"Many people think virtual reality is like being taken for a motorcycle ride. But in this virtual world, you are in command."
—Edith Ackerman, MIT Media Laboratory

Members Only
Saturdays: May-June
10:30AM-12:30PM

Is Virtual Reality a Learning Tool?
See For Yourself

Virtual world programmed on a 486 50MHz PC, donated by Digital Equipment Corporation, with WorldToolKit Virtual Reality Development software from Sense8, and a Beachtron Three-D audio card from Crystal River Engineering.

Museum visitors can explore the microscopic world of cell biology, using virtual reality (VR) technology, April 9-June 30, 1994. From 2-5pm daily, visitors can don a head-mounted display and enter a virtual world to build a human cell, blown up millions of times life size. During school vacation week, April 16-24, the virtual world will be open 10:30am-12:30pm and 2-5pm.

Tickets for the head-mounted display, which are limited, are free to members and available to the public at $3.00/person first-come, first-serve, starting at 10am, for that day only. Non-ticketed visitors can watch live demonstrations and view the virtual world on a large monitor nearby.

With partial support from the National Science Foundation, the Museum has been carrying out research on the effectiveness of virtual reality as a tool for informal learning. "While much has been written on the educational potential of VR, little research has been done on it as a tool in informal science education," said Hyman H. Field of the National Science Foundation. An NSF Small Grant for Exploratory Research has enabled the Museum to test if visitors' understanding of the human cell is improved by "walking into" this basic biological building block and studying it in an interactive, three-dimensional virtual environment versus two-dimensional graphics.

For testing, VR was defined as having three qualities: 1) It is fully interactive, i.e., objects in the world react to your interaction with them; 2) you move and interact with it naturally using sensors tracking your head and hand movements; 3) the world is immersive via a head-mounted display using goggles and headphones.

An Inaccessible World Opens

Visitors can use a hand-tracker to manipulate objects in the virtual world. Touching a (computer-generated) girl's head, arm or stomach, the visitor is flown inside a room containing an empty six-foot neuron, muscle or intestinal cell. The cell is surrounded by organelles (the different elements of a cell), explained with animations and sound effects. When visitors place the right organelles in the cell, an animation shows the cell in action.

"This immersive environment is the most interesting I've ever seen," said Edith Ackerman, a study advisor, who designs learning environments with Seymour Papert. "In addition to exploring an inaccessible world, as you build the cell, it responds. That's powerful."

"The challenge was to build a world that wasn't a shooting game, but was educational and gripping," said project co-investigators David Greschler and Eben Gay. To make the cell more accessible and alive, three-D sound effects are used.

Pilot research showed that while visitors found it exciting to enter a virtual world and move things around, they often became so involved with the novelty of the interaction, they lost track of learning about the cell. "I felt as if I were in another place and time," said a Boston University student. "When I took off the helmet, I half expected the objects to be there," agreed graphic artist Chuck Eichten. "I see the educational potential, but the technology is still so clumsy that I missed the point. You have to think too much about moving around."

Bridge to Learning

What engaged visitors most was how real the micro-world seemed. Having a cell to build, they wanted to stay there and take control. "VR could be a wonderful bridge to learning for young people," noted one visitor. Almost all the teenagers in the pilot survey said they would like to use VR in their classes.

Using the pilot results, the Museum enhanced the system, adding a "VR tutorial" to familiarize visitors with the technology, sound effects and visual cues to make the world more responsive, and audio explaining the activity and cell structure.

Formal testing involved a random sample of 600 visitors, interviewed before and after the half-hour experiment about their understanding of the cell and their enthusiasm for cell biology. One-third explored the world in a fully interactive way with head-mounted display and sensors; one-third engaged the world using a joystick to move about a two-dimensional screen; one-third watched a video on a big screen without control over the presentation. The Museum is assessing the differences in learning among the groups. For the results—available this summer—e-mail *computer_info@tcm.org* with *request* in the subject line and *send help instructions* as the body of the message.

Reaching Out to New Friends

As the Museum moves into its second decade, it embraces new communities to serve and new groups to fuel the execution of our educational mission. To reflect this, the Museum has expanded its governance. After a Board vote last summer, the original Board of Directors was replaced by two Boards: a 25-person Board of Trustees with the fiduciary responsibility for governing the Museum and a Board of Overseers with a mandate to shape the Museum's planning and development.

The Museum already has 31 Overseers spanning both coasts, the computer industry, and the local community. For example, Jeff Braun, Chairman and CEO of MAXIS, in Orinda, California, is in the thick of the current explosion in the educational software market. His enthusiasm and support led to some fine interactive exhibits in the *Robots & Other Smart Machines* gallery. Juanita Wade, President of Freedom House in Dorchester, an underserved community in Boston, is a leader in the development of community-based afterschool programs that enrich the lives of neighborhood children. Groups from Freedom House use the Museum's Computer Clubhouse as a source of expertise in establishing their own technology program.

Our new Director of Development, Betsy Riggs, greatly strengthens our ability to reach out and respond to these and other new

Director of Development Betsy Riggs, who joined the Museum in September 1993, has a "keen sensibility of the Museum's mission and a wonderful enthusiasm about its educational potential," said Oliver Strimpel.

Keith Quenzel/FAYFOTO

constituencies. Betsy has already launched a new "Friends" group led by Development Committee Chair and Trustee Tony Pell.

We are eager to increase the involvement of volunteers in all areas of Museum operations. If you or a friend would like to volunteer, please contact Volunteer Coordinator Heather Sievers at (617)426-2800 x411 or e-mail "sievers@tcm.org".

Oliver Strimpel
Executive Director
strimpel@tcm.org

Networking Exhibit to Address "Human Side"

With a Planning Grant from the National Endowment for the Humanities (N.E.H.), the Museum assembled a distinguished group of humanities scholars and social scientists to review plans for the Museum's exhibition on global computer networks and identify the critical humanities issues.

Opening November 12, 1994, the exhibit will offer first-hand experiences with networks and explore the social ramifications of this vast technology. The advisors discussed the "human side"—how the exhibit would address public concern over privacy, access, property rights, and information overload, as well as the technology's effect on democracy and globalization.

They recommended the exhibit engage visitors not just as technology users but as its shapers. University of Pennsylvania historian Thomas Hughes explained, "Visitors should feel that their values can be reflected in the design of computer networks." For example, in the exhibit, visitors will experience scenarios

threatening their privacy (e.g., their electronic mail being read by others). They will learn of systems that better protect privacy and choose which they prefer. The advisors also recommended that the exhibit present a balanced vision of computer networks, using real-life experiences, and enable visitors to evaluate the technology's potential benefits and costs.

Members of the N.E.H. Advisory Committee are Robert Baum, Dept. of Philosophy at the University of Florida; Paul Edwards, Dept. of Science, Technology, and Society, Stanford University; Diana Forsythe, Dept. of Computer Science, University of Pittsburgh; Thomas Hughes, Dept. of History and Sociology of Science, University of Pennsylvania; Rob Kling, Dept. of Information and Computer Science, U.C. Irvine; John Ladd, Dept. of Philosophy, Brown University; Lee Sproull, School of Management, Boston University; and Alan Westin, Dept. of Political Science, Columbia University.

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The Computer Clubhouse	**x347**
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Membership	**x376**
Museum Store	**x306**
Public Relations	**x341**
Volunteer Program	**x411**
Fax	**(617)426-2943**

For Museum staff, e-mail: *lastname@tcm.org*
For general Museum information, e-mail:
computer_info@tcm.org with *request* in subject line and *send help instructions* as the body of the message.

Winter Hours: Open Tuesday-Sunday, 10am-5pm. Closed Mondays, except Boston School holidays and vacations. Closed Thanksgiving, Christmas, and New Year's Day.

Summer: Open daily, 10am-6pm.

Admission: Adults $7.00, students, children five and up, and seniors $5.00. Half price Sunday 3-5pm. Free to Museum members and children four and under.

Humans and Computers Vie for Chess Cup

Grandmaster Joel Benjamin (above defeating the winning computer program, Heuristic's Socrates Esp) also captured the 4th Harvard Cup title.

Each year, advances in hardware and software close the gap between the brute force of computer chess strategy and the collective abilities of their human opponents. To explore how fast that gap is closing, The Computer Museum will host the 5th Harvard Cup: Human vs. Computer Chess Challenge, Saturday, October 1-Sunday, October 2, 1994.

Although our capacity to imagine and create mechanical "peers" goes back to Homer, it has grown dramatically in the last 200 years. Mary Shelley's *Frankenstein*, *The Wizard of Oz*'s Tin Man, and more recently, the computer powerhouse HAL 9000 from "2001: A Space Odyssey" all capture our fascination with the potential of technology to emulate human intelligence and emotions. As the second millenium ends, advances in computing will enable us, at least in part, to turn these fictions into realities.

Premier Showcase

In November 1993, spectators filled the Museum's auditorium, eager to witness the 4th Harvard Cup, the only annual event in which grandmasters—the highest player ranking in professional chess—compete against computers. The Harvard Cup has become the premier showcase for grandmasters to test their acuity against commercially available personal computer applications and dedicated chessplaying machines. The 1993 Challenge was the first in which applications ran on Intel Pentium™ processor-based machines.

"Years ago, it would have been inconceivable that computers could play chess so well," observed Christopher J. Chabris, editor of the American Chess Journal and Challenge co-organizer. "Today, we're on the cusp between a time when the development and execution of complex strategies were solely human and when they will be successfully emulated by computers."

1993 Harvard Cup Winners

Grandmaster Joel Benjamin and Socrates Exp, a chess application developed by Heuristic Software, captured the Cup title, winning six and three games, respectively. In the Scheveningen-style Challenge, one team, in this case the American grandmasters, round robins with a second team, the chess-playing computers, in a series of 36 games.

The 1993 Harvard Cup grandmasters scored 27 of 36 possible points: Benjamin scored six of six; New England Champion Alexander Ivanov scored five; U.S. Chess Champion Patrick Wolff, Former Soviet Chess Champion Boris Gulko and World Junior Champion Ilya Gurevich each scored four and a half; Defending Harvard Cup Champion Michael Rohde scored two and a half.

The team of computers scored nine points: Socrates Exp scored three; ChessSystem R30, a dedicated chessplaying machine designed by the Dutch-based TASC Company, scored a draw and two grandmaster scalps; BattleChess 4000 SVGA, an animated software application from Interplay Productions, scored a win and a draw; M-Chess Professional, a software application by Marty Hirsch, drew one and was the only machine to defeat Wolff; Renaissance SPARC, a dedicated chessplaying computer from Saitek Industries, Ltd., scored a draw; Kasparov's Gambit, a software application from Electronic Arts of San Mateo, California, secured a winning position against Benjamin, but ultimately lost on time.

Closing the Gap?

In the first Harvard Cup in 1989, the computers won a mere nine percent of the total points. Each year, with advances in processing power and software, the computers' performances improved, capturing 28 percent in 1992.

With the arrival of Intel's Pentium processor in 1993, observers, including Larry Kaufman, editor of Computer Chess Reports, predicted the computers would amass many victories over their human competitors. Although application speed and performance improved—many almost defeated grandmasters, but lost on time—and the computers won 25 percent of the total points, they performed slightly lower than the 1992 high of 28 percent.

"Undoubtedly, this year's spectacular performance by Heuristic's Socrates was due to the Pentium processor," said Kaufman. "The more sophisticated hardware enabled the programs to play perhaps twice as fast as last year."

More than anything else, processing speed now benefits chessplaying programs as they search vast databases and "evaluate" potential moves, often anticipating millions of subsequent actions and reactions to determine "the best" move. While humans rely on knowledge, experience, intuition, and imagination, computers rely solely on databases and evaluation functions; faster processors enable more exhaustive database searches, and more advanced functions yield more successful and "human-like" strategies.

As for the 5th Harvard Cup, Chabris said, "It will be interesting to see what happens once refinements in the software catch up with the hardware."

Museum Brings Auction Block To Cyberspace In

In a high-tech twist on the charity auction, The Computer Museum is hosting "The First Internet Auction" April 22-29, 1994, to support its educational programs. The Auction, the first of its kind, will be conducted entirely through electronic mail on the Internet using software created and donated by Enterprise Integration Technologies (EIT). Appropriately, many of the items up for bid are vintage components or documents of technologies from which the Internet ultimately evolved.

The Computer Museum First Internet Auction is open to anyone who sends e-mail to: "*auction-info@auction.tcm.org*". A computer server functions as the "auctioneer," and anyone who submits a bid becomes a participant. People who want to bid but do not have e-mail can call (617)426-2800 x322 or e-mail from a terminal in The Computer Museum Store from 10am to 5pm daily.

Over 60 items include early computing memorabilia and a unique assortment of goods and services donated by industry leaders. Bidding for the most affordable items, such as Cardiac, a cardboard computer developed at Bell Labs, begins at $5.00. The most expensive item is an Ethernet Sniffer™ network analyzer (worth $10,000) from Smart Valley's Harry Saal and the Network General Corporation, which starts at $3,000.

For computing entertainment, highlights include the opportunity to have an evening playing Space Wars, the "mother" of all computer games, on a 1962 PDP-1 at The Computer Museum. For the highest bidder, Microsoft Chairman Bill Gates is providing the entertainment selection he'd want with him if stranded on a desert island (with electricity). Miller Communications is offering PR wizard Fred Hoar's services as toastmaster or ghostwriter. Plus, a panoply of entertainment tickets and other services are up for bid.
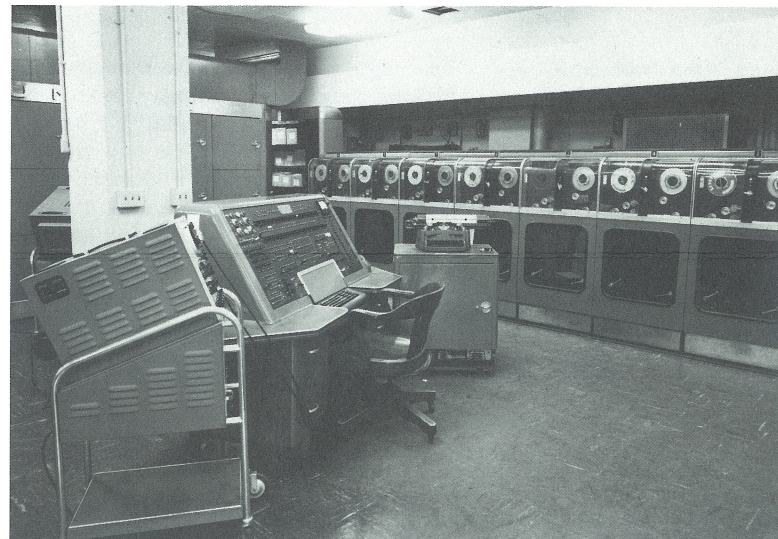
For computer history and nostalgia buffs, the Auction has over 25 items: original material from MIT's 1952 Whirlwind computer and, from the other end of Cambridge, a Harvard Mark I "package" including a tour of the computer at the Croft Computation Laboratory. The Auction also offers collectors rare product manuals and books, many signed by their authors or key industry figures. The selection includes a collection of essays by and about Albert Einstein, signed by himself, and a first edition of *Cybernetics*, signed by Norbert Wiener.

NOTEBOOK STORAGE in Manual Computation

ELECTROSTATIC STORAGE in WHIRLWIND I Computation
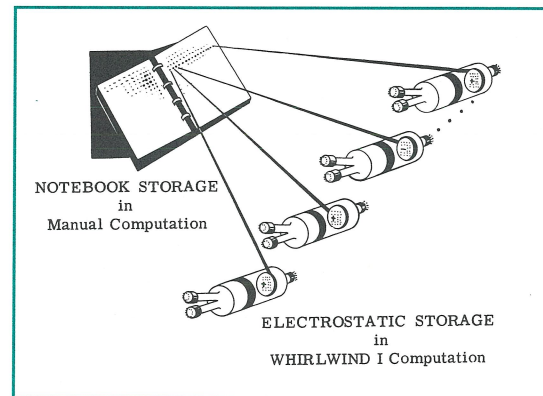
This illustration is from an original Whirlwind I manual featured in the Auction.

Official U.S. Air Force Photo

The Auction features original 1950s' manuals that explain how to program the UNIVAC I (seen above).

A
Counter Wheel Position at "4" Time
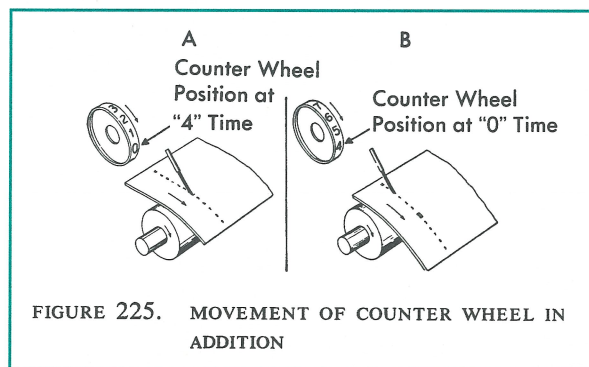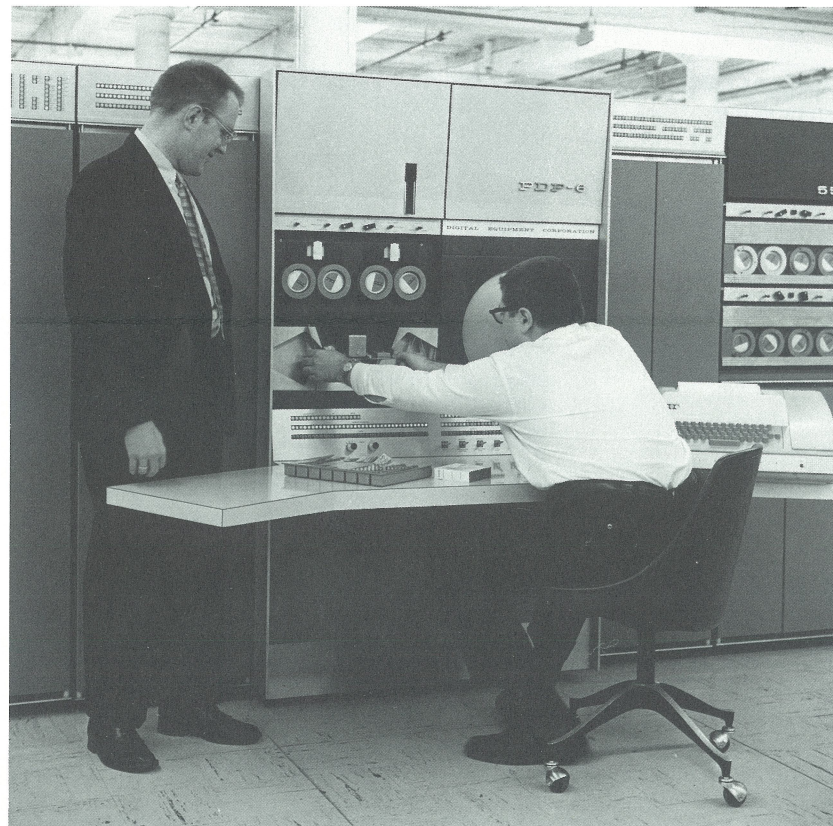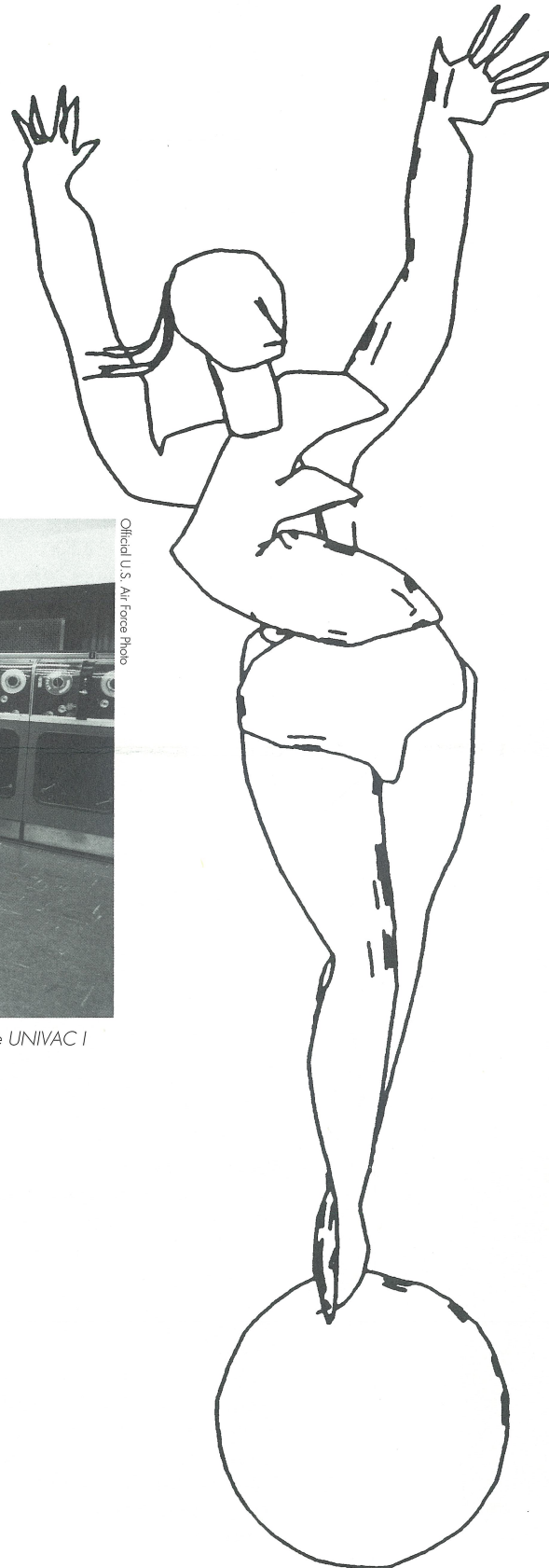
B
Counter Wheel Position at "0" Time

FIGURE 225. MOVEMENT OF COUNTER WHEEL IN ADDITION

This illustration is from a classic 1960 IBM Reference Manual, which—along with the actual brushed aluminum plugboard and patch cords—is up for bid.

The 1st Internet Auction

Computer engineer Gordon Bell (seen above in 1966 with fellow engineer Alan Kotok at a PDP-6) has donated an autographed copy of his Computer Engineering: A DEC View of Hardware Systems Design (1978), along with rare modules from the PDP-1, 4, 6, 8, and 11. Starts at $50.00.

The drawing is from Aaron's Code: Art, Artificial Intelligence and the Work of Harold Cohen (1991), donated by author Pamela McCorduck and signed by her and Cohen. The bidder also receives an original Cohen print and two invitations to the premier showing of his painting robot machine. Starts at $175.00.

©1991 Reprinted with permission of Pamela McCorduck and Harold Cohen

How It Works

To bid, send an e-mail at any time to: "*auction-info@auction.tcm.org*". Instructions and a registration form are returned promptly via e-mail. When you return the completed registration form via e-mail, a confirmation and list of Auction items are automatically forwarded. (Participants who wish to remain anonymous may choose a "handle.")

Bidding begins on April 22 at 10am, EST. The Auction continues 24-hours-a-day until the last items close April 29 at 8pm, EST. The server "auctioneer" processes bids according to arrival time and returns e-mail messages as bids are accepted or superceded. Every day, starting April 25, some items close. When time is almost up on an item, the "auctioneer" automatically reminds the three top bidders.

On Monday, April 25, the first set of items closes including a hardbound UNIVAC I manual with a module made by the Eckert Mauchly Computer Corporation. On Tuesday, another batch closes with the highest bidder getting a rare Gortex jacket distributed to the Lisa development team, that bears the inscription "thinker, star-gazer..." On Wednesday, Apple Computer Vice President and Chief Scientist Larry Tesler's thoroughly autographed copy of a 1970s Mid-peninsula Free University catalog, complete with a drop of General Magic President Marc Porat's blood, can find its way to a new owner. Then, on Thursday, another dozen items close, and the winner may receive an original Intel 4004 chip mask, signed by Ted Hoff, one of the chip's inventors, and suitable to display as art. Finally, Friday, the last 25 items may bring the Internet to a screeching halt if all the "techno-geeks" dial up at the last minute in hot pursuit of the rarities available.

Enterprise Integration Technologies, Palo Alto, California, has developed and donated the software for the Auction. The Auction is implemented using EIT's ServiceMail toolkit. EIT is a contract R&D and commercial consulting practice that develops software and services to help companies do business on the Internet.

For more information, e-mail "*auction-info@auction.tcm.org*" or call (415)323-1909 or (617)426-2800 x322. For information about EIT, e-mail: "info@eit.com".

Launched

The Computer Clubhouse is for Boston's underserved youth, age 10 to 16, to develop skills by applying the latest computer technology to their own projects. Young people work together with a committed group of mentors—students and professionals in art, music, engineering, education and other fields.

One high school student has developed an interactive multimedia essay about Native Americans for an independent study project. A graduate student in engineering and three seventh graders are building a computer-controlled robotic interface for a science fair. Five high school students and a graphics designer are developing a computer-based "art" project.

The Clubhouse is open for drop-in visits by individuals Tuesday-Friday 2pm-5pm and Saturday 10am-4pm.

Interested in becoming a member or mentor? Call Clubhouse Program Manager Sam Christy (617)426-2800 x347 or e-mail "christy@tcm.org". For information on mentors, call Noah Southall (617)426-2800 x374 or e-mail "southall@tcm.org".


Photograph: Keith Quenzel/FAYFOTO

Young people from Dorchester, Mass., create computer-controlled LEGO devices in the Clubhouse.

Volunteers Make a Difference

Two volunteers have helped the Collections Department move ahead on two big projects. John Campbell, a consultant and former MITRE Corporation employee, has been sorting and cataloging some of the more arcane documentation donated to the Museum over the years, as well as working to identify and list posters, journals, and programs on paper tape. Simson Garfinkel, an artificial intelligence researcher and author of books and articles on subjects ranging from AI and UNIX to contemporary Japan, has developed a demonstration module for a new image database of the Museum's photograph collection. The demo shows how, once Simson has catalogued and digitized the entire collection of over 4,000 photos, a researcher—or a curious Museum visitor—will be able to search the database for individual images or groups of images relating to specific subjects or to more general themes.
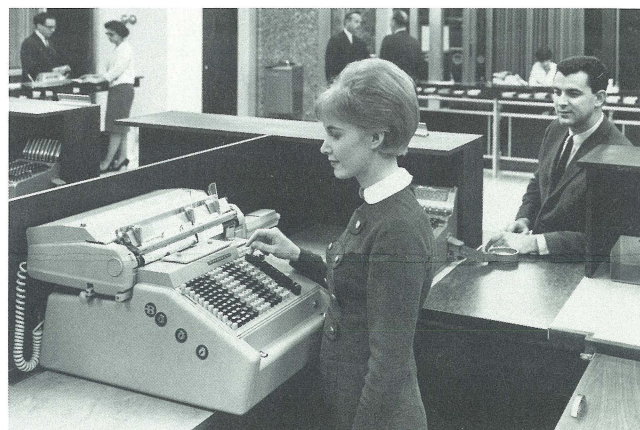
Photograph: The Computer Museum

Currently catalogued only as a photograph of a Burroughs disk file system terminal, this image of an early remote banking terminal will be digitized and listed under both manufacturer and model name and under keywords like telecommunications and banking.

Even Computers Go To Sleep

So discover the children of all ages who pile into The Walk-Through Computer™, sleeping bags and pillows in tow, as part of The Computer Museum's new Overnights Program. Directed by Eileen Knight, the Museum's Manager of Special Services, this innovative program lets kids explore the Museum, participate in a wide range of exciting games and educational activities, make new friends and spend the night camped out in our galleries.

"Our kids get a chance to learn in a playful way how computers work and to explore imaginative applications that might not be available at home or school," said Larry Ockene, who recently brought a Newton, Mass., Futurekids group to the Museum. "Overnights are a great programming alternative for group organizers," said Knight. "Kids love spending an entire night in a museum."

For more information, please call us at 1-800-370-CHIP.

Photograph: Eileen Knight

Some Futurekids catch 40 winks inside The Walk-Through Computer™.

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The Museum recognizes all In-Kind Donors, Donors of $100 and more, and Volunteers in its Annual Report.

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

VIRTUAL REALITY

Saturday, April 9-Thursday, June 30, 1994: 2-5pm

School vacation week:
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Using VR technology, build a giant human cell.

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Friday, April 22-Friday April 29, 1994

To bid on-line and make history, e-mail: "auction-info@auction.tcm.org" or call (415)323-1909 or (617)426-2800 x322.

THE COMPUTER BOWL® ALL-STAR GAME

Friday, April 29, 1994

*Live Event & Party: Doors open at 5:30pm
San Jose (CA) Civic Auditorium*

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The Computer Museum*

This contest pits the Most Valuable Players from the East and West Coast teams from the past five Computer Bowls against each other to determine who has the ultimate computer smarts. For sponsor and ticket information on both coasts, call (617)426-2800 x399.

COMPUTER ANIMATION FESTIVAL

Friday, July 1-Sunday, July 3, 1994

As part of Boston's annual Harborfest celebration, screen some of the finest computer-generated animation by local and international artists. For information, call (617)423-6758.

Support The Computer Museum! 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 x376.

The Computer Museum

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