the On-Line Museum.

In the meantime, the Museum's two major fundraisers have become completely intertwined with digital networks. The Computer Bowl® will link teams on each coast together in real time as they wrestle with questions posed in "cyberspace" (see page 3). And the Internet Auction will use brand-new World Wide Web auction software to offer pictures of the items and make participation more exciting with a real-time view of bidding (see page 6).

These events usher in an age of network interactivity beyond video conferencing and picture phones. The Museum's challenge is to develop a new and exciting kind of experience for tomorrow's virtual visitors. Share your ideas with us, on-line or off, as we establish our Internet presence.

Oliver Strimpel
Executive Director
strimpel@tcm.org

AARON *(continued from P.1)*

not color. But color is staggeringly complex. Since AARON can't see, writing the program is a bit like telling someone over the phone, "use this bright red," when you know he can't visualize exactly the shade and intensity red that you see. Cohen observed, "The central problem is that we don't deal with color symbolically, as we do in thinking about subject matter or composition. In writing the program, however, I can only deal with those aspects of color that can be represented symbolically."

He began by developing a set of strategies for coloring on the screen of his Silicon Graphics workstation, writing in Lisp. But coloring in this domain involves additive mixing, and the next task was to translate these strategies into terms appropriate to the subtractive mixing of the actual dyes he would use with the painting machine. Then, Cohen had to build a robot that could mix and spread colors in a style befitting a fine artist. Problems arose—from finding archival paper that wasn't too heavy for hanging to trying to make the machine quieter.

Quest

In 1968, when Cohen was in full command of his art with a "reputation as a painter equal to that of any British artist of his generation," according to Michael Compton, Keeper of Modern Painting at London's Tate Gallery, he left that world. "He had all the accolades, but the quest—to express what he knows and sees—took him somewhere else. The quest is the same. He just changed the means of achieving it, choosing the more difficult path," said McCorduck.

A limited Museum Edition of signed Cohen paintings will be available in the Museum's auction on the World Wide Web, starting May 22.

The Robotic Artist: AARON in Living Color is being sponsored by Gordon and Gwen Bell, American Airlines, the American Association for Artificial Intelligence, and Silicon Graphics.

The Computer Bowl 2.0 in Cyberspace

On the West Coast (at the Santa Clara (CA) Convention Center), Brenda Laurel will ask questions of the players.
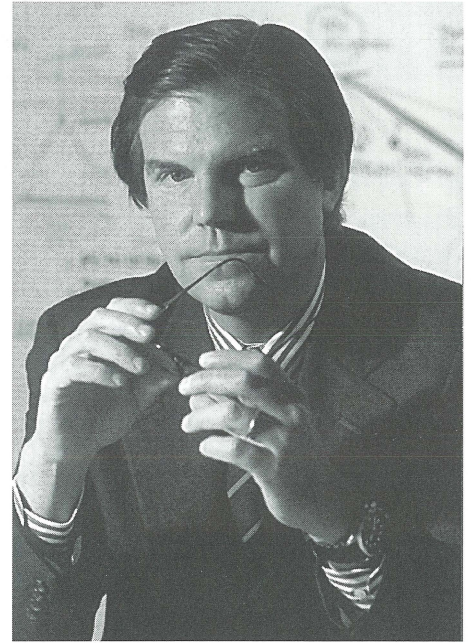
Nicholas Negroponte will be posing questions at the World Trade Center in Boston.

The first series of five Computer Bowl games ended brilliantly last May. By the time the 1994 All-Star Bowl was all over, The Computer Bowl® earned a place in computer industry lore and a total of more than $1.7 million over five years for The Computer Museum's educational programs. The challenge for this year's Bowl, to be held April 20, is to sustain the momentum and expand the Bowl's reach to help meet the ever-increasing needs of the Museum's educational programs.

To meet that challenge, Presenting Sponsor Apple Computer, Electronic Cafe International and America Online are joining with PBS' "Computer Chronicles" to broaden the Bowl's reach. Electronic Cafe will spearhead the Bowl's move to "cyberspace." In essence, the East and West teams will stay on their respective coasts and play the game via the latest in communications technology: high-speed audio and video transmission lines. On each coast, computers will handle the video, sound and particularly the players' buzzers. Using T-1 transmission lines, the computers will exchange their audio and video data real-time so there is no perceptible time delay.

Simultaneously, thousands of America Online subscribers will participate real-time from their personal computers as the service will make the questions available as soon as they are read to the teams. Participants will be able to score them-selves against the real Bowl players to see how they match-up. Prizes will be awarded to the highest scoring on-line participants.

"It's a natural step for The Computer Bowl to use new technology to enhance loyal Bowl fans' sense of presence at the event, as well as interest new audiences. The Computer Bowl is an important event, and this kind of innovative attitude will ensure that it survives," said Brenda Laurel, celebrated 20-year industry veteran. Laurel and Nicholas Negroponte of MIT's Media Lab will share the duty of asking the questions of this year's Bowl players. Chris Morgan will serve as "Game-Master."

The 1995 Bowl players are an exciting mix of personalities and talents. For the West Coast, the players are: Eric Benhamou, president & CEO, 3 Com Corporation; Steve Blank, president & CEO, Rocket Science Games; Andy Hertzfeld, vice president, General Magic Corporation; Roel Pieper, president & CEO, UB Networks; Cheryl Vedoe, president & CEO, Tenth Planet.

The players for the East Coast are: Joseph Alsop, president & CEO, Progress Software; Katherine Clark, CEO, Land-mark Systems Corporation; Paul Gillin, editor, Computerworld Magazine; John Landry, senior vice president, Lotus Development Corporation; Carl Ledbetter, president, AT&T Consumer Products Division.

This year's game will also become more visually stimulating for television audiences. The new format will make use of "virtual sets" sponsored by Intel Corporation. The players will appear to be playing from deep within a computer with the specific location in the computer changing for each new quarter. The teams will actually be at the Santa Clara (CA) Convention Center and Boston's World Trade Center.

In addition to the companies listed above, sponsors for this year's game include: American Airlines, Association for Computing Machinery, Cirrus Logic, CKS Partners, Computerworld, Cunningham Communication, Kleiner Perkins Caufield & Byers, Powersoft Corporation, Price Waterhouse, Progress Software, Silicon Valley Bank, Stratus Computer, UB Networks and Visix Software.

For sponsorship and ticket information, please contact Carol Welsh, director of the Museum's West Coast Office, at (415)323-1909 or e-mail her at: welsh@tcm.org

THE NETWORKED PLANET Opens

Since *The Networked Planet* opened in November, attendance is 50 percent higher than it was last year. Excitement over the $2 million exhibit was sparked by widespread media coverage and the Museum's first-ever television ad campaign. A series of Boston Globe stories culminated opening day in a front page "Living/Arts" feature. A two-day visit from Gerd Meissner of the German news magazine, Der Spiegel, produced two features. The AP, NPR, BusinessWeek, and local TV also covered the exhibit. With donations from WBZ-TV and the sponsorship of Lotus Development Corporation, a brilliant 30-second TV spot took viewers down a futuristic Information Highway, composed of screen images from the exhibit.

The exhibit, a microcosm of global networks, is linked via Novell's NetWare. After visitors log in, choose a Network Guide, and decide to share their information with other visitors or keep it private, their activities are tracked throughout the exhibit and a report is given at the end. Live data feeds of the FAA, an ILX system and NEXRAD provide instant access to large-scale networks used to manage air traffic, track transactions on the New York Stock Exchange, and forecast the weather. The exhibit also offers an introduction to the Internet and on-line services through first-hand experiences. The critical link onto the Internet is maintained by a Stratus fault-tolerant computer via Sprint T-1 lines.

For Harvard Community Health Plan's Dr. Bob Kupsc, the exhibit's interactivity is its strongest suit. "Visitors actually experience and learn more than if I just tell them." In January during a special weekend of hands-on demonstrations, Dr. Kupsc showed Jerry Kutcher of Tewksbury, MA, how to design a healthier work environment, using the exhibit's model office area. "I knew what I was doing was wrong. But I didn't know how wrong," said Kutcher, who can now relieve his neck pain by simply adjusting his terminal.

The Networked Planet meets an educational need of school groups. Seekonk High Computer Literacy teacher Peg Cassels explained that her school had just put in a computer lab. "This exhibit is the most interesting, informative thing I've seen on networks. It gives kids a real taste. Next time, I'll plan a three-hour visit, not two."

The Networked Planet gives people the opportunity to understand what the information highway really is. This exhibit is the cutting-edge example.

—US Rep. Edward Markey (D-Malden)

In December, Congressman Markey, outgoing Chairman of the Subcommittee on Telecommunications and Finance, joined students for a tour of the Information Highway. The exhibit's treatment of privacy prompted a spirited discussion. Markey noted that the real world does not give the same choice of privacy as the exhibit. From the left: Executive Director Oliver Strimpel and US Rep. Markey explore the Internet Sampler with students.
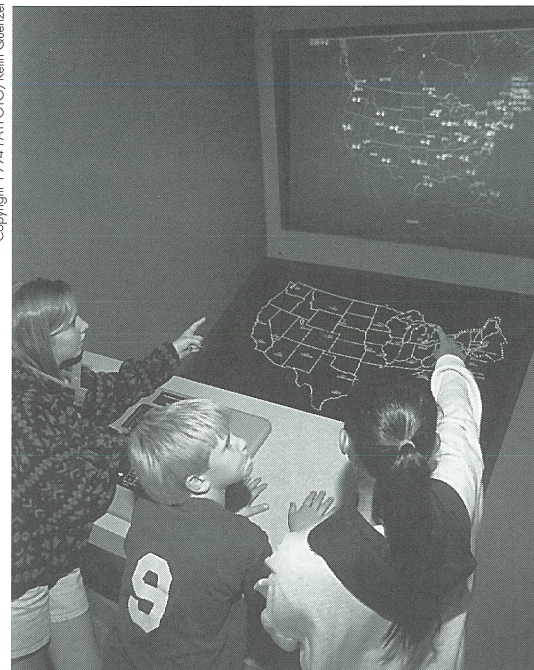
Young people discover how the FAA uses computer networks to manage air traffic across the United States. An up-to-the-minute feed provides access to the actual data used to resolve congestion. A screen display shows all of the commercial flights in the sky at that moment. Visitors can zero in on one airport to see what is landing.

Visitors use a Key Card to log onto the exhibit's network. After deciding if their Network Guide's speech will be captioned in English or Spanish, they type in their name. They choose to share this information with other visitors—which allows them to "peek" at others—or keep it private. Those who share can press the "Who's Out There?" button to see where other visitors are and read their personal information. The Guides discuss the societal impact of networking.

Using a program that simulates the S.W.I.F.T. global banking network, visitors discover how rapidly and safely $1 million can be transferred from Holland to Boston. They also experience the volatility of global markets by seeing how rapidly prices fluctuate as they try to invest $1 million in stocks and art.

Auction on World Wide Web

The Computer Museum will hold its Second Internet Auction May 22-26, 1995. This year's auction will take place on the World Wide Web. Items include computer memorabilia, products and services. Illustrated descriptions will be available through an on-line catalog. The software for the WWW Auction is part of the launch of a new, novel interactive shopping service being developed by Jerry Kaplan and Alan Fisher.

While making use of the real-time, interactive elements of the Net, the Auction will also feature proxy bidding. The server will actively bid for those who are unavailable during the Auction or do not have access to an Internet connection. The technology of the Web will allow for many additional enhancements which, with real-time bidding, will create the feel of participating in person.

Items for the auction include a pre-World War I Dictaphone with Ediphone; signed, limited edition paintings from "AARON," Harold Cohen's artificially intelligent robotic artist; a six-foot yellow slide rule; a luggable Osborne; and an original BASIC manual signed by Tom Kurtz.

A text listing of auction items will be available for those who are not on-line. Proxy bidding will be available on-line or through the West Coast Office or the Museum Store in Boston. For more information, please e-mail: welsh@tcm.org or call (415)323-1909.
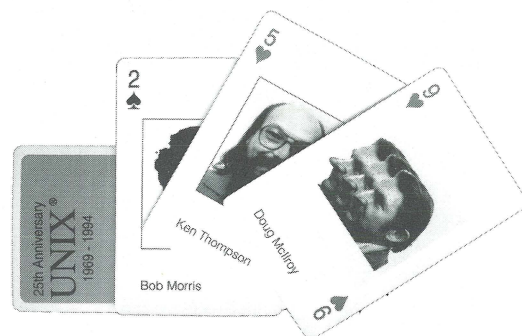
One of this year's auction items is this deck of playing cards featuring faces of UNIX pioneers. The USENIX Association, the original UNIX users group, offered the deck to honor UNIX contributors on its 25th anniversary in 1994.

"Letter" Goes On-Line

The Collections Department has launched an Internet-distributed "Occasional Letter from the Historical Collection." The letter helps us maintain contact with the far-flung core supporters of the historical collection and is an important step toward the development of on-line information on the Museum's historical collection.

The first letter, published in November, features an outline of the Museum's collecting guidelines, and the December letter relates the story of an extensive donation of early Remington Rand and Univac components to the Museum. In addition to the main article, each letter contains behind-the-scenes news, updates on new acquisitions, requests for information, and a "wish list" of artifacts the Museum hopes to add to the collection.

The wish list has already netted us an important acquisition. The Intel Corporation Museum has promised to donate a Busicom, the calculator that spurred the development of the first microprocessor, the Intel 4004.

If you would like to subscribe to the newsletter or read back issues, please send e-mail to: collections_news@tcm.org Include your name, e-mail and postal addresses, and, since, at present, we are processing inquiries manually, a simple note telling us what you would like.
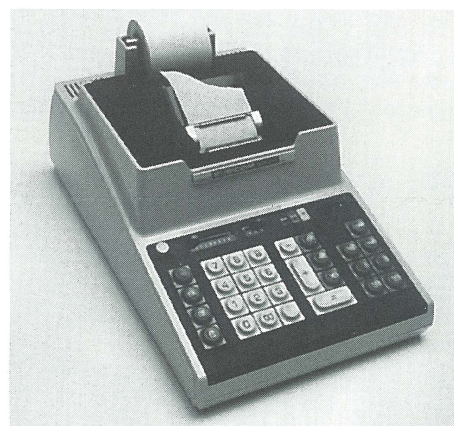
Busicom calculator

On-Line Gallery Opens

Since The Computer Clubhouse opened to Boston's underserved youth in 1993, computer graphics has been one of its most popular project areas. While learning to use professional imaging software, Clubhouse members have also created self-portraits, tableaux, collages, and cartoon characters. To make these images available to the rest of the world, members and mentors have designed an on-line gallery for the World Wide Web.

The "remote visitor" clicks on an artist's picture to access his or her exhibit page, featuring thumbnail sketches of their work. A full-screen image may be viewed by clicking on the corresponding sketch.

Participant Mike Lee, 19, said that gaining useful computer skills at the Clubhouse has also made him "more aware of my world." Boston University student and mentor Dan Lottero found it rewarding to introduce the participants to the Internet and give their projects "a new life on-line."

The gallery has generated interest in the Internet among other Clubhouse participants. Some are creating their own WWW pages. Plans include expanding the gallery, adding theme shows, and inviting young people from other sites to participate. Access the gallery via the Museum's Web site: http://www.net.org/
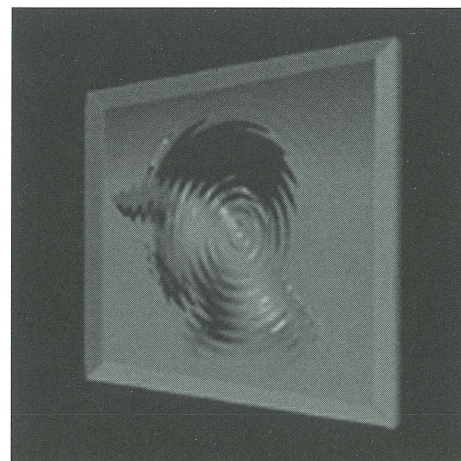
Reflect by Mike Lee

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We apologize for any inadvertent omissions from our donor list. Please inform us of any errors so that we may correct our records.

April 1–May 29
The Robotic Artist:
AARON in Living Color
M—April 2
Members-Only Preview 4-6 p.m. For more information, call Julie Rackliffe at (617)426-2800 x432. See page 1.

April 20
The Computer Bowl
Watch The Computer Bowl in "cyberspace" at parties in Boston or Santa Clara. For more information, call Carol Welsh at (415)323-1909. See page 3.
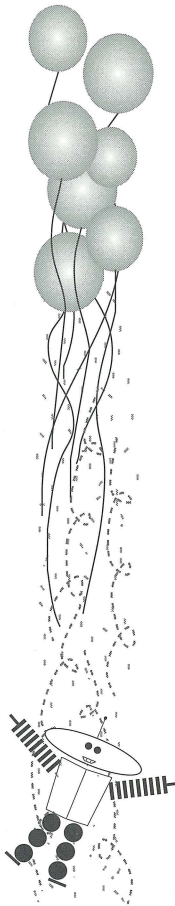
May 22–26
Internet Auction 1995
The Museum's second on-line auction starts on the World Wide Web. For more information, call Carol Welsh at (415)323-1909. See page 6.

July 17– August 10
Computer Camp
One-week sessions start every Monday. See to the right.

M—Members-Only Events

Whirlwind Birthday Parties

Just like the Whirlwind computer of the early 1950s, a Whirlwind birthday party at the Museum is big! Host your child's next birthday at The Computer Museum and enjoy a fun-filled, full-service package that includes birthday cake, decorations, a private party room, gifts for the party-goers, a supervised scavenger hunt, and unlimited access to all five exhibit galleries.

Computer Museum Camp 2.0

Computer Camp sessions are fully booked for school vacation weeks in April, but space is available for week-long summer sessions for children ages 8-15. Sessions begin July 17 and run 9am-4:30pm Monday-Friday. The Computer Museum Computer Camp offers a unique combination of hands-on experiences in The Computer Clubhouse and guided activities in our five exhibit halls.

For more information on birthday parties and Computer Camp, contact Maria Bruno at 426-2800 x334 or e-mail: bruno@tcm.org

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The Museum offers valuable challenges for Volunteers. Call (617)426-2800 x433

M E M B E R S H I P

Members get free admission for one year; The Computer Museum *NEWS*, a newsletter of Museum activities; the *Annual* report; invitations to exhibit previews and members-only events; advance notice of exhibitions and lectures; and a 10% discount on purchases over $5 in the Museum Store. For more information, call the membership department at (617) 426-2800 x432.

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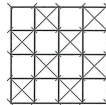Card#: _____ Expiration Date ____

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The Computer Museum
300 Congress Street
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Address Correction Requested