Digital Computer Museum

First Annual Report

Although the idea for the Digital Computer Museum was a vision of Ken Olsen and then Gordon Bell for a number of years, funding by DEC did not bring results until last year. The first Computer Pioneer lecture by Maurice Wilkes on September 24, 1979 marked the completion of phase zero. The response from the September event was so positive that it triggered staffing the Museum and permanent establishment. At the end of the first year, we have accomplished the following:

* A format for building exhibits was established;
* Literature and documentation was developed; and
* A lecture and event series was started.

This document has three parts. The first section relates the historical reasons for the Digital Computer Museum and outlines the general scope of the program. The second section expands on the current status and plans for fiscal 1981. The third section outlines ideas for the future growth and development of the Museum.

I. WHY THE "DIGITAL COMPUTER MUSEUM"

Several unrelated events and decisions all worked in the direction of Digital Equipment Corporation developing the Digital Computer Museum. Ken Olsen took it upon himself to preserve and store Whirlwind , TX-Ø and early DEC equipment in a warehouse facility. Gordon began a collection of early calculators and logic devices and wanted to continue and expand his interest in the taxonomy of computers. A consultant/curator was hired and came up with a report of other museums. Her activity was shortlived because the approach was to do a computer museum for the public -- looking costly and not very sophisticated and was further doomed by an industry depression. Both Ken and Gordon went to other computer exhibits and were extraordinarily disappointed that the Smithsonian was not making an effort to appropriately classify and organize its material; fascinated by the IBM wall (now in a warehouse) but considered that its emphasis on the interaction of social events and computing was not the story to be told; impressed with the solid display at the Museum of Science in London; totally dismayed that the computer exhibit at Boston's Science Museum was only a superficial display ad for Honeywell; and delighted that the Boston Children's Museum could teach computing (hence DEC supported this effort.)

These events led to both Ken and Gordon to conclude that a Digital Computer Museum was needed. Ken's goal, to create a place to preserve machines so that computer scientists, engineers, and programmers can see the antiques that they had worked on as little as ten years ago, and Gordon's goal, to create an understandable taxonomy of all computers and related computing devices, are complementary.

The role of the Museum is to make sure that significant artifacts are kept. Having the original or a copy (eg. Guatelli made replica of Babbage's Difference Engine) that appear in various museums), is necessary in order to distinguish a museum from a special library. As a hardware oriented company, the preservation of artifacts and documentation of significant software is appropriate. Unfortunately, many parts of early machines have already disappeared and a few good photographs are available. Hence, the Museum will collect what is available and try to insure that good portraits are taken of classic machines. (One of the dreams for the Museum is to have life sized holograms of the machines so that one could in effect walk through them. Failing this, then projecting life sized photographs provides an alternative.)

The priorities for the Digital Computer Museum are to exhibit real time, scientific and interactive computing, with a limit of 50% of the exhibits directly pertaining to Digital Equipment Corporation. Eventually all items will be identified within a taxonomic structure of pre-computer and computer generations in order that the viewer can understand the evolution of computers. The first step has been taken in this direction with the production of a PDP-tree poster.

These goals have been discussed informally with some eminent computer historians and explained to others in seeking their cooperation. The first newsletter, attached, shows a listing of people and institutions that have contributed thus far. We have found enthusiasm for our efforts and have generally been plummetted forward by positive feedback, obtaining many hours of free services from both inside and outside DEC. Thus, like most Museums, our budget, is magnified by the gifts of time and artifacts.

II. PRESENT STATUS

The Digital Computer Museum, was sanctioned by the Operations Committee of the company a year ago. January 1, 1980 the Museum staff was in place. Gordon Bell, Keeper provides direction for the program, and through Mary Jane Forbes, Administrator, the Secretariat for the Operation. Gwen Bell, Assistant Keeper, provides day to day direction on a full-time, volunteer basis. Jamie Parker, Coordinator, is the only salaried member of the Museum Staff. The security and building group at Marlboro provide their services as needed under the direction of Joe Savignano and Dave Yates. As landlord, Joel Schwartz's support and assistance in direction setting has been essential. While we pay for warehousing space, the Museum space itself carries no charge since it is the lobby and balcony of a beautifully designed Vincent Kling building (constructed for RCA). Individuals who have contributed to specific exhibits are acknowledged below. An advisory committee representing various cooperating groups within DEC, eg., Industrial Design, Digital Press, Public Relations, etc., meets occasionally to review progress.

The activities can be categorized into five areas: archives, exhibits, events, products, and public relations. Each are discussed separately, and then related corporate activities reviewed.

Archives.

* Cataloging and storage. During the summer of 1979, all the artifacts in the warehouse were photographed and cataloged. The system is being kept up to date, with the ability to track artifacts. The database is not yet computerized -- a task that we would like to accomplish in fiscal 1981.

* Exhibit directory. A directory of all exhibits as of September 24, 1979, is on the VAX system and can be queried by Museum visitors.

* Video and audio tapes. Video tapes of all lectures in the computer pioneer series will be made. The video tapes of the first lecture by Maurice Wilkes are now available. Gordon also plans to start to make audio tapes of informal discussions with people who worked on the early machines. Other video and audio tapes by computer pioneers will be acquired as they become available.

Exhibits.

* Whirlwind. This exhibit of the memory, a register and other parts is being supplemented with some photographs, and the publication of a DEC Press book by Redmond and Smith on Whirlwind.

* TX-0. The TX-0, replicating its appearance at MIT in the 1950s, has been installed by John McKenzie, the technician who maintained the machine at MIT (now retired) and

Stanley Schultz. A group of TX-0 alumni are getting together to discuss improving the display and perhaps getting the machine to run.

* Calculators. New cases were purchased for the calculators and this exhibit, essentially complete, will continue to be improved. We are looking for the Anita -- the first electric calculator. Gwen is now working on a poster of the generations of pre-computer calculating devices and writing a A/V user activated slide talk to explain their evolution. This should be complete by September 1980. The project may also result in a small picture book.

* Office of the Past. Mary Jane Forbes has put together an exhibit (in a closet) of the office circa 1910. This will be completed prior to September, 1980.

* Logic Devices. Three cases are used to exhibit the four generations of logic devices. These are explained in a user activated slide talk given by Gordon Bell. This exhibit will grow as we get more early artifacts from critical early machines.

* Memory. Three cases show the four generations of primary memory devices. In addition, a large disk and a transparent RK05 are exhibited. A secondary memory devices exhibit and a user-activated slide-talk are in the planning stage.

* Analog computers. An analog computer is displayed simply give the visitor an idea of what these were like. This exhibit should be developed.

* PDP Family of Computers. A poster of the family tree of the PDP computers has been completed and is available. This family tree will be used with all displays of DEC machines to identify their relations with the other machines. Specifically, PDP-1 is running with the original Space War program. Stan Schultz has taken this as his project and is now putting joy sticks on the machine. He also sees to it that the Classic 8 runs with non-interactive demonstration programs. An 11/20 is on the floor along with the original hand-done artwork for one of its modules. The other mainframe machines are represented by consoles, documentation, and photographs. The LINC is the first of DEC's personal laboratory computers on display. The LINC-8, PDP-12, and a working MINC are complemented by a user-activated slide talk introduced by Dick Clayton, The basis for this comes from two films -- one made by National Educational Television and the other by the DEC LDP group. Peggy Sullivan has been coordinating these efforts.

* Computer Art. An exhibit of four lithographs by Harold Cohen, University of California-San Diego, is displayed on the first floor. We have agreed with the artist, who uses a PDP-11 to create artwork by artificial intelligence, that he will paint a mural for the museum totally covering

one of the balcony walls. We will document the making of the mural for a user-activated exhibit. See events for more information on this project.

* Computer Music. We have been in contact with Barry Vercoe of MIT and John Chowning of Stanford. Barry Vercoe has agreed to compose a piece of music specifically for the museum space, probably making use of the computing capability of the VAX. John Chowning composed music on the PDP-1 and we are in touch with him to gain access to this. These projects will probably come to fruition in fiscal 82.

Events.

* Sept. 24, 1979. Luncheon opening by the Operations Committee of Digital Equipment Corporation.

* Sept. 24, 1979. Computer Pioneers, Lecture 1, Maurice Wilkes and the EDSAC.

* April 5, 1980. VAX five-year birthday party celebration. All of the people who brought VAX into the world came to a celebration, each bringing a VAX artifact to contribute to the Museum.

* May 8, 1980. Computer Pioneers, Lecture 2, George Stibitz and the Bell Labs Relay Computer. (A mailing list of 200 people outside of DEC has been developed. About 50 of these people are in the Boston/Amherst area and are being invited to the lecture.) The newsletter format will be used to announce these public lectures.

* Sept. 22, 1980. Museum dinner for the Board of Directors of the Corporation introducing them to the museum.

* Sept. 23, 1980. Opening, lecture - demonstration. Mural by Harold Cohen. Jamie Parker is coordinating this event to bring in people from the "art" and "museum" as well as the "computer" world.

* Employee family open houses to be coordinated with the entire Marlboro facility through Joel Schwartz.

* Future events: Computer Pioneer Lectures -- Forrester coordinated with publication of DEC Press book on Whirlwind by Redmond and Smith; then Atanasoff, Eckert, and Burks will be asked; Board meeting of the Charles Babbage Institute.

Products.

The Museum is planning on having a small "store" of appropriate products. In addition, we will do a number of things that will be free. (First the free items.)

* Buttons with the core memory symbol to replace the visitor badge for people coming to the Museum.

* Newsletter. Number 1 is attached to this document. We distribute internally by EMS, and via hard copy to those without EMS access and to our outside list. The newsletter will keep people up to date on our progress and be issued occasionally as the need is felt.

* PDP Family Tree poster.

* Products for sale.

  - Pre-computer Generations poster. (This is now being designed and should also be ready for September.)

  - History books from DEC Press. The Press has an allocation of two books per year on computer history. These will be on sale along with the Bell/Mudge/Mcnamara book on the DEC Computers.

  - Other books, such as Eames, Computer Perspectives, Harvard University Press.

  - Simple Calculating Devices. We are talking to the SEE Corporation about selling their reproductions of the Pascal Adder and Napier's Bones.

* Products on Display. The Annals of Computing History and Charles Babbage Institute Newsletter will be displayed with appropriate order forms for those

Public Relations and Museum Visitors.

Our strategy has been to slowly open the Museum. DEC-related groups and visiting computer scientists have begun to find the Museum and go through it on their own. There would seem to be an opportunity to cooperate with both DECUS and the educational groups to insure that the facility and the archives are accessible and used.

We have provided special tours for classes from both MIT and Harvard, as well as several local high school groups. Unescorted high-school groups can and have wrecked havoc in the Museum -- the PDP-1 groaned for a week until Stan Schultz could come and fix it. In the present state of exhibits, the viewer needs to have an appreciation for the delicacy of what might look like an indestructible machine.

A guest book is on the desk for visitors to sign.

Relations with other institutions.

Although we can't take on the world, we want to keep abreast of what is happening so that we can allocate our time and efforts appropriately.

* Support for other exhibits. Corporate Contributions give computers to support museums including a computer for the Boston Symphony Orchestra for it's 100th anniversary next year, a PDP-8 to the Canadian Science Museum in Ottawa, and a PDP-8 and a plane from the first core memory on Whirlwind to the British Science Museum. We forward parts to the Smithsonian when they take them (Whirlwind core memory and display that Mitre put together). Requests for artifacts from our archives may be made directly to the Museum or go through Corporate gifts. We hope to loan artifacts and displays to both DEC sites and other institutions.

* Ken supports Charles Babbage Institute and we cooperate with them in our complementary interests, although we have requested the Corporation to fund the Digital Computer Museum instead of CBI given the limited supply of money.

* We did not take on any of the Codasyl archives because it is open ended and feel that others should take on this responsibility; similarly, we did not contribute to archiving the Mauchley papers because we feel that Univac and the Penn. must do this. We would undoubtedly support something which would be otherwise dropped.

* The Museum staff visited the IBM warehouses April 17th.

* Gwen is going to the opening of the Computer Exhibit in Ottawa, April 30, and will visit the Children's Museum in Washington the first week of June. She hopes to develop cooperation so that we might "sell" each other's products learn from each other's displays, and look at feasibility of joint, display design and generation.

* Gwen and Jamie will attend the American Museum Association meeting in Boston in mid June. They plan to invite Museum people from scientific museums to see the Digital Computer Museum and will attend appropriate seminars.

III. FUTURE GROWTH AND DEVELOPMENT

We are trying to build a system to archive, build displays, slide talks, etc. so that the museum will grow and develop. Two new avenues appear to be appropriate -- the Museum will fund people who want to put up appropriate displays and we will formalize a small outside group of advisors who are known as computer pioneers and historians. On the first, we have written to Professor Cohen at Harvard, Professor Randell at Newcastle, and Professor Wulf at CMU suggesting that one of their computer science students might propose to do an exhibit for the Museum. The TX-0 alumni group might also come up with some ideas for displays. On the second, a small outside group of advisors might be able to help the Museum acquire artifacts outside of DEC and in accomplishing our goal of becoming the computer museum for computer professionals.

On our own, funded at the present level, we are confident of an exciting and growing future and are ending this document with a short list of a few of the exhibits focussing on real time, scientific and interactive computing and its predecessors.

<u>Ideas for future displays.</u>

* Scale dioramas of the development of card tabulating and computing;
* Other pre-computer artifacts (eg. Network analyzer);
* I/O Equipment, and communications equipment;
* Secondary Memory, including recording techniques;
* Integrated Circuits- getting artifacts from TI and Intel
* Important computers: Cray's machines, 360/370, Amdahl, Intel, Manchester, BTL, Penn. MIT and others;
* First Generation computer photo gallery;
* Multiprocessors, multicomputer and network structures--including CMU's;
* Computing in laboratories before computers;
* Miscellaneous application displays (eg. power control, air traffic control, EKG's, trains, process control);
* A Programming Languages display;
* On the importance of algorithms;
* Important systems (eg. UNIX/MULTICS, FORTRAN, COBOL, APL); and
* Robots (including automatons).

Attachment: First Newsletter
Brochure

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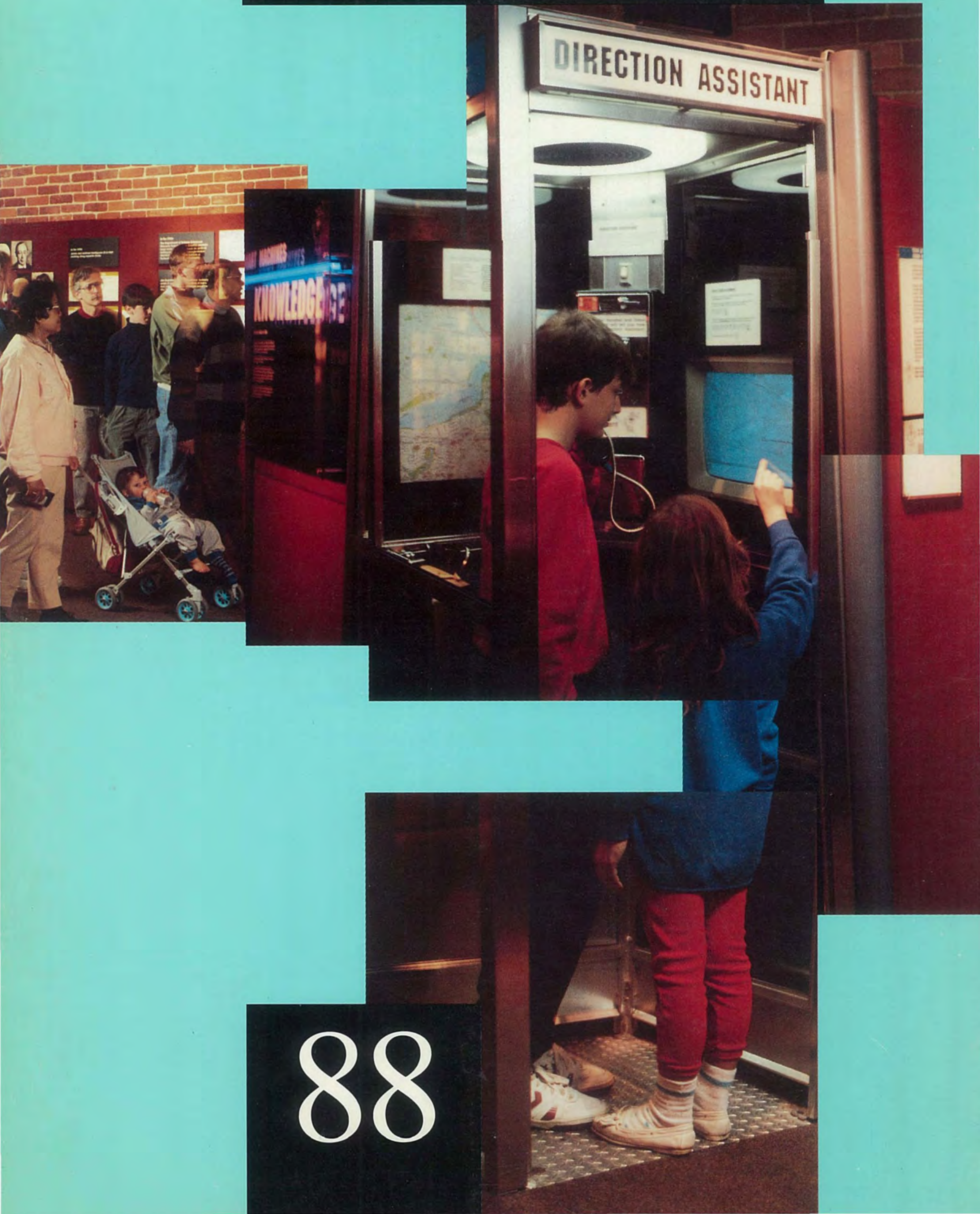
Gordon Bell, Keeper Gordon Bell

Gwen Bell, Assistant Keeper Gwen Bell

THE COMPUTER MUSEUM ANNUAL



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The Computer Museum

The Computer Museum Annual is the culmination of a year's effort on the part of many.

In particular, we would like to extend thanks to:

Advanced Computer Graphics, for providing typesetting.

Aetna Printing Services, for printing the Annual.

Boris Color Labs, for photo prints.

DesignSystems, of Cambridge, which designed and produced the *Annual*.

Martha Everson, who photographed the SAGE exhibit on page 13 and the Computer Bowl on page 7.

Stu Rosner, who photographed the *Annual* cover, the portraits on pages 1, 3, 8, 9 & 12, and items from the collection on pages 21, 23, 24, & 25.

Other photographs:

p. 10
Duane Winfield

p. 14
Barry Stark

p. 22
Arthur M. Riehl

p. 4 (left to right)
Linda Holekamp,
Duane Winfield,
Linda Holekamp

p. 5 (left to right)
Linda Holekamp,
Richmond News-papers,
Steve Nelson,
Michael Chertok

p. 29
The Boston Globe

p. 30
Duane Winfield

p. 31, 32
Linda Holekamp

inside back cover
Marjorie Nelson

The Computer Museum

Founded in 1979, The Computer Museum is an international collecting and exhibiting museum. The only museum in the world devoted solely to computers, it was incorporated as an independent non-profit educational institution in 1982.

The Museum has assembled the most extensive collection of historical computers and robots in the world. Open to the public in downtown Boston since November 1984, the Museum welcomes over 100,000 visitors each year from around the globe.

The Museum's mission is three-fold:

To educate and inspire all ages and levels of the public through dynamic exhibitions and programs on the technology, applications and impact of computers.

To preserve and celebrate the history and promote the understanding of computers worldwide.

To be an international resource for research into the history of computing.

The history and current application of computers is presented in over 19,000 square feet of temporary and permanent exhibition space. The historical exhibits make ample use of the Museum's rare and growing collection. Some 60 hands-on exhibits enliven the visitor experience and provide a window on the future of computer technology.

The Museum brings its message to a wide and varied public through a program of daily demonstrations and guided tours, frequent lectures, workshops and events, and a national program of traveling exhibits.

Each year, over forty thousand students are introduced to the world of computing at the Museum. Teacher workshops empower educators to expand their students' use, understanding and appreciation of computers. An active outreach program sends museum educators into the schools with programs on computers and robots. Educational materials for the classroom are distributed nationally.

The Museum is funded through corporate and individual support, admissions, foundation and government grants. Members receive a bi-monthly newsletter and *The Computer Museum Annual*, a richly illustrated report of the Museum's activities.

Located on Museum Wharf at 300 Congress Street, Boston, Massachusetts, the Museum is easily accessible by public transportation and is only minutes away from Logan International Airport and Boston's financial district.

Public open hours are Tuesday through Sunday, 10 am - 5 pm, Friday until 9 pm, and daily during the summer.

C O N T E N T S

THE NEXT FIVE YEARS

Gardner C. Hendrie
Chairman,
The Computer
Museum

The Computer Museum has certainly come a long way from its early days in Marlboro with its collection of early computers. It now has a wide range of interactive exhibits in both the Smart Machines Gallery as well as the Graphics Gallery. These exhibits help to expand the audience for the Museum from technically trained people who have grown up in the computer industry to include both children and adults who are curious about computers and how they work and how they are used.

The two primary challenges which I see for the next five years are:

1. To further expand the audience of the Museum in terms of both the age and background of our visitors.
2. To expand support for the Museum to include individuals, foundations, and corporations that span all segments of the computing community, both suppliers and users.

To achieve these goals we need to:

1. Continue to expand and improve our exhibits. Oliver Strimpel's article describes the new exhibits that will be devoted to history, will explain how computers work and will illustrate new and significant applications.
2. Create exhibits, events, and materials that allow us to share our collection and resources with organizations around the world. One of these is an exhibit on pocket calculators which is currently traveling throughout the country. The Computer Bowl was a simultaneous East and West Coast event that was later shown as two programs of the PBS show *Computer Chronicles*; the questions and answers were reproduced in *The Communications of the ACM.*
3. Develop the Museum's Education Department. Adeline Naiman, the new education director has a long list of programs currently being developed for school-age visitors.
4. Expand the involvement of the business community through innovative programs such as our breakfast seminars. These seminars bring industry luminaries to the Museum to talk about what is happening in computing today, and what may lie in the future.
5. Complete Phase II of the Museum's Capital Campaign. This Campaign is the principle means for funding the expansion of the Museum's programs. In the first year, we successfully raised over 1.2 million dollars. However, we still have a long way to go to successfully reach our goal of seven million by 1992.
6. Broaden the participation of individuals and corporations in the Museum's programs. Volunteer activities in public relations, collections and exhibit development have occurred from Louisville, Kentucky to Newcastle, England.
7. Promote pro-active collecting. The Museum has a preeminent collection from the 1950s and '60s and all of the very earliest PCs. However, we need to add the important advances of the '70s and '80s.

These programs will help us achieve the goals of The Computer Museum over the next few years. The most important element, however, is you: the member, the contributor, the visitor, the volunteer.

The Computer Museum Staff

Joseph F. Cashen
Executive Director

Gwen K. Bell
Founding President

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Jane Dusza Stanhope
Development Coordinator

Valerie Freitas
Membership Coordinator

Education

Adeline Naiman
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See Page 20

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Exhibits
See Page 9

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Jonathan Rotenberg
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Joseph F. Cashen
Executive Director,
The Computer Museum

As the only museum in the world solely committed to computers and their impact on society, we have before us extraordinary opportunities and an audience with both national and international dimensions.

Fundamental to our mission is the preservation and celebration of the history of this remarkable and dynamic field, and the exciting and educating of all levels of the public about computing and its impact on their lives.

The Museum has what is unquestionably the best collection of post-1950 computers and robots in the world. Rather than just storing the collection for preservation purposes, we leverage it by utilizing key artifacts in exhibits to help us implement the other parts of our mission. An example is our Smart Machines Theater which presents our unique robotic artifacts with an explanatory light/video show that is both entertaining and educational for many levels of visitors. Our national impact is being increased by such activities as *Computers in Your Pocket*, a travelling collection-based exhibit currently on a 16-city tour across the country, our CDC 1604 on display at Cray in Minnesota and our Univac 1 being exhibited at the Computer Science Conference in Louisville.

More than 60 computer-based, interactive stations provide more interesting and educational opportunities for our visitors. Our longer term exhibits are complemented by time-sequenced temporary ones such as the SPOT exhibit which vividly demonstrates how digital satellite imagery helps humanity deal with natural resource utilization. The computer processed satellite images are also highly prized for their artistic beauty.

Although we have a separate Education department, our education mission permeates all our exhibits and programs; our responsibility as an informal learning center for computing is woven into all our activities. Our various outreach programs have been well received and we are committed to building this activity even more in the months and years ahead as a way of improving our rapport with young people in particular. Nurturing this link to youth is an exciting way the Museum can help the great numbers of people who have no knowledge of computers at all or who are intimidated by them.

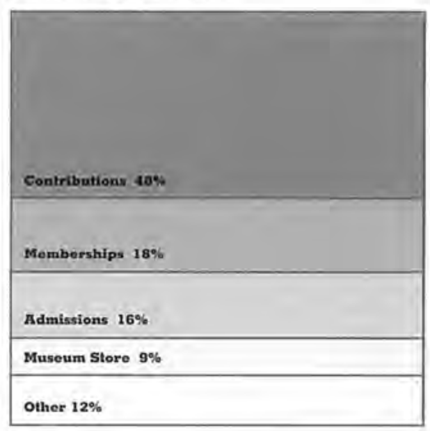
Given our ambitious role and our limited resources, the need for good, committed staff people is particularly obvious. With the addition of our new senior Education Director and other key new people, our staff is capable of addressing the challenges in the months and years ahead. The "Year in Review" section of this report hopefully gives you a feeling for the pace and vitality of the Museum, and the accomplishments of the staff. It also points out the increase in our national impact through such activities as our first travelling exhibit and the highly successful, exciting inauguration of The Computer Bowl.

On the subject of national and international impact, it is interesting to note that 50% of our visitors are from outside of Massachusetts and about 12% of them are from foreign countries.

A common question from people interested in the Museum involves where our funding comes from and how it is used. Audited financial statements are available for those interested. The charts below graphically depict the flow of our Operating Budget. Note that the Operating Budget does not include new exhibit development costs. New exhibits are all self-funded in that the dollars needed are raised on a per-exhibit basis. The Museum is primarily funded by private contributions and memberships. The Commonwealth of Massachusetts supplies some funding for reduced admissions, but very little support comes from government agencies.

I sincerely hope this Annual gives you a more complete understanding of what The Computer Museum is about. We believe every Museum visitor gets a better understanding of the computer revolution and its impact on society. With your continued interest and support, The Computer Museum will implement its critical mission even more effectively and grow into the world-class institution we all want it to be.

Fiscal year 1988 operating revenue



Fiscal year 1988 operating expenses

The Year in Review

This banner year began with the signing of a historic joint collecting agreement with the Smithonian Institution and culminated in the world's first Computer Bowl, a nationally televised event benefitting our educational programs. The Museum launched its first traveling exhibit and its first internationalcomputer graphics research project. *How Tall Are You?* became our first outdoor exhibit. A children's robot-building workshop encouraged youngsters' hands-on involvement.

1987

Museum signs historic joint collecting agreement with Smithsonian Institution.

October 7
Charles E. Sporck, President & CEO, National Semiconductor Corp. Breakfast Seminar: ***Sematech: Why Manufacturing is Important.***

October 11
Marvin Minsky, MIT: ***The Society of the Mind: A Psychological Look at Artificial Intelligence.***

October 18
J. W. Forrester, MIT, Robert R. Everett, The MITRE Corporation, and C. Robert Wieser, Science Applications International Corporation: ***Whirlwind's Genesis and Descendants.***

November 1
Hans Moravec, Carnegie-Mellon University: ***Robots: A Recapitulation of Life.***

November 5
Joseph T. Brophy, Senior Vice President, The Travelers Companies. Breakfast Seminar: ***Linking the Knowledge Workforce.***

November 6-8
25th Anniversary of Computer Games features representative exhibits and symposia on past, present and future games.
Gala party for *Spacewar!* inventors.
2nd International Core Wars Tournament and teach-in.
Demonstration of world champion MITEE Mouse robot.

December 3
William F. Zachmann, Senior Vice President, International Data Corporation. Breakfast Seminar: ***The Second Era of Information Technology: The 1990s ...and Beyond.***

1988

January
Education Department takes lessons in robots and computer literacy to New England classrooms.

January 14
Naomi O. Seligman, Senior Vice President, The Research Board. Breakfast Seminar: ***Roots and Rhythms of the Future: Compelling Technologies.***

January 28
Jon D. Miller, Director of the Public Opinion Laboratory, Northern Illinois University. Breakfast Seminar: ***The Future of Scientific Literacy.***

February
Compare the Candidates program allows visitors to contrast presidential candidates' views.

February 4-6
Alice Trexler, Tufts University, introduces computer-assisted dance.

February 7
Ken Knowlton, Wang Laboratories: ***Experiments in Computer Graphics and Art.***

February 20-21
Third Annual ***Kids Computer Fair*** introduces educational and entertaining software via special interactive exhibits, resource center, and robot playpen.

February 28
Stephen Ocko and Mitchell Resnick, Media Lab, MIT: ***LEGO/Logo: Building a New World in the Classroom.***

March 6
Peter Oppenheimer, The Computer Graphics Laboratory, New York Institute of Technology: ***Beyond Nature: Computer Graphic Simulations of Life.***

March 13
Ray Kurzweil, The Kurzweil Foundation: ***Intelligent Machines of Today and Tomorrow.***

March 18
Max D. Hopper, Senior Vice President, Information Systems, American Airlines. Breakfast Seminar: ***Strategic Uses of Technology: Benefits and Pitfalls.***

March 19-20, 26-27
SIGGRAPH Electronic Theater

April
As part of Boston's Museum Goers Month, ***Awesome Adventures*** introduces interactive exhibit of maze exploration, flight simulation and 3-D animation.

April
By Kids' Design exhibit features winners of national computer creativity contest for students and teachers.

May 5
First teachers' workshop, supported by Massachusetts Council on the Arts and Humanities.

May 1
Dennis Ritchie, AT&T Bell Labs: ***Unix: A Dialectic.***

May 8
David Zeltzer, Media Lab, MIT: ***Interacting with Animated Microworlds.***

Jay Forrester at the Whirlwind reunion.

*The opening of **The Interactive Image.***

Ray Kurzweil: lecture and demonstration

We opened a host of new exhibits while continuing to draw computer pioneers, innovators and industry leaders from around the world to meet, share, and contribute. The events of this successful year are a tangible expression of our mission — to educate people of all ages; to preserve, promote and celebrate computing; and to be a resource for the international community.

May 9
Institute of Electrical and Electronics Engineers, Inc., honors Board Member Robert M. Metcalfe. He donates $10,000 award to Museum.

May 12
Stuart Wecker, President, Interface Design, Inc. Breakfast Seminar: ***Computer Networks: Myths, Reality, and the Future.***

May 15
Tod Machover, Media Lab, MIT: ***Valis: A New Computer Opera.***

June 17
Gardner Hendrie elected Chairman of the Board.

June 17
Ralph E. Gomory, Senior Vice President for Science and Technology, IBM. Breakfast Seminar: ***Trends in Computing.***

July 2-4
The Computer Animation VideoFest

July 13
Pilot PC Resource Center opens, supported by ComputerLand Corporation, Apple Computer, Computer Arts Resource of Brookline, and Radio Shack Computer Centers.

July 14
Celtics' great Dave Cowens opens new outdoor ***How Tall Are You?*** exhibit.

August
How Fast Are Computers? updates CRAY exhibition of supercomputers.

Milestones: The History of Computer Graphics project starts, supported by ACM SIGGRAPH. Massachusetts Council on the Arts and Humanities grant funds admissions for students from low and middle income communities.

August 15-November 15
Imagine: Art With the Macintosh exhibition features dazzling full color art.

August 1
Computers in education expert Adeline Naiman becomes Director of Education.

August 27
First traveling exhibition ***Computers in Your Pocket*** opens at the Science Museum, Richmond. Circulated by the Smithsonian Institution Traveling Exhibition Service; funded by Hewlett-Packard.

September
Award for collections conservation study made by the Institute of Museum Services.

September 7
Henry J. Crouse, President, Open Software Foundation. Breakfast Seminar: ***Open Software Foundation's Contribution to the Computer Industry.***

October 7
The Computer Museum launches the world's first Computer Bowl. The East Coast team emerges the winner.

October 14
Max Toy, President, Commodore Business Machines. Breakfast Seminar: ***Personal Computing—Yesterday, Today, and Tomorrow.***

October 30
Robert Abel, Odyssey Filmakers: ***The New Age of Computers: Life in the Hypermedia Fast Lane.***

November
Can Computers Understand English? shows public how computers can begin to understand English.

November 6
Thomas A. DeFanti, Electronic Visualization Laboratory, University of Illinois: ***Computer Graphics And Beyond: The Viewer As Participant.***

November 6
The Interactive Image adds six state-of-the-art graphics workstations to the Image Gallery.

November 9
David L. Nelson, President, Confluent Systems. Breakfast Seminar: ***Technology Trends in the 90s.***

November 29
Terra Firma in Focus: The Art and Science of Digital Satellite Imagery **opens,** supported by SPOT Image Corporation, The Analytic Sciences Corporation, and Digital Equipment Corporation.

December 1
Edward Feigenbaum, Professor of Computer Science, Stanford University. Breakfast Seminar: ***Expert Systems: Industrial and Commercial Successes of the First Wave.***

December 26
First robot-building workshop.

December 26-31
The Computer as an Artist's Tool educational program features Boston artists working in their media to create dramatic new images.

*Dave Cowens opens **How Tall Are You?***

*The opening of **Computers in Your Pocket** at the Science Museum, Richmond, Virginia.*

Computer Bowl wizard Mitchell Kapor.

Robot-building workshop for students.

The Computer Bowl

By now, everyone has heard about the world's first Computer Bowl — described by the media, audiences, and sponsors alike as "the best event of the year in the computer industry." And by now, everyone knows that despite tough competition from the West Coast, the East Coast team was victorious!

But does everyone know that the big winner was The Computer Museum and the winning team was the many sponsors and volunteers who made this event possible?

A major event doesn't just happen. It begins with a vision which takes shape as a plan that becomes a reality through the efforts, energies and commitment of many people.

The "vision" that became The Computer Bowl began in 1988 with 800 computer-related questions brought to founding President Gwen Bell. The questions were the brainchild of Steve Coit, a partner of Merrill, Pickard, Anderson & Eyre, a West Coast-based venture capital firm. Recognizing that they had the makings of an extraordinary fundraising vehicle, they set to work. Gwen Bell recruited Steve Coit and Technology Research Group president Andy Rappaport as co-chairmen, and hired Boston event marketing and sponsorship consultant Janice Del Sesto.

The next task was to transform 800 trivia questions into a one-of-a-kind event that would attract media, sponsors, and audience. In so doing, the Museum would raise money for its education programs and increase public awareness of the importance of computer literacy.

Thus, The Computer Bowl was conceived. The event would provide a forum in which industry luminaries would for the first time actually "play out" the legendary East/West Coast rivalry. It would parody sports events, and be packaged to attract sponsors competing for industry "position." It would offer an evening of incomparable fun, excitement, and the chance to rub elbows with industry legends. At the same time it would raise money for The Computer Museum.

A strategy in place, the planning group recruited an event committee comprised of board members, friends, and other Museum supporters. They also called upon the talents of the Museum's Public Relations Committee, a group of seasoned PR professionals who advise the Museum on major events. Even before the first press release was issued, a leak leading to a story in the *San Jose Business Journal* prompted many inquiries. Calls and letters began to pour in from media, potential sponsors and ticket purchasers from around the country.

One was from the PBS award-winning TV program, *The Computer Chronicles* , which agreed to videotape and broadcast the event as a special feature and to manage a satellite feed to the West Coast audience.

Now the recruitment of a West Coast committee and a national chairperson were crucial. The national chairperson was an obvious choice. Except for the title, Pat Collins Nelson was already acting as national chairman. Pat was a full-time volunteer working alongside Jan Del Sesto as the project manager. In addition, she and her husband Dave Nelson, a Museum board member, had become "founders" of The Computer Bowl. Having assured her that the only new responsibility would be adding a title to her signature, Pat signed on. She soon recruited Trish Simeone to give up her summer off and become project coordinator.

Meanwhile Gwen Bell and Steve Coit were at work on the West Coast. They convinced Steve's partner Jim Anderson and his wife Nancy, and Kleiner, Perkins, Caufield and Byers' John Doerr and his wife Ann to co-chair a West Coast Committee. The bi-coastal event now had the necessary bi-coastal committees!

Coordination of more than 100 volunteers and contracted personnel became a balancing act. The Museum staff had to balance the requirements of their daily jobs with the additional efforts an event of this magnitude requires. Fortunately, technology helped here. A Xerox-donated facsimile machine and the use of speaker phones made "real time" bi-coastal meetings and immediate responses to press inquiries possible.

Media from around the globe called every day with questions, requests for photos, interviews, and sample Bowl trivia questions. Interviews and photo sessions had to be scheduled, and travel and hotel accommodations had to be made for the celebrities.

There was a game show to produce, a script to write, a set to design and build. Who could the Museum recruit for that? Fortunately, the choices here were obvious: Chris Morgan, a collector of rare computer books and a former editor of *Byte* would select, edit, and write additional questions with Gwen Bell. Lighting designer Alan Symonds and sound man Michael Callahan who had worked on several Museum exhibitions would design and build the set with Tom Merrill and Dan Griscom of the staff.

Meanwhile, using Alan Shapiro's official logo design, the creative studio of Carol Lasky was creating posters, program books, t-shirts, and invitations (the inventive invite produced on a Dysan floppy disk received media acclaim). Tony La Fuente had his crew at Flagraphics busy at work making the banner and flag that would greet everyone at Boston's World Trade Center.

Cash sponsors were signing on after negotiating their "official" status. Trade sponsors came through with much needed services and products. More and more people called wanting to help out, to become a part of that exciting adventure called The Computer Bowl. Eventually, 40 sponsors contributed more than $400,000 in cash, products, and services for this event.

By October 7, the invitations, word-of-mouth, and extraordinary media coverage in industry journals and publications including *The Wall Street Journal, The San Francisco Examiner, Business Week* and *USA Today* spread the excitement. It seemed everyone knew about The Computer Bowl. And judging by the number of phone calls in that last week before the event, they all wanted to come. The Museum had created what was to become the most talked-about, best-covered event of the year (outside of industry product announcements that is!). Several weeks later more than 800,000 TV viewers across the country had the chance to see East and West battle it out when PBS aired the event on *The Computer Chronicles.*

Did the event turn out as expected? Well, not exactly. There were a few surprises. We can thank technology for one. Satellite problems delayed the broadcast for thirty minutes. But even that had its bright side. The East Coast audience was able to hear all of host Chris Morgan's techie jokes. The West Coast audience got to see hosts Gordon Bell, wizard of the tech world, and venture capitalist John Doerr tap dance to the tune of "computer companies I have known and loved!" Bowl watchers on both coasts claimed to have enjoyed the surprise entertainment.

Other surprises? Well, if you ask the West Coast team (David Bunnell, Adele Goldberg, William Joy, Allen Michels and Casey Powell), they'll tell you the biggest surprise was that they didn't win. If you ask the East Coast team (Richard Shaffer, Esther Dyson, David Hathaway, Mitch Kapor and John William Poduska, Sr.) they'll tell you everything went just as they expected.

But the biggest and best surprise of all was that the extraordinary efforts of volunteers, staff, and team members, and the exceptional generosity of businesses and individuals resulted in this event being the most successful in The Computer Museum's history! Press, audiences, and sponsors raved about the Bowl for months afterward. Letters and calls to the Museum expressed praise and thanks for an evening to remember.

And what may come as no surprise at all is that now nobody can wait for the next Computer Bowl in 1990. See you there!

A Ten Year Perspective

Gwen Bell
Founding President

A decade ago, in the winter of 1979, I met with a small group of people at Digital Equipment Corporation to talk about plans for a computer museum. In 1976, Ken Olsen had asked a consultant to write a report on the idea of such an institution. The focus of this report was the education of school children. Concurrently, Jonathan Rotenberg put together his first proposal for a computer discovery center, and a Silicon Valley group started the idea of their high technology center. All of these ideas were ahead of their time, and are only now starting to get off the ground.

Ten years ago, when the plans for The Computer Museum were made, they reflected the environment of the time. The mainstream of computing was time-shared minis and batch-processed mainframes. The Apple II, Commodore Pet, and TRS-80 were a year old and considered to be "hobbyist" computers. Dan Bricklin was dreaming up the first spread sheet to be sold to mini-computer users along Route128. Few people foresaw the spectacular personal computer revolution that was to come. Few people cared about the early first generation vacuum tube computers that were being thrown out.

It was easy to start The Computer Museum by collecting old machines, film, and video and doing some "oral video" of the pioneers of computing, who, with a few exceptions, were alive and well.

Even Release 1.0 of The Computer Museum was more than hardware boxes sitting out on the floor. What changes a collection into a museum is the human interface, the software interpretation that allows people to appreciate and learn from the exhibits. In Release 1.0, these were mainly signs and photographs that helped to interpret the early machines in their context. Like many first releases, the human interface was hardly easy to use. The oldtimers, who remembered programming in assembly language and hand-soldering machines, loved these exhibits. In fact, one said to me, "Why isn't the Museum in Boston, like the first one in Marlboro?" This is a minority opinion, the first exhibits were inexplicable to most people and did not begin to meet any public need for explaining computers.

In the eighties, a rapid change started to occur in the industry. Within three years, the PC was announced with word processing, spreadsheets, and enough memory to make it a business and educational tool. This revolution, along with a move to Boston, allowed the Museum to take on a new look and feel.

In the fall of 1984, Release 2.0 of The Computer Museum opened at the present site. Many of the old machines were put away in the warehouse. Only the most dramatic and special computers were put on display in a context with more information than Release 1.0, but at a level best understood by engineers. Guided tours with trained interpreters from the Museum staff help make these exhibits understandable to school groups and other visitors. One-third of Release 2.0 used interactive computer stations where even the unknowledgable could have fun experimenting with personal computers and investigating graphics applications.

It became clear that the interactive element — computer discovery — was what most of the visitors liked, even if they came to see some of the historic machines.

In June 1987, the Museum opened *Smart Machines*, release 2.5, where the visitor explores and investigates the world of artificial intelligence and robots. Human interface in this area is even easier: machines respond to voice and speak back, to physical presence, and with touch. Keyboards are only one small part of this interface and signage is supplemented by video, sound, and dramatic displays.

Release 3.0, the future museum, may finally be able to realize the dreams of ten years ago to communicate the excitement of computing to a broad audience. An unparalleled collection will continue to be used to develop unique and exciting historical exhibits. The tools of new easy-to-use computers will be used to define a new level of interactivity in Museums. For the first time, using interactive video, exhibits can have layered messages that will appeal to different levels and interest groups. The evolution of the computer — that we celebrate — will also transform this Museum into a new multi-level, multi-layered experience that can grab every family member from a six-year old to a PhD in Computer Science and to a grandmother intimidated by the new world of computing surrounding her.

In all of this the Museum proceeds step-by-step, experimenting with the new while preserving the old. The vision leads to Release 4.0, reflecting the new advances that are still in the realm of "computer imagineware." Come along this road with us. Help the Museum preserve a distinguished past and bring the newest computing concepts to the public.

A Plan for the Museum's Exhibits

Oliver Strimpel
Curator & Associate Director

The Computer Museum Exhibits Committee

Gardner Hendrie
Sigma Partners
Chairman

I. Bernard Cohen
Harvard University

Robert W. Lucky
AT&T Bell Laboratories

James L. McKenney
Harvard Business School

David Nelson
Confluent Systems Inc.

The Computer Museum Staff

Oliver Strimpel
Gwen Bell
Joseph F. Cashen
Adeline Naiman

The Computer Museum's mission is, in part, to educate and inspire all ages and levels of the public through dynamic exhibitions and programs on the technology, applications and impact of computers.

Over the past year, The Computer Museum's Exhibits Committee has debated the future of the Museum's exhibits. What exhibits should characterize Release 3.0 of The Computer Museum? The first step towards answering this question has been taken — the Committee has produced a long-range plan for the Museum's exhibits. This article presents the essence of that plan.

The Purpose of the exhibits

Exhibits provide an environment for "landmark learning," the grasping of key ideas in a new subject. Exhibition galleries filled with an engaging array of interactive displays, original artifacts, and video have a special power to inspire visitors to make mental leaps into new fields. The selection of content and media serves the educational goals of the Museum.

What are the educational goals of the Museum? They are to stimulate the general public's curiosity about computers; to address their fears and misconceptions; to evoke an interest in computing that could profoundly affect the course of a visitor's life, especially among the young; and to reveal how computers work, what they do, and the role they play in society — past, present, and future. The Museum's educational thrust is described more fully in the article on page 12.

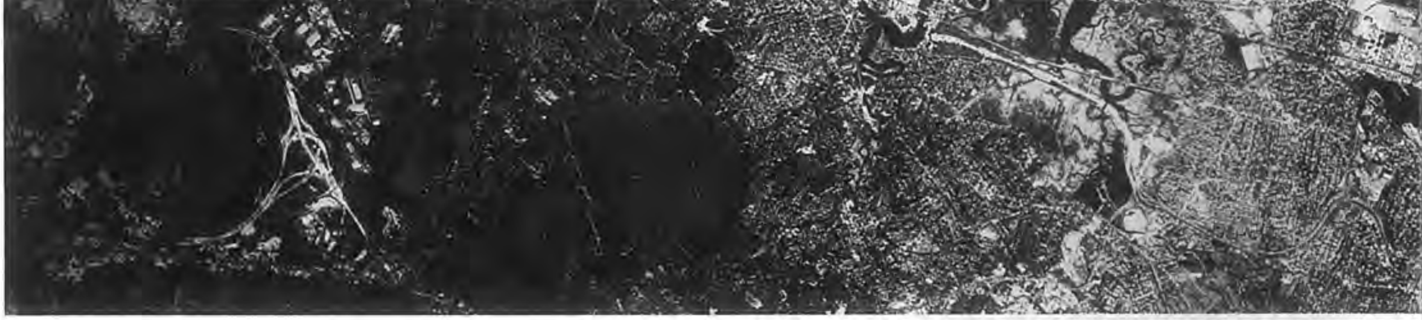
Communicating with visitors

The Museum attracts visitors of all ages and diverse backgrounds. Forty percent are children, and the majority of the adults do not know much about computing. A significant minority are computer professionals. Over half the visitors come from outside Massachusetts, and over 10% come from abroad. The Museum's exhibits must strive to open new horizons for all its visitors.

An important tactic for accomplishing this will be to plan diverse exhibits that offer great variety as the Museum is traversed. Individual exhibits may appeal to particular visistors more than others, but the overall mix at the Museum will offer a rewarding experience for all.

Two exhibit types can have particular impact on visitors. The first is the "larger-than-life" display, epitomized by the walk-through human heart in the Chicago Museum of Science and Industry, or the "Soup Machine" animated computer of the National Museum of Science and Technology, Ottawa. Such exhibits envelop visitors with a revealing new perspective on the museum's subject matter. They instill a powerful take-home impression that is a salient characteristic of many successful museums. The Computer Museum's new galleries will include two such exhibits: a recreation of a giant 1950s computer room and the Walk-Through Personal Computer.

The second highly effective type of display is the hands-on interactive exhibit where visitors learn by doing something themselves. This stimulates a depth of understanding not attainable through passive watching or listening. The Museum currently has over 60 interactive, computer-based exhibits; over the next few years, this number will approach 100. In addition to offering fresh experiences, this increase will ease crowding, allowing a greater proportion of visitors access to the interactive exhibits of their choice.



Smart Machines

Opened in June 1987, Smart Machines *explores artificial intelligence and robotics with many interactive exhibits, including expert systems, natural-language-based systems, robot sensing demonstrations, and a theater with a multimedia show, that features the classic robots. The 3,750 square foot gallery cost $500,000 to develop, with an equal match of in-kind donations of hardware, software, and labor. It is the Museum's most popular exhibition.*

Exhibit content

Each of the Museum's exhibits will address one or more of the following topics: computer applications and the social impact of computing, how computers work, evolution of computing, and people in computing. Many exhibits will contain a richly interwoven mixture of all these areas.

Computer Applications and Social Impact

This topic has wide appeal because people want to discover what computers are capable of doing and learn how they will affect their lives. The Museum is a natural place in which to demonstrate computer applications; visitors can engage with them directly, gaining an experience that cannot be matched by print or audiovisual media.

The two most popular major galleries in the Museum, constituting over a third of the current exhibit space, focus primarily on computer applications: *Smart Machines,* featuring artificial intelligence and robotics, and *The Computer and the Image,* showing image processing and computer graphics.

The Museum will radically expand the scope and range of computer applications presented, starting with a major exhibit on personal computers. This will demonstrate key application areas and will offer visitors many hands-on interactive computers for experimentation and play.

Another exhibit featuring applications and their social impact will be *The Networked Society.* This will present large-scale computer applications that control information essential to the running of modern society. Examples will include telephone networks, airline reservations, on-line banking, international finance, manufacturing, and retail networks.

How Computers Work

The centerpiece in this area will be a giant walk-through personal computer. Visitors will roam through this gallery-sized simulation of the inside of a working computer, discovering what the main parts of the machine are and how information flows between them. Visitors will be able to interact with this "computer" by means of giant input devices and see their data or instructions travel to the processor and memory, be manipulated, and sent to an output device. This larger-than-life exhibit will create an indelible impression for visitors and may become the Museum's hallmark.

Topics that will be adressed in other exhibits include miniaturization, the difference between hardware and software, and the nature of a program. Special care will be required to make these exhibits truly accessible to visitors with little computer knowledge, while serving the intellectual needs of experts.

The Evolution of Computers

The Museum plans to develop two permanent historical exhibits. *Milestones of Computer Evolution* will present the key innovations in the history of computer hardware, software, and applications. The exhibition will feature the social factors that stimulated the development of computing, and, in turn, the effect of computers on society. *Milestones* will define a basic level of computer history literacy for schoolchildren and the general public.

The second exhibit will feature the world's largest computer — a SAGE system from the U.S. Airforce's early warning line, active from the late 1950s until 1983. The display will combine the Museum's SAGE artifacts with audiovisual and special effects to create a dramatic reconstruction of an early computer environment.

Terra Firma in Focus
The Art and Science of Digital Satellite Imagery
The Computer Museum's most popular temporary exhibit of the year displays spectacular imagery from SPOT, the French remote-sensing satellite. The displays demonstrate how, with the help of computers, satellite images can provide valuable information for agriculture, natural-resource exploration, map making, and news gathering.

In addition, many other aspects of computer evolution will be covered as introductory or background sections within other thematic exhibits, both permanent and temporary. The history of personal computers, for example, may be presented within a thematic gallery on personal computing.

Visitors who wish to see artifacts from the Museum's collection that have not been selected for public display will be able to tour the Museum's Visible Storage area. There they will see all the significant artifacts in the collection, labeled with general descriptions and detailed specifications.

People in Computing

The achievements of individual computer engineers and entrepreneurs provide a good vehicle for focusing on specific technologies, applications, and their social impact. Temporary exhibits will be mounted to feature specific groups of individuals, perhaps on the occasion of important anniversaries. Audiovisual programs showing computer innovators will be used wherever appropriate to add a human dimension to the exhibits.

Serving the national and international public

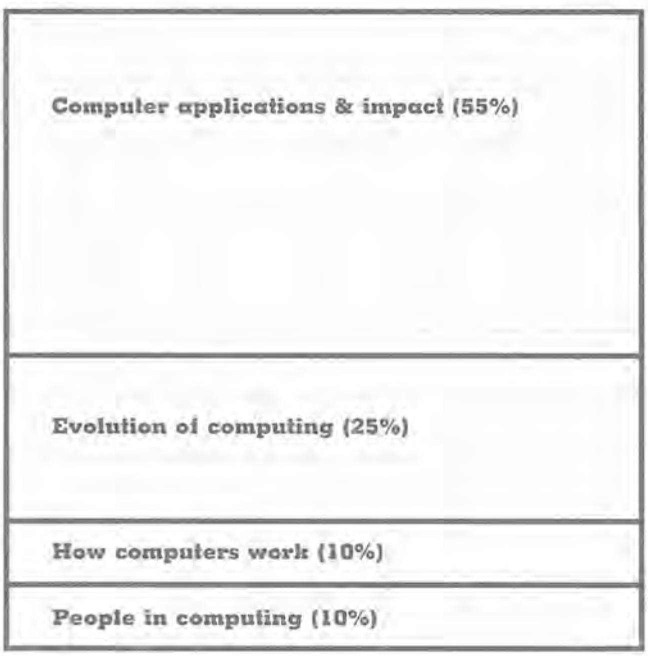
In many parts of the world there is a crying need for resources that can stimulate the growth of computer literacy. The Computer Museum has the world's most extensive set of exhibits on computing. We plan to maximize their educational impact by sharing them with a broad public in other parts of the country and abroad. The Museum is pursuing two approaches to meet this need.

First, the Museum will create exhibits that tour science and technology centers under the auspices of the Smithsonian Institution Traveling Exhibition Service (SITES) or the Association of Science-Technology Centers. *Computers in Your Pocket* is the first such Computer Museum exhibit, currently being toured by SITES.

Second, the Museum plans to distribute exhibit kits that provide the materials and information required to replicate Computer Museum interactive exhibits. Exhibit kits would be sold at reasonable prices to science and technology centers around the world, saving needless reinvention and bringing the benefit of The Computer Museum's experience to tens of millions of museum and science center visitors each year.

The Museum currently has 19,000 square feet (almost half an acre) of public exhibit space, with a further 9,000 square feet available within the building. Over the next four years, over half the existing exhibit space will be redesigned from scratch, and a new 2,500 square foot bay will be opened.

Proposed allocation of exhibit space
(proportional)



The Living Classroom

Adeline Naiman
Director of Education, The Computer Museum

The forms of education have been changing as rapidly as society itself in recent years. The proliferation of information has made this the age of the specialist. No brand of conventional schooling can prepare students adequately to meet an indefinable future, yet this is what schools today are expected to do. No wonder they are charged with failure.

Still, we humans are remarkably resilient—and entrepreneurial. In the past couple of decades, "continuing education" or "lifelong learning" has helped restore educational possibility to those who missed it first time around or who want to better their lives.

More recently, the notion of "informal education" has come to the fore. Its underlying assumption is that people must take charge of their own learning and not simply receive it whole as packaged and directed instruction. Museums are ideal places for informal learning. This does not mean that we abandon the responsibility for presenting knowledge and throw the whole smorgasbord out on the table for visitors to sample heedlessly. No indeed; the recognition that people of all ages come to a museum to explore, enjoy themselves, and find answers to their questions puts an even greater reponsibility on museum staff to set the table carefully and selectively, to make the array appetizing, and to frame the setting to satisfy explicit and hidden hungers. We must shape the learning environment with greater care than a classroom or textbook can, because we cannot simply "teach"; we have to capture and satisfy our learners.

Of course, the mission of every museum is, in part, to educate—to preach to the unconverted. The Computer Museum stands in a special relation to that mission because the technology that constitutes our collections, exhibits, and programs is a scant half-century old, and while our members and supporters are well informed about computers, most of the public is not. Indeed, what brings a great many of our visitors to the Museum is their curiosity to find out about this dazzling new technology, see it in action, and try it for themselves. The Museum's exhibits are increasingly designed to meet their needs.

The Computer Museum's Education Department builds on this desire for knowledge in several ways. One way is to work with the staff to help them match their tours and presentations to the requirements of visitors of a range of ages, background understanding, hands-on experience, and interests. We make a special effort to reach young people from school, camp, and community groups. We have a particular goal of bringing inner-city children to the Museum and helping them recognize it as theirs. We reach out to elderly visitors and to people who are physically limited. Always, we strive to maintain gender equity in our programs and materials; the computer is, after all, neuter.

Other ways we support such efforts is to design, refine, and present new demonstrations on topics of general or school interest and to incorporate these into the regular visitor schedule. To the extent possible, we also offer presentations to groups outside the Museum. By collaborating on exhibit development, we try to add an explicitly educational perspective to the design and communication aspects of exhibits.

All student groups receive a guided tour of the historical galleries. Here, an MI explains the SAGE Blue Room.

Future educational services

A long-term goal is to expand the educational services we provide to people who call or write in for specific information, resources, or other help. Our newly revised and reprinted Educational Activities Kit serves as a brief introduction to computers. It is routinely given to all school tour leaders, so that they may prepare students for the Museum visit and follow it up with classroom activities. Following reviews in national media, orders are coming in from all over the country. We expect to add toour existing printed handouts and workshops and to develop new resources—videotapes and descriptive sheets about the Museum's collections and exhibits, focused publications, topical teaching guides.

We plan to create within the Museum a teacher resource center, where we will offer presentations, workshops, and short-term courses. Here we expect to have the latest and best available hardware and software designed to bring the classroom and curriculum up-to-date. Teachers will be able to try out equipment and courseware they might not otherwise have an opportunity to explore for themselves. Students and their parents will be helped to use innovative teaching materials, and all visitors will be welcome to test the cutting edge of educational technology.

The center will have educational software, books, and periodicals, as well as videodisks, CD-ROM disks, audiocassettes, and videotapes, all with players. It will have printers and a local-area network with server and software. We already have a start on telecommunications equipment with subsidized connect time to a number of databases. We are looking to commercial sources to fund and equip the Center and help us staff it. It is our hope that teachers and school administrators will come to regard this as their special place within the Museum.

Steps we're taking right now

Meanwhile, we are expanding free or reduced-admission visits for low-income schools with the help of increased funding from the Massachusetts Council on the Arts and Humanities. In early October, we sent a new tour guide to schools and community groups within comfortable visiting range of Boston, and we continue to host groups from the New England states and even beyond. Each tour begins with a survey of the great computers on exhibit and allows time for free exploration of our interactive exhibits. Visiting teachers report considerable satisfaction. Repeat visits are common.

During school vacations and on weekends and holidays, we offer special events. This December vacation week featured demonstrations by computer artists-in-residence. A successful first was the "Build Your Own Robot" workshop for child-adult pairs. This will be repeated on coming holidays.

February vacation week culminates in Kids Computer Fair, which brings commercial vendors to the Museum and allows children and their parents to sample the latest software. Special Needs Day and October Computer Learning Month offer additional opportunities for participatory learning.

Off-site presentations have been much in demand and serve a valuable function in bringing the Museum to audiences that might not otherwise come here. Only a shortage of staff limits the number of requests we can meet, and we are seeking foundation support to expand our outreach activities.

These and many other activities have been carried out by our small education staff. During the summer, Michael Chertok, Education Coordinator, set up a pilot Computer Resource Center with borrowed equipment, and staffed it with Boston high school students. Visitors were able to try out personal computers, application software, and a telecommunications network. These hands-on activities were especially appealing to school-age visitors, including those who came on tours from summer camps. They also proved engaging to adults eager to get their hands on new equipment and software.

I joined the Education Department in August, 1988. Building on the Museum's existing strengths, and in collaboration with the staff of the other Museum departments, I am confident that we will fulfill our collective mission to make The Computer Museum a significant force in the education of a wide public and help to create a technology-literate citizenry.

Computers and Scientific Literacy

Jon D. Miller

Professor Miller, Director of the Public Opinion Laboratory, University of Northern Illinois, has been measuring scientific literacy for more than a decade. The Laboratory is currently undertaking the Longitudinal Study of American Youth with support from the National Science Foundation. Three thousand seventh- and tenth-grade students will be followed for four years. Their teachers and parents will also be interviewed. The following article is based on preliminary results concerning the level of scientific literacy of tenth-grade students, and the impact of computer awareness on scientific literacy.

Basic scientific literacy refers to the ability to read and write about scientific topics. Functional scientific literacy allows a citizen to understand major public policy issues involving technological issues.

Basic scientific literacy demands a vocabulary and an understanding of the process of science. To test concept comprehension, people have been asked to rate their own understanding of terms like radiation, DNA, and computer software. To test understanding of the process of science, people have been asked to explain in their own words "what it means to study something scientifically."

Technological literacy concerns the understanding of the impact of science on society and vice versa. National samples of adults have been asked to describe the advantages and disadvantages of events like the construction of a nuclear power station in their local area, efforts to communicate with other intelligent life in the universe, or the additives to their foods.

These three substantive dimensions are functional scientific literacy. These concepts are important in thinking about science and technology and should influence the selection of strategies for public communication on issues.

Distribution of functional scientific literacy

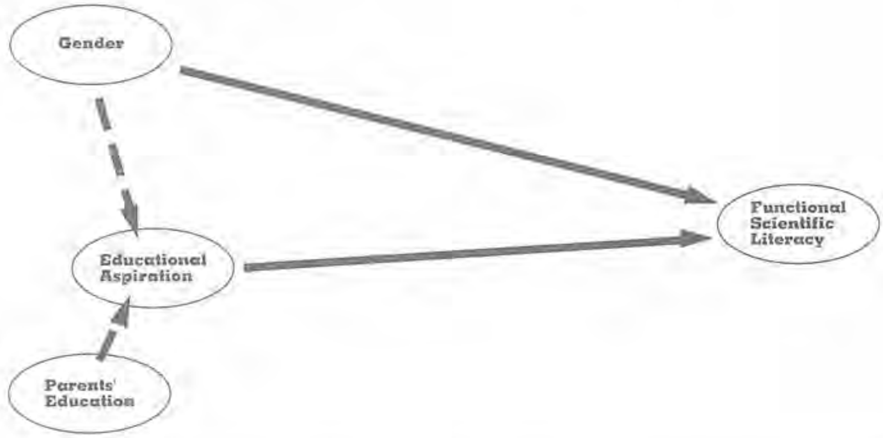
The Longitudinal Study of American Youth found that 81 per cent of high school sophomores failed to qualify as either scientifically or technologically literate. The student's gender, educational aspirations, and parent's education skew this distribution. Table 1.

To assess the relative important of gender, educational aspiration and parental education, a log-linear path model was constructed. This model, Figure 1, shows that educational aspiration and gender are directly related to functional scientific literacy and that parental education exercises influence only through the level of educational aspiration. The data suggest that better-educated females tend to share their own interest in science and technology with their children and to stimulate the early acquisition of functional scientific literacy.

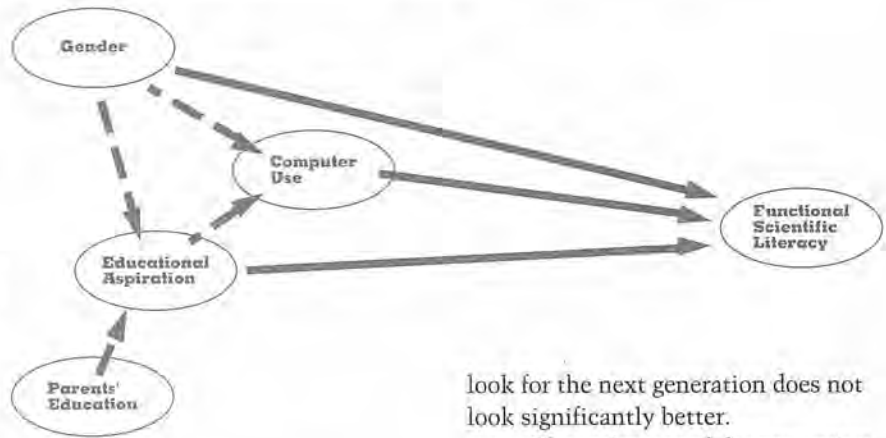
The Distribution of Functional Scientific Literacy among High School Sophomores by Gender, Educational Aspiration, and Parents' Education. 1987.

Parents' Education	Educational Aspiration	Boys %		Girls %	
High School or less	Less than college	**1**	(171)	**2**	(163)
	Baccalaureate	**11**	(70)	**1**	(56)
	Graduate degree	**30**	(20)	**0**	(57)
Some college	Less than college	**4**	(87)	**1**	(79)
	Baccalaureate	**13**	(41)	3	(71)
	Graduate degree	**21**	(41)	9	(54)
Baccalaureate	Less than college	**1**	(36)	**0**	(30)
	Baccalaureate	**11**	(65)	**1**	(58)
	Graduate degree	**21**	(87)	**10**	(98)

A Path Model to Predict Functional Scientific Literacy among High School Sophomores. 1987.



A Path Model to Predict Functional Scientific Literacy among High School Sophomores, including the Influence of Computer Use. 1987.



The impact of computer use

Students were asked whether or not they used a computer 10 or more hours during the preceding summer. This is a useful measure because summer use would most likely be voluntary — as opposed to a classroom requirement. Seventeen percent of high school sophomores reported that they had used a computer more than 10 hours.

This variable was placed in the path model of family education level, gender roles, and educational aspirations. Computer use was found to have a direct and significant positive relationship with functional scientific literacy. (Figure 2)

The level of summer computer use is influenced by the level of educational aspiration and gender. The influence of parental education appears to be limited to fostering educational aspirations with no residual effect on summer computer use or functional scientific literacy. The level of educational aspiration is the strongest influence on summer computer use, accounting for 53 per cent of the total mutual dependence. In contrast, gender accounted for 16 per cent of the mutual dependence.

How are we to attribute influence? Variables were entered into a stepwise model that we think mirrors reality. Each variable predicts the maximum amount of mutual dependence possible. We reasoned that the level of educational aspiration is a long standing attitude and that computer use is a more proximate variable and should be entered first. If this order is followed, then summer computer use accounts for 22 per cent of the total mutual dependence. Educational aspiration is then entered second and accounts for an additional 36 per cent and gender is entered last, explaining about 17 per cent of the mutual dependence of the model.

What difference does each variable make, holding constant all of the other variables? What is the unique contribution of summer computer use when the level of educational aspiration and the gender of the student are held constant? Using a main effects model, and examining a series of models that systematically delete each variable one at a time, summer computer use accounts for only nine percent of the total mutual dependance.

The discrepancy between the two models tells us that there is a very strong joint effect between the level of educational aspiration and computer use, which is what we might have expected.

Implications

Thinking ahead to the 21st century, it is likely that the number and sophistical of science policy issues on the national political agenda will markedly increase. Many issues, like recombinant DNA processes and products, will require a reasonable level of understanding of modern biology. Other issues, especially those involving risk assessments, will require an understanding of probability. My findings show that present levels of adult scientific literacy could not support a meaningful broad-based political debate on these issues. Unfortunately, the outlook for the next generation does not look significantly better.

The estimates of the proportion of high school sophomores who are functionally scientifically literate indicate ranges from zero to 30 percent for various demographic groupings. The strong skews in functional scientific literacy away from women and the children of less-well-educated families will make participation all the more difficult for many groups that have been historically underrepresented in the political system. This is a recipe for increased alienation in the political system.

The problems of scientific illiteracy are not going to be reversed or even significantly reduced in the next generation with a significant intervention in the education system. Opportunities in informal education, in access to computers and alternative opportunities for youth are extremely important. The political perils of this situation are great. Attention needs to be focussed on this problem so that we can press for major improvements.

Trends in Computing

Ralph E.Gomory
Dr. Gomory is Senior Vice President for Science and Technology at International Business Machines Corporation, Armonk, New York. This article is based on his talk at a luncheon following the Annual Meeting of The Computer Museum. June 17, 1988.

Miniaturization

Every talk on trends in computing includes a discussion of the continuing progress in miniaturization that has brought us in 20 years from one memory bit on a chip to more than a million. It is worthwhile to reflect on how the industry is able to sustain this remarkable progress.

One way of looking at this that tends to confirm the notion of an endless path of improvement is to remember that we don't do any work in this industry. It may not feel that way at times, but computing does not involve physical work. This industry is quite unlike the auto manufacturers, for example, who have to build a car that will carry people up a hill. All that computer products do is move marks around, and we make progress by making these marks (ones and zeros) smaller. There seems to be no limit to this miniaturization, and that, to a large extent, is the game we're in.

The dominant FET (Field Effect Transistor) logic is rapidly moving from one micron toward .35-micron technology and smaller. This inevitable miniaturization process will provide more and more MIPS (Millions of Instructions Per Second) on fewer chips per computer.

The quarter-micron limits that were projected just a few years ago are fading away as they are realized. Tenth-micron technology is working today in the laboratory, and we see no reason to think that can't be improved on. My personal point of view is that even if we should run out of gas in semiconductor technology, we will find other ways to make very small ones and zeros.

Large tools for small circuits

As the circuits get smaller, the tools to make them get bigger. We'll probably, at some point, have to go from optical lithography to something with a shorter wavelength to draw

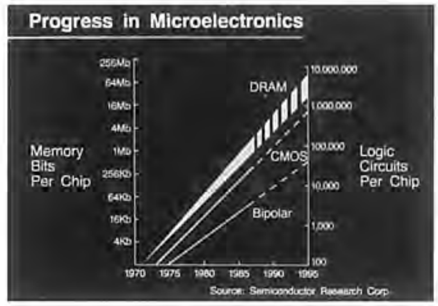


Figure 1. Progress in Microelectronics.

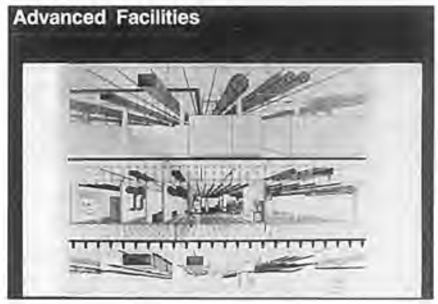


Figure 2. A contemporary three level silicon factory. Only the middle level of the three is used for production. It is isolated for cleanliness and supplied with all the chemicals needed for processing.

Disk Performance Gains

	1956 (RAMAC)	1971 (3330)	1987 (3380)
Information per spindle of disks (millions of characters)	5	100	3,750
Time needed to access data (milliseconds)	600	30	16
Read/write speed (characters per second)	9,700	806,000	3 million

Figure 3. Disk performance gains.

circuits with finer features on the silicon. One of the interesting characteristics of this industry is that if you can make a picture of something, then you can make it. And the finer the picture, the more of them you make.

None of this is cheap; it is just the opposite. To make progress, you have to make things small. To make things small, you need complicated tools. Further, these tools have to operate in a clean environment. The result is that the tools are expensive and the plants are even more expensive. Modern silicon factories can effectively use only one-third of their floor space. The rest is to keep things clean and circulate the processing gases and other chemicals. Such a facility costs about $1000 a square foot.

Packaging the chip

Especially in the highest performance computers, the package, the way one chip is wired to another, is as complicated and challenging as the chips. The cycle time, or interval between successive operations in a large system is about equally divided between the chip, the package and other factors combined. With faster circuitry, better packaging is needed to exploit it.

In low-end machines, the principal packaging consideration is not the speed of the interconnections, but their cost. This cost, measured in pennies per wire or input/output connection is what matters in providing low-cost computers, and there is tremendous progress in this area, too.

Increasing disk densities

While progress in microelectronics seems natural, magnetic disks and disk drives are often thought of as clumsy mechanical components that sooner or later ought to be replaced with some kind of solid state storage so that all those nasty moving parts won't be needed. Yet the disk has stubbornly defined extinction. To me it is one of the most amazing branches of computer technology.

A disk, whether it's in a desktop computer or a big disk farm in a large computing center, is fundamentally the same thing. It is a platter that spins at engine speed, typically 3600 rpm, very much like a phonograph, and represents ones and zeros by little magnetized areas on the surface. Figure 3 shows the dramatic improvement in storage capacity and speed from the time of the RAMAC, the first disk.

The problem in disk technology is to sense the magnetization as the disk rotates. The only way to distinguish one bit from another is to get close to them so that the sensor's field of view is filled by a bit. Unfortunately, there is no way to beam magnetic fields.

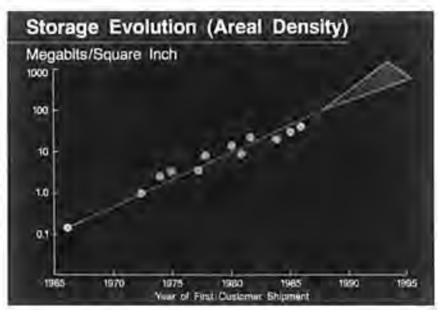
About 1970, the read/write heads in magnetic files were flying between one and two wavelengths of light above the disk surface. And when I use the term flying, they really fly; they are shaped like little airplane wings, and the air holds them up, and springs push them down. Flying one or two wavelengths of light above an imperfectly smooth surface going at 3600 rpm seems improbable. And in the early seventies we thought this was the limit of closeness. No. Today the heads are flying only a third of a wavelength of light — smaller than any dimension in semiconductors — above the still bumpy surface and they are going to keep coming closer to the disk. Because again, progress is made by making the magnetized areas smaller, and that means getting the head closer to the surface.

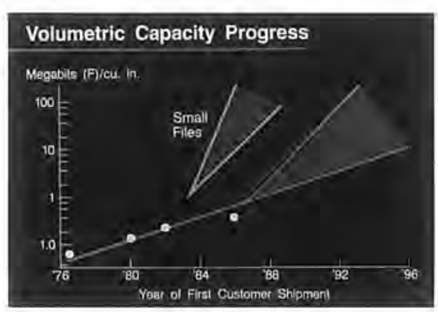
With the advent of desktop computers, the third dimension is becoming more important. Bits per cubic inch is a better measure of how much storage you can put in a small machine than bits per square inch. Progress in getting disks closer together is even more rapid than in packing the bits more densely.

Optical storage is very attractive because light has some nice features. It comes in beams, which allows the head to be moved away from the disk surface. Very small marks can be made with light, and that increases the number of bits per square inch. However, the heads are more complicated, requiring the disks to be spaced farther apart at the expense of cubic density.

The scenario for optical storage started at the write once/read only stage. It is moving toward read/write, relatively low performance products that may march right on up the performance curve.

Figures 4 and 5. The increase in the number of bits stored per square inch of disk surace, and the equally significant progress in reducing the volume of disk storage.





The scanning tunneling microscope

In 1986, two scientists at the IBM Research lab in Zurich were awarded the Nobel Prize for the scanning tunneling microscope. This device, like disks, is a reminder of the power of mechanics. Although mechanics has an old fashioned flavor to it, the notion that the wavelength of solid objects is very short compared to the wavelength of light offers possibilities for very precise measurement. The scanning tunneling microscope is not often looked at as a masterpiece of mechanics, but essentially that's what it is.

The scanning tunneling microscope is basically a tripod with three legs and a little pin that sticks down between them. The mechanics are so good that the little pin can be positioned very close to surfaces. When I say close, I mean 5 or 10 angstroms — one or two atomic diameters. The legs can be extended and contracted with great precision to walk the pin across the surface, scanning it.

The presence of the surface is sensed by putting a voltage on the pin so that some current will tunnel through the gap between the pin and the surface. The wider the gap, the less current flows, so as it marches along, the current varies. This variation maps the heights of the surface at the atomic level.

In Figure 6, each bump is associated with one atom. So in a very real sense, in this picture you are looking at individual atoms. This is different from looking at an x-ray picture of a crystal, where in fact you are looking simultaneously at millions of atoms which, when symmetrically placed, give you a single picture. The scanning tunneling microscope pictures provide views of individual atoms.

In principle, if you can look at atoms one at a time, you can also mark them. This has been done by putting fairly complex molecules on a surface and then, by applying a voltage, changing their state. The pin can be marched away, come back later, and sense the change of state. This is a demonstration of storage created at the molecular level, something I believe we will be doing routinely in the long run.

The human interface

While progress inside the computer is dominated by the paradigm of making things small, the human interface is measured by its ease of use, and we have to do something other than miniaturize it. However, Figure 7 shows that miniaturization helps here, too, because it provides more power for processing new forms of input.

The traditional input methods, hammering on a keyboard or moving a mouse, don't take a lot of processing power. But an easier to use scanner takes more, and handwriting and speech recognition even more. Indeed, speech recognition and eventually machine vision will only become practical because of cheap MIPS that can be devoted to them.

When I joined IBM, 1200 of us shared one 704 computer. If we had decided to devote that 704 to word processing, it could have been fairly successful for one person. Believe me, the thought never crossed our minds. Similarily, what a profusion of MIPS can do is something that is often hard to forecast until they become so cheap that people start to fiddle with them.

Speech recognition is clearly benefiting from cheap processing power. At IBM Research, we have PCs with one or two special cards that will recognize 20,000 spoken words. I don't mean words that run together; you .. have .. to .. pause .. between .. each .. word. With very high speed chips devoted to recognition, this is affordable and will continuously improve.

The great mystery about speech recognition has been the problem of finding a useful application. As the capability has steadily improved year by year, the number of actual uses has remained very low. The goal of dictation to a machine remains elusive.

I don't know how many people want an electronic book, but it's coming and it will be made by sticking together the pieces of technology I have talked about. My model electronic book contains one of those small, very dense disks coming in a few years that will store approximately 300 novels. It has a flat display, a technology which is evolving from the bottom up. That is, it's the same liquid crystal display that originated in wristwatches and just keeps getting bigger. Liquid crystal displays increased in size to become very small television screens, got larger on portable computers, and are on their way to becoming a major alternative to the familiar cathode ray tube.

The book's display surface will also allow hand-marking and character recognition. In a small corner of its disk it will carry correspondence so you can write and edit your letters. The book will be hinged in the middle. I sometimes think that the most doubtful part of the whole thing is whether we can get the optional leather cover to adhere to the back. But all the rest of the technology is going to be available.

Today, workstations are what people use. With their tremendous computing power they are beginning to present an interface that is more natural than anything we have ever seen, as well as being significant computing engines. Many of the obvious things that people do can be dealt with simultaneously on their mul-

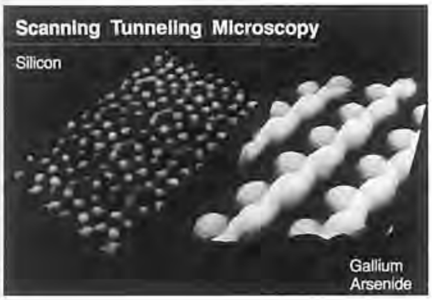


Figure 6. Scanning tunneling microscope images of silicon and gallium arsenide surfaces.

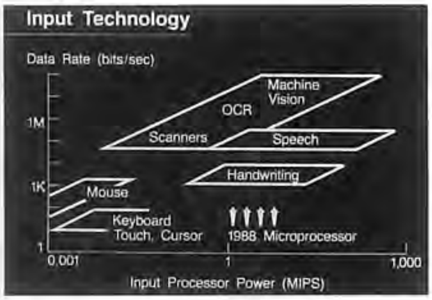


Figure 7. Input Technology.

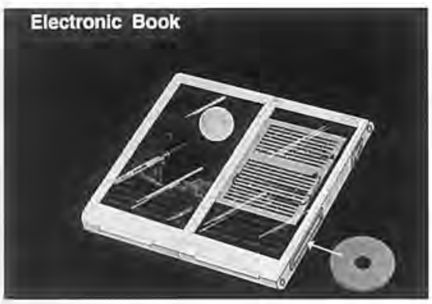


Figure 8. Electronic book.

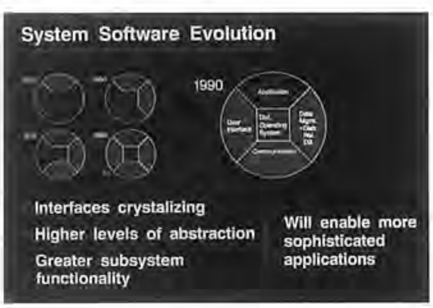


Figure 9. System Software Evolution.

tiple windows. Their power, especially when they are backed up by networks of other computers and with expert systems, will enable users to do very intricate things that will be a mixture of computing and visualizing information.

Software evolution

In 1950, if you wrote an application, you really wrote an application; you wrote it all. Now you tend to write only the part that's unique to the job at hand. The various activities common to many applications have been split off and become subsystems of the system software.

Writing to a tape, for example, gradually turned into a file subsystem, that didn't have to be rewritten for each application. The file system turned into a hierarchical database, then into a relational database, and one day it will become a collection of objects. Similarly over time, other common functions such as communications and independent front-end subsystems are being split off. This means that application programmers can spend their energies on the application, and the system takes over the other functions.

As software evolves, the interfaces between different parts of the system have become cleaner and cleaner. In older operating systems, everything was scrambled together. Modern system software communicates at higher levels of abstraction. For example, in a very modern database (or one just around the corner) you should be able to have a command like "retire" that sets in motion a whole series of changes that reflect an employee's status. The tendencies continue to be: clean up the intrface, deal at a higher level of abstraction, and find greater function in the subsystems.

Software development itself is in rapid transition today thanks to a combination of things: new specification and design tools, languages that enable the use of modules from many different origins, and the ability ot maintain all this, in an orderly way, in a single repository that is accessed by many different tools. Powerful workstations for the programmer are helpful, too, because they allow viewing of work at different levels of detail.

Progress in hardware and software

The technology trends I talked about earlier were not obtained by plotting history on semilog graph paper and drawing a straight line. They were obtained by making the best technological projections about what is possible or what can almost certainly be done. And since they are based on what we already know how to do today, I think most of the surprises will be on the up side.

The growing power in both hardware and software will allow us to move into a tremendously different future. We are only at the beginning. The changes in the next 30 years will be even greater than in the last 30 years, since the time I first used that 704.

The Computer Museum Collections

The collections of the Computer Museum are broken down into three categories: artifacts, film and video, and documentation including photographs.

During the last year, all of the collections (not on loan) were moved to the Museum Wharf site. A 4000 square foot room has been set aside for on-site Visible Storage and to house the archives. A working area will be set up for research. In addition, the Museum has two smaller storage areas where items are kept compactly. The Museum could accommodate the collection in this area because it had arranged with Digital Equipment Corporation to store the Whirlwind and the TX-0, and to loan the CDC 1604 to Cray Research. These objects, alone, would have filled the 4,000 square foot visible storage room. The Museum will continue to make creative arrangements with other organizations to appropriately preserve, exhibit or store other artifacts that we have preserved.

In moving all the artifacts, the collection acquisition's policies were reviewed by the staff and Collections Committee.

Two activities were initiated: a conservation survey funded by the Institute for Museum Services and a project on Milestones in Computer Graphics funded by ACM SIGGRAPH.

The continual refining and development of the collections is made possible with the help of The Collection Committee who meet three times per year. In addition, the group is helpful in providing ongoing advice.

Artifacts

In the last year, 110 artifacts were added to the collection, representing about twenty percent of the offers received. Three large-scale acquisitions were made: the major components of a UNIVAC I, a corner of the CDC 7600 Serial Number 1, and an IBM 3851 "honeycomb" Mass Storage Unit. Representative samples have been taken of a variety of machines, including an IBM 360/40 console front panel, a CDC 39 inch disc, and a SWAC Williams Tube. In some cases, when an object was rejected for the collection, documentation was kept for the "virtual collection."

The Computer Museum Collections Committee

Bruce Eric Brown
Wang Laboratories

Bruce Bruemmer
The Charles Babbage Institute

Joseph F. Cashen
The Computer Museum

I. Bernard Cohen
Professor Emeritus Harvard University

Jon Eklund
The National Museum of American History, The Smithsonian Institution

Gardner Hendrie
Sigma Partners

Christopher Morgan

Jean Sammet
Consultant

The Computer Museum Staff

Gwen Bell

Oliver Strimpel

Allison Stelling

Computers

Computer
Devices Inc.
DOT, 1979
Portable Personal
Computer
Gift of Mark J. Lowenstein
X911.88

Compusource, Inc.
Abacus Personal
Computer, 1984
Portable Personal
Computer
Gift of Dr. Kenneth Levites
X917.88

Control Data
Corporation
CDC 7600 Serial # 1,
see photo p. 26.
Gift of Lawrence Livermore National Laboratory
X942.88

Convergent
Technology
Workslate Computer,
Briefcase-sized fixed
program Personal
Computer 1985
Gift of Allen H. Michels
X951.88

Data General
Data General One,
Lap Top Personal
Computer 1985
Gift of John Kendall
X908.88

Digital Equipment
Corporation
PDT-11
DEC's first Personal
Computer
Gift of DEC
X860.88

Evans and Sutherland
PS 1, Serial No. 1
Gift of USCD
X943.88

UNIVAC
UNIVAC I
see photo & story p.22.
Gift of Mrs. Sarah J. Lawson
X941.88

The University of
Illinois Team
PC of the Year 2000,
Prize winning model
1988, *see photograph*
Gift of the team and Bartlett W. Mel
X876.88

Videobrain Computer
Company
Videobrain, 1978
Personal Computer
Gift of Charles Backlund
X874.88

Subassemblies & components

Datanet 760
BCU 7600
Gift of Rob Staples
X921.88

G-2 8-input
Nand/Nor Gate
Decoder for counters
of registers
X959.88

IBM
360-40 Console Front
Panel, c 1968
Gift of Data Sales
X948.88

Infocon
Vista Basic 1
Computer Terminal,
1969
Gift of Michael A. Mahoney
X947.88

Jade Computer
Systems
Jade JG Z80 Board,
1979
Gift of Robert Leffert
X936.88

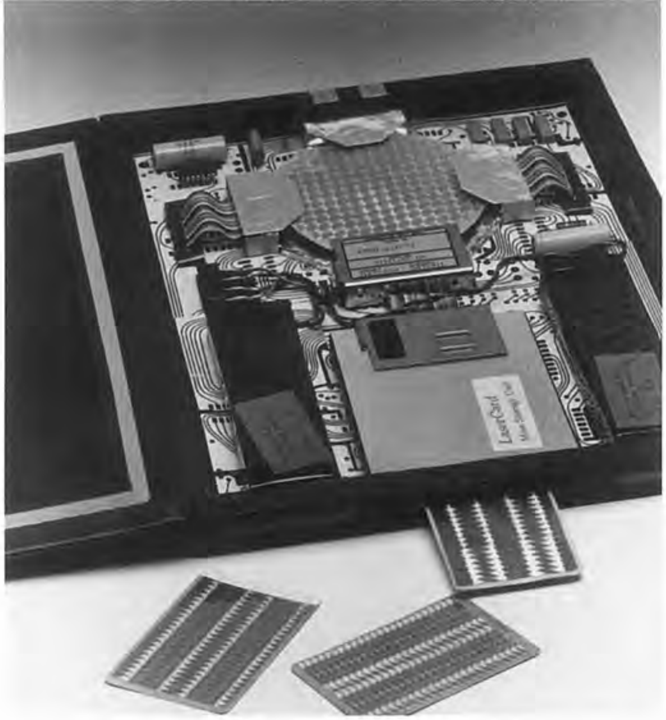
Keypact
Vicro-VIP series
computer terminal,
1978
Terminal in a
Samsonite case
Gift of The Corris Company
X950.88

MITS
Altair Boards, 1976
Gift of Robert Leffert
X935.88

Mountain Hardware
Prorom Board, 1977
Gift of Robert Leffert
X932.88

Bob Mullen's
Extendor Boards, 1978
Gift of Robert Leffert
X937.88

Remington Rand
UNIVAC I circuit
board
Gift of John Hancock Mutual Life Insurance Company
X862.88



PC of the Year 2000
Luke T. Young, Kurt H. Thearling, Steven S. Skiena, Arch D. Robison, Stephen M. Omohundro, Bartlett W. Mel, Stephen Wolfram, University of Illinois at Urbana-Champagne.

On January 28, 1988, the University of Illinois Team won Apple's competition "PROJECT 2000." John Sculley, Apple's chairman and chief executive officer, stated the purpose: "PROJECT 2000 extended a challenge to students to visualize how computer technology will be used in the year 2000. At the same time we wanted to engage in an enriching educational experience that would lead them to explore the possible social, economic and technological climate of the world at the turn of the century."

Characteristics: Tablet will have the same dimensions as a standard notebook: an 8" x 11" retangular slab. The front screen is a high-resolution touchscreen. A LaserCard replaces the disk media. These will be credit card sized optical RAMS with a single one gigabyte card holding four hours of video or 2,000 books. Tablet integrates a cellular telephone link. Along three sides of Tablet will be an infrared bar interface through which Tablet will talk to its local enivironments: printers and projectors, stereo headsets and video cameras, toasters and roasters, other Tablets and just about anything else. Tablet will have a GPS (Global Positioning System) receiver as a built-in component. GPS is an existing satellite system that enables objects to locate themselves in the world.

From A Day in the Life: "On October 5, 2000, Alexis Quezada sits under a tree, positions her Tablet on her lap, contacts the university's lecture database and begins to view her Conversational Japanese lecture for that day. Tablet allows her to unlock mysteries much as an earlier tablet, the Rosetta stone, provided the key to deciphering ancient Egyptian writing ... "

For the Museum, this acquisition and its predictions will be interesting to examine on October 5, 2000!

UNIVAC I

The UNIVAC I, , Universal Automatic Computer, first delivered in March, 1951, was the most important machine during the early 1950s. It is a single-address, decimal computer with 12 digits/word. Two instructions are stored per word. The primary memory has 1,000 words with ten words per delay line. Addition and subtraction took 525 microseconds.

The main parts of a UNIVAC I were saved by Mr. Lawson, and put in his garage in Goodlettsville, Tennesee, with the idea that sometime it would be important. And indeed, because of his foresightedness, the Museum was able to acquire the artifacts from his widow, Mrs. Sarah I. Lawson.

Professor Arthur Riehl, University of Louisville, and Dr. John McGregor, Murray State University, Murray, Kentucky, and their students have taken the components of the UNIVAC to Louisville for refurbishment for the February Computer Science Conference where it will be on display.

The UNIVAC was the first commercial computer in the United States, although it was predated by the ERA 1101, the first "commercially-sold" research computer, and a contemporary with the LEO 1, produced by the Lyons Tea Company in the UK. Nevertheless, to many people, the UNIVAC I was the first computer that was widely recognized. Its fame came from correctly predicting the landslide 1952 Eisenhower election victory.

The UNIVAC was capable of statistical, scientific, logistical and commercial applications. It produced the Population Tables for the 1950 Decennial Census. Prior to this, the Census had used card accounting processes with each step handled by a person. The computer mechanized these tasks performing all the steps from the initial feeding of the cards to the printing of the tables.

For scientific use, the UNIVAC had a general-purpose matrix algebra routine that could subtract, multiply, and reciprocate matrices of orders up to 300. The UNIVAC was used commercially to handle premium billing for life insurance processing an average policy in less than 0.5 seconds. For logistical purposes, the UNIVAC was programmed to quantify a mobilization plan.

Forty-eight one-million dollar UNIVAC I's were produced. But $1 million was only a fraction of the real cost. For example, for the installation at Franklin Life, they removed four feet of wall between two windows to allow sections of the central computer to be craned in; enclosed 390 square feet for a switchgear room; removed a false ceiling; installed air conditioning in the basement and ran lines to the computer room. In addition to the costs preparing the computer room, the average installation required hiring 80-100 people. These included supervisors, programmers, coders, librarians, operators, engineers, technicians, and tape handlers.

Sources: J. Presper Eckert, Jr., James R. B. Weiner, H. Frazer Welsh, Herbert F. Mitchell, "The UNIVAC System", AIEE-IRE Conference, 6-26, December 1951; Martin H. Weik, A Third Survey of Domestic Electronic Digital Computer Systems, *Ballistic Research Laboratories Report No. 1115, March 1951.*

Rochester Data Inc.,
Dynatyper, 1978
Electric Typewriter attachment for Apple II
Gift of Charles Mann
X914.88

Teleterm Computer Devices
Computer Devices Terminal, 1970
Gift of Richard W. Herzfield
X913.88

Thinker Toys
Morrow Speakeasy, 1977
Gift of Robert Leffert
X938.88

Memories

3M
Winchester Disk Drive, 1981
Gift of David Sager
X909.88

California Computing Systems
M-XVI 16K Static Ram Module Kit, 1978
Gift of Alan Frisbie
X930.88

Cambridge Memories, Inc.
ExpandaCore 11
Add on memory for PDP-11/45
Gift of James Prater
X952.88

Control Data Corp
CDC 39 inch magnetic disk
Gift of Computer Science Department, University of Colorado
X949.88

Compupro
Godbout Memory Boards
Gift of Robert Leffert
X940.88

Datanet 760
Memory Unit
Bulk Core
Memory Unit
Bulk Core Unit 7600
Delay Line
Interface Card
Memory Unit
Memory Driver
Memory Driver
Gift of Rob Staples
X919.88-X926.88

Dynastor
Dynastor Floppy Disk Recording Cartridge, 1977
Gift of Ron Hopley
X888.88

IBM
IBM 1401 Disk Pack, 1965, In transportable "hat-box" suitcase
see photo p. 23
Gift of David S. Neroda
X887.88

IBM
3350 Direct Access Storage Device
Gift of John Hancock Mutual Life Insurance Company
X865.88

IBM
3851 Mass Storage Unit
Magnetic "honey-comb" and disk storage
Gift of John Hancock Mutual Life Insurance Company
X863.88

IBM
3851 Magnetic Cartridge
for the "honeycomb" storage unit
Gift of John Hancock Mutual Life Insurance Company
X864.88

Ithaca Audio
Audio 8K Static RAM Board, 1977
Gift of Robert Leffert
X934.88

Institute for Numerical Analysis
National Bureau of Standards 1951
SWAC Williams Tube,
Gift of Harry Huskey
X872.88

LFE, Laboratory for Electronics
Bernouli Disk Memory, c 1960
Spinning mylar disk with fixed heads
Gift of Herbert S. Teager
X956.88

Ramo Woolridge
Magnetic drum
Gift of Herbert S. Teager
X971.88

Raytheon
Four K, 18 bit
Core memory board
Gift of Herbert S. Teager
X958.88

RCA
Bizmac Magnetic Drum Ring
Gift of Francis Hjarne
X966.88

RCA
Bizmac Magnetic Core Elements
Gift of Francis Hjarne
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Robins
Paper Tape Slicer
Gift of Francis Hjarne
X962.88

S.D. Sales Company
Memory Board, 1976
Gift of Robert Leffert
X939.88

Solid State Music
8K RAM Board, 1977
Gift of Robert Leffert
X933.88

Robots

Minsky Tentacle Arm
Gift of Marvin Minsky
X927.88

Tandy Electronics
Robie Jr., 1986
Remote controlled talking "robot"
Gift of Tandy Electronics
X945.88

Tandy Electronics
Mobile Armatron
Remote control robot arm
Gift of Tandy Electronics
X946.88

Electronic calculators

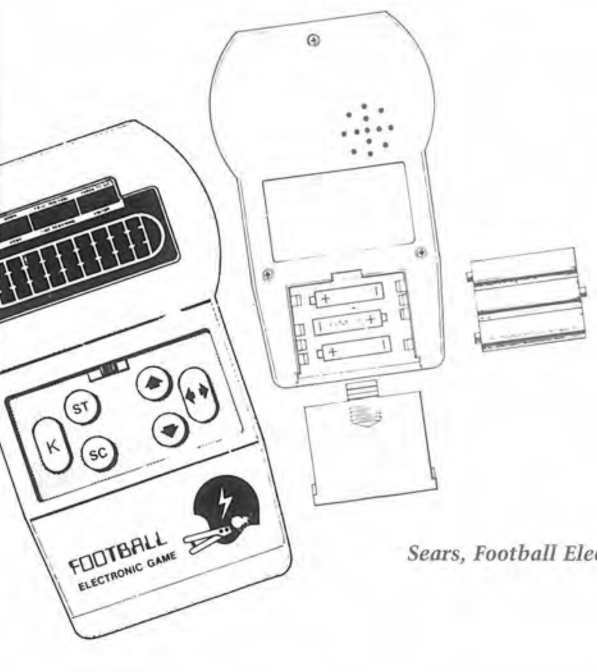
Casio, Inc.
Casio fx-7000G Scientific Calculator, 1986
Gift of Casio, Inc.
X902.88

IBM 1401 Disc Pack
A portable "hat box" disc pack was devised so that programs and data could be carried from site to site.

Olivetti Programma 101

The Programma 101 produced in 1968 is one of the first desk-top electronic calculators that is almost a computer. It has a sufficient instruction set to be classified as a computer, but the storage for temporary data, constants, and programs is limited. This calculator was programmed using special magnetic cards.

The Programma 101 costing $3,500 in 1968 is slightly less expensive than the HP 9100A, the contemporary desk calculator that is almost a computer. The program library for the Programma 101 was extensive with many multiple card large FORTRAN programs.



Sears, Football Electronic Game

Gillette Company
GPA Calculator PC-1
Gift of Gary Boone
X904.88

Litronix Inc.
Litronix 1602, 1975
Four-function electronic calculator
Gift of Gary Boone
X905.88

Litronix, Inc.
Litronix 2200 Series, 1975
7 Electronic Calculators
Gift of Gary Boone
X907.88

Olivetti Underwood
Programma 101, 1965
Desk top size
see photo p. 24.
Gift of Leslie Meyer
X915.88

Summit International Corporation
Summit Calculator MB-8, 1972
Gift of Gary Boone
X903.88

Texas Instruments
TI-1200,
Gift of John McKenzie
X928.88

Microprocessor-based devices

Adidas
"Micropacer" Running Shoes, 1985
see photo p. 25
Gift of Adidas
X901.88

Coleco Industries
Talking Wrinkles, 1981
Gift of Coleco Industries
X944.88

Milton Bradley
Comp-IV, 1978
Based on "Mastermind"
Gift of Tom Restivo
X868.88

Parker Brothers
Merlin, 1978
Includes Blackjack 13, TicTacToe, and Follow the Leader
Gift of Tom Restivo
X871.88

Sears
Football Electronic Game, 1979
see illustration p. 24
Gift of Tom Restivo
X869.88

Sears
Electronic Basketball. 1979
Gift of Tom Restivo
X870.88

Seiko
World Time Clock, 1987
Gift of Seiko
X931.88

Waddington House of Games Inc.
Wizard, Model 2004, 1979
Gift of Tom Restivo
X867.88

Slide rules & calculators

Air Express
"Air Express Shipping Estimator"
Circular Slide Rule
Gift of W. Thomas Wagner
X889.88

The Carpenter Steel Company
"Carpenter Stainless Tubing"
Slide Rule
Gift of W. Thomas Wagner
X892.88

Dwyer Instruments
"Air Velocity Calculator", 1972
Slide Rule
Gift of W. Thomas Wagner
X890.88

E. I. Dupont Company
"MYLAR Cost Comparator"
Slide Rule, 1956
Gift of W. Thomas Wagner
X894.88

Freemont and Lewis Inc.
Hoffman Slide Rule No. 601UTO
Gift of W. Thomas Wagner
X900.88

Jeppesen and Co.
"Jeppesen Computer" Model R-2
Circular slide rule for pilots, 1955
see photo p. 25
Gift of W. Thomas Wagner
X896.88

Kieley and Mueller, Inc.
"Valve Capacity Calculator", 1947
Slide Rule
Gift of W. Thomas Wagner
X893.88

Keuffel & Esser Company
Polyphase Slide Rule
Gift of John McKenzie
X929.88

IBM
Hexadecimal Adder
Gift of S. Lester Ungerleider
X879.88

Lightning Manufacturing Company
Lightning Adding Machine
Gift of Irwin Sitkin
X875.88

Perrygraph Corp
"Reynolds Wrap Time-temperature Cooking Guide", 1959
Slide Rule
Gift of W. Thomas Wagner
X897.88

Redi-Mix, Inc.
ACU-Math Concrete Calculator
Slide Rule
Gift of W. Thomas Wagner
X891.88

Rockwell Manufacturing Company
"Rockwell-Nordstrom Multi Port Valves" Demonstration
Slide Rule
Gift of W. Thomas Wagner
X898.88

Safety Grinding Wheel and Machine Company
Guedon Slide Rule
Gift of W. Thomas Wagner
X899.88

Textron Electronics Inc. 1960
"Vibration Computer",
Slide Rule
Gift of W. Thomas Wagner
X895.88

Ephemera

Charles Andres
"CPU Wars"
see illustration p. 26
Gift of R. D. Mallery
X883.88

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OPM Silk Tie
Gift of Philip H. Dorn
X885.88

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Burroughs Compilogram, 1961
Gift of Philip H. Dorn
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IBM Flowcharting Templates
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IBM
Sign
"IBM Scheduled Preventative Maintenance in Progress"
Gift of John J. McCaffrey
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Plant Tour Book
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X961.88

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"Think" sign
Gift of Francis Hjarne
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"Think" sign and holder
Gift of S. Lester Ungerleider
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"Think" notepad
Gift of S. Lester Ungerleider
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IBM
Time clock card, 1956
Gift of John S. McCaffrey
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RCA
Bizmac notepad, stylus and pen
Gift of Francis Hjarne
X968.88

Other

IBM
519 document originating machine plugboard
Gift of Francis Hjarne
X960.88

IBM
Punched card gauge, needle and measure
Gift of Francis Hjarne
X967.88

IBM
Control panel wiring tool, 1959
Gift of Francis Hjarne
X965.88

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Key Punch Machine
Gift of John Hancock Mutual Life Insurance Company
X861.88

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Gift of John J. McCaffrey
X953.88

Instruction Displays Inc.
"Model 105 Instruction Display"
Gift of John McDermott
X866.88

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088 Collator Column Sensing Brushes
Gift of Francis Hjarne
X964.88

Mathatronics, Inc.
New Mathatron, 1964
Gift of Phillip F. Lynn
X918.88

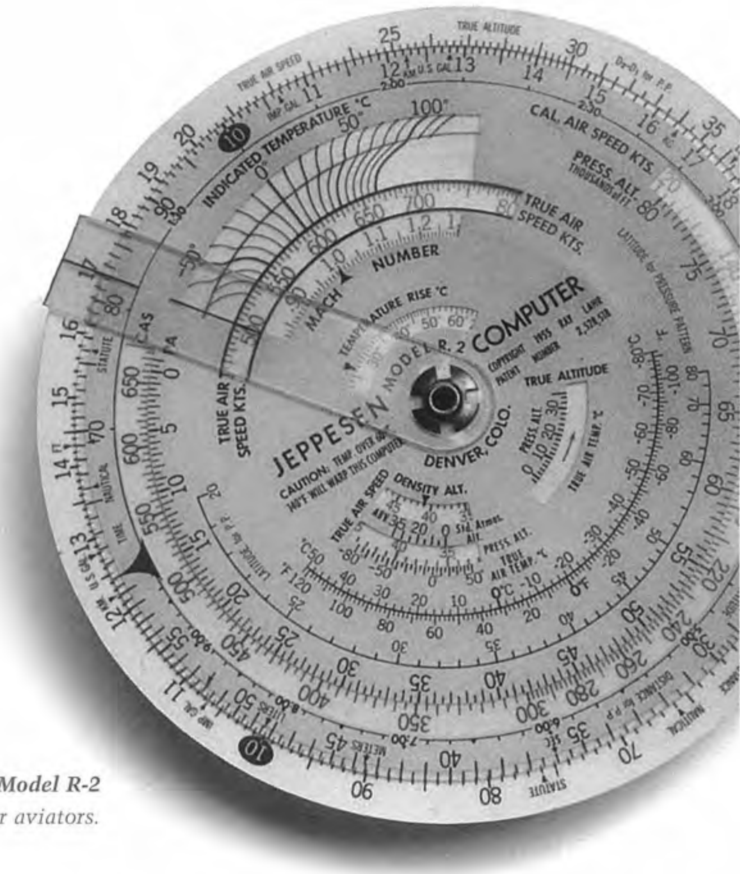
Oliver Garfield Company 1955
GENIAC Construction Kit,
Gift of William R. Simpson
X877.88

Film & video

Mudge, Rose, Guthrie, Alexander & Ferdon
The PDP-1, Space-War!, 1988
Gift of Mudge Rose Guthrie Alexander & Ferdon
VT180.88

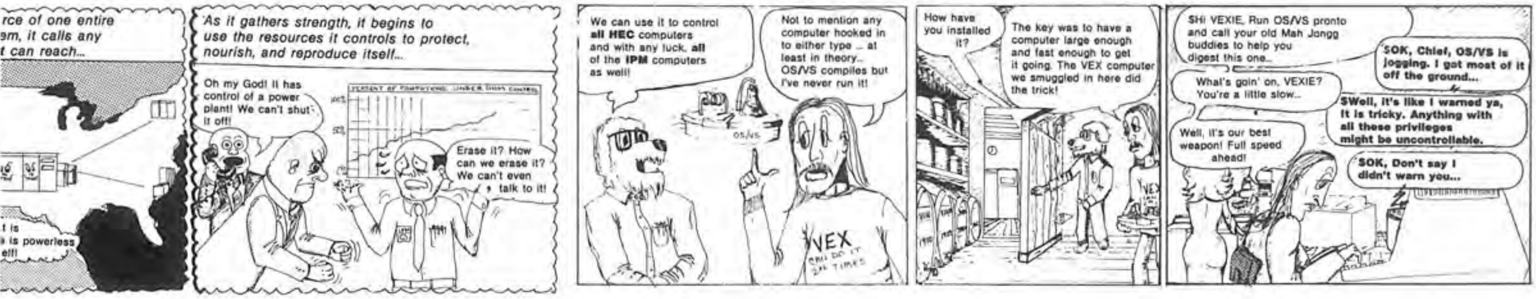
WGBH, NOVA
Artists in the Lab, *VT 181.88*
The Robot Revolution?, 1986, *VT 182.88*
The Mind Machine, 1986, *VT 183.88*
Computers, Spies, and Private Lives, *VT184.88*
Gifts of WGBH

"Micropacer" Running Shoes
The shoes calculate speed, distance and caloric output.



"Jeppesen Computer" Model R-2
A circular pocket calculator for aviators.

CPU Wars
This "comic book" was created in the seventies by an engineer at Digital Equipment Corporation and later published by DECUS.



CDC 7600, Serial Number 1
Serial number one of the 7600 was delivered to Lawrence Livermore Laboratories in November 1969 where it became the center of the "Octopus" network that tied together many of the computers. It operated until October 1988 when it was "cut out of the system." The cables in the Octopus network running under this floor were literally cut, when the system was taken down.

The Museum acquired two processor segments and one fake wood corner piece. A second corner set is on display at The Computer Museum in Livermore that has samples from all the benchmark machines at the laboratory. A visit may be arranged by contacting Barbara Costello at the Laboratory.

The CDC 7600 is an upwardly compatible member of the CDC 6000 series designed by Seymour Cray. Its predecessor, the CDC 6600 (also in the Museum's collection), was the first commercially successful super-computer. The first 6600 was delivered in September, 1964, and the 7600, delivered in 1969, was four to six times faster. Both computers had densely packed "cordwood" modules that were cooled by conduction to a plate with Freon in it. Although integrated circuits had been used in computers, both machines used discrete transistors and core memory.

Documentation & photographs

The documentation is divided into two parts. The Museum has a small library and an archive of documentation. The library includes books relating to the collecting areas of the Museum, computer history and reference books. Of particular interest are the books on computers and computer architecture from the 1960s and 1970s. Some consider these books outdated, but the Museum was happy to accept such books from the Boston Museum of Science Library and would be pleased to receive other additions.

The archives document the computers in the collection and the ones that we would like to have in the collection. The Museum has also extended archives on special collecting and exhibiting areas, such as computer graphics, artificial intelligence and robotics.

Charles Jortberg Associates, and particularly Ann Russell, has been assisting the Museum in developing a data base of the archival material. By the time of the next *Annual*, we should have an active searchable data base on the holdings.

This coming year, the Collections Committee will consider various aspects of the software issue including documentation. All of the language manuals from the Museum have been sent to the collection assembled by Jean Sammet.

The Charles Babbage Institute for the History of Information Processing documents the location of major archives and also collects in this area.

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Cleveland Clinic Foundation
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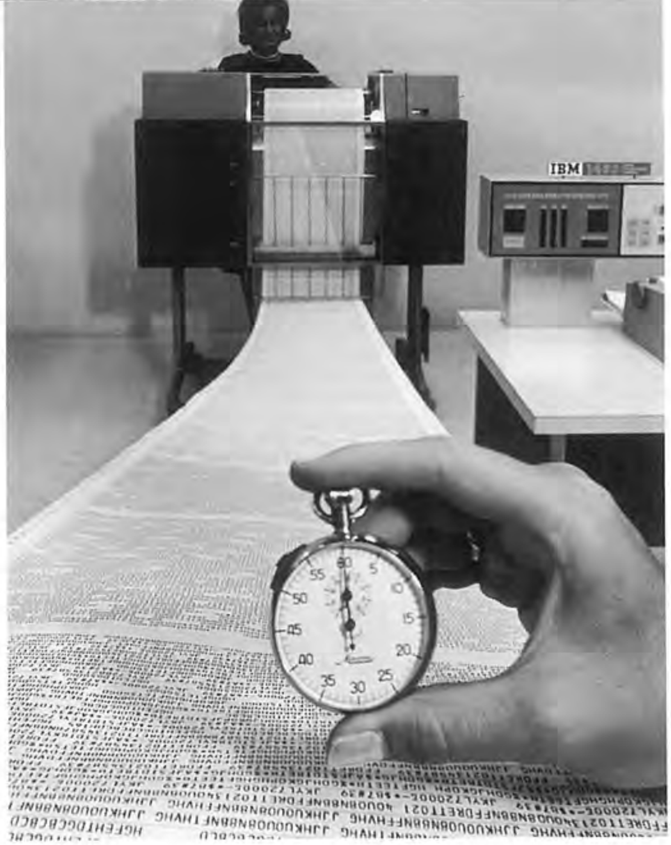

Historic photograph of IBM 1460 printer
"This new, 1963 printer, is capable of producing 1,100 lines of alphabetic and numeric information in one minute."

Sanders Associates *electronic assembly line, c. 1970.*

It takes the financial commitment of many individuals, businesses, and government agencies that believe in an institution's vision and programs to keep things going. The Computer Museum gratefully acknowledges the support of those listed here and hopes that this list will inspire others to join them in supporting The Computer Museum programs.

PHASE 1

Donors to the first phase of the capital campaign had the faith to buy into a concept before there was an actual product. They provided the seed capital needed to open the Museum in its present facility in Boston in November, 1984. Their support helped refurbish the building and develop the first set of exhibitions. At the campaign close in April 1988, $3.3 million has been raised.

64K or more

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P H A S E 2

Donors to the early stage of the second phase of the capital campaign have contributed funds needed to buy the building, develop the second set of exhibits, and begin building an endowment that will ensure the future of the Museum by providing long-term finanicial stability.

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Robert Berkowitz

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The Index Group

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Ed Schwartz

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Daniel Weinreb

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Less than 4K

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Thomas F. Stephenson

__Spacewar__ inventor Shag Graetz at the console of the PDP-1. Graetz joined dozens of other pioneers at the Museum's symposium on the 25th Anniversary of Computer Games.

Exhibit engineer Dan Griscom repairs the Denning Sentry Robot, which is used in one of the Museum's daily public demonstrations.

ANNUAL FUND '88

The Annual Fund is comprised of gifts from individuals, corporations and other friends which are pooled to help offset annual operating expenses. The fund helps our programs flourish while allowing us to reach new audiences and continue serving as an international resource for computer research and education. Continued growth of the Annual Fund is important as the Museum expands its services.

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CORPORATE MEMBERS

Education Coordinator Michael Chertok brings a robot workshop on the road to classrooms throughout New England – one of several outreach programs provided by the Museum.

Corporate members support the Museum annually through participation in this program. Member corporations are recognized in our bi-monthly newsletter and receive a sliding scale of benefits. These include free admission passes; individual memberships for corporate designees; the opportunity to use the Museum for corporate functions; use of the Museum's archives and the ability to participate in the Museum's Collection Loan Program.

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Verbum Magazine
Wollongong Group
XRE Corporation

National chair Pat Nelson coordinates Computer Bowl volunteers from coast to coast.

THE COMPUTER BOWL

The World's First Computer Bowl is now a bi-annual international event to raise funds for The Computer Museum's educational programs. The full story of the Bowl can be found on pages six and seven of this Annual. The Computer Bowl was successful because of the founders, sponsors and volunteers listed below who gave so generously of their money, time and ideas. They helped set a standard of excellence for the next Computer Bowl, to be held in early 1990.

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Breakfast Seminar Series

The museum hosts ten early-morning breakfast seminars each year. Key industry leaders and experts share their views on the trends and emerging technologies that will shape the computer industry over the next five years. Invitations to the series are an exclusive benefit of corporate membership. Recent speakers have included Joseph Brophy, Henry J. Crouse, Ralph Gomery, Max Hopper, Edward Feigenbaum, Regis McKenna, David Nelson, Charles Sporck and Max Toy.

The series is sponsored by:

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Individual Membership

Space limitations make it impossible to thank each of the 2000-plus individual members who support the Museum. Though all of the individual members have not been listed, the Museum gratefully acknowledges their support. Members provide a wide base of support while at the same time benefitting from the numerous programs available to them.

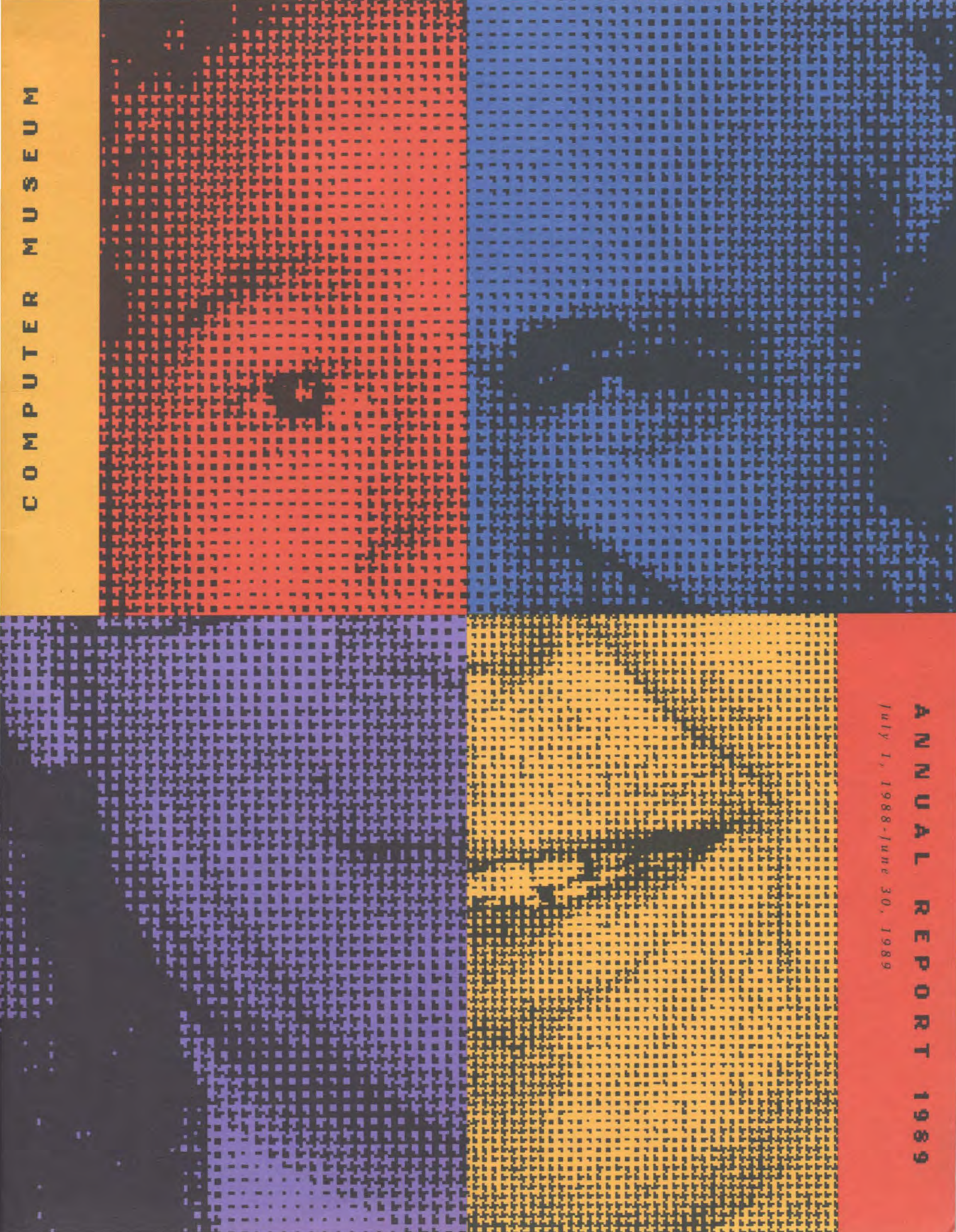
Every effort has been made to insure the completenesss and accuracy of these lists. Please notify the Development Office of any errors or omissions.


SENSES

The Computer Museum

Museum Wharf
300 Congress Street
Boston, Massachusetts 02210

tel 617 - 426 - 2800
fax 617 - 426 - 2943



COMPUTER MUSEUM

ANNUAL REPORT 1989

July 1, 1988-June 30, 1989

Fact sheet

Boston Opening November 14, 1984

Background In 1974, Ken Olsen and Bob Everett saved the MIT Whirlwind computer from the scrapheap. They determined a need to preserve the history of computers and in 1982 founded The Computer Museum as a public, non-profit organization with a board that included 16 other industry leaders. It is the world's only museum devoted solely to computers and their impact on society. The Museum has the most comprehensive collection of historical computers and robots in the world.

Facilities 53,000 square feet; 6 exhibition galleries; 275-person auditorium (3,200 square feet); Museum Store.

Annual Operating Budget $1.5 million. Income sources: donations-45%; memberships-18%; admissions-16%; Museum Store-11%; functions-8%; other-2%.

Audience 100,000 visitors/year (40% students); over 1 million served through traveling exhibits.

Members 2600 individual from 45 states and 13 countries; 142 corporate members worldwide.

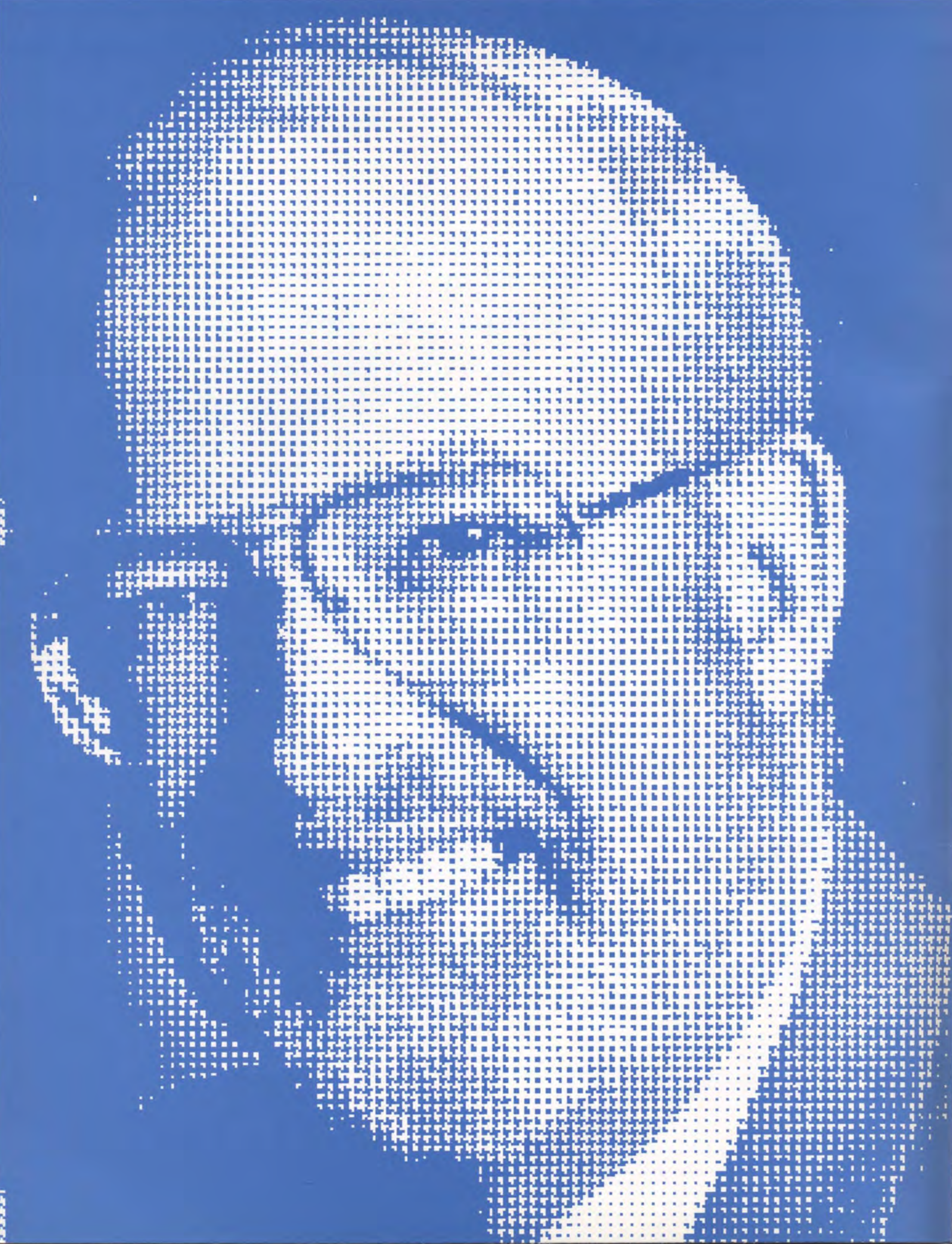
Museum Hours Winter: Tuesday through Sunday, 10am to 5pm, Fridays until 9pm; Summer: daily, 10am to 6pm, Fridays until 9pm.

Admission $6.00 for adults; $5.00 for students and seniors; free for Museum members. Half price Friday 5-9pm. Group rates by arrangement.

Contents

The Museum's mission is threefold:

- To educate and inspire all ages and levels of the public through dynamic exhibitions and programs on the technology, application, and impact of computers;
- To preserve and celebrate the history and promote the understanding of computers worldwide;
- To be an international resource for research into the history of computing.



from the Chairman

The 1989 fiscal year ended just after our Annual Meeting in June. It was a year marked by a significant strengthening of the Museum's management and governance. At the beginning of the fiscal year, Adeline Naiman, a well known figure in computer education, joined the Museum as Director of Education. In March, Janice Del Sesto was named Director of Development and Public Relations.

In addition, a number of new Board Members were added which broadened our representation in both the business community and the computer industry. C. Gordon Bell of Stardent Computer, Lawrence S. Brewster of Aspen Technology, Richard Case of IBM, Seymour Papert of MIT, Anthony Pell of Pell, Rudman, Robert Shafto of The New England, and Casimir Skrzypczak of NYNEX all joined the Board. August Klein and Carver Mead moved on to become Trustees.

Unfortunately for the Museum, Joe Cashen, our Executive Director, informed us in March that he wished to leave to pursue other interests. A committee was formed to search for a successor.

The Exhibit Planning Committee completed its recommendations for the development of the remaining space in the Museum. It settled on four major exhibits to be developed over the next few years. The first, The Walk-Through Computer, will help provide insight into how computers work. Milestones of a Revolution will offer a coherent history of the development of computers by focusing on nine major steps in their development. A Computer Discovery Center will attempt to demystify personal computers for the general public and show what they can do and how they do it. The Networked Society will focus on the behind-the-scenes ways in which computers impact our daily lives.

In the area of collections, our biggest successes include the rescue of the Johnniac from its outdoor storage location in Los Angeles and acquisition of the 1970s operational Superpaint computer built at Xerox PARC.

Probably the most exciting event of the year was the first Computer Bowl which pitted celebrity teams from the East and West against each other in a test of knowledge about computer trivia. Led by a remarkably quick-witted Mitch Kapor, the East won the contest. However, the West vowed to recoup their honor in the Second Bowl in April 1990. In addition to being fun for all who participated, both contestants and audience, it raised over $450,000 in cash, products and services for the Museum.

This is the Museum's fifth year at its downtown location as a public institution. I think we have made significant progress in our goal to expand both the audience the Museum serves and the base of support locally and nationally which makes such an institution possible. However, much remains to be done if we are to achieve our ambitious exhibit, collecting, and educational program goals. We thank the many individuals, corporations, foundations and government agencies who have supported us and look forward to adding new friends in the future.

Gardner Hendrie

the Year in review

A dominant focus this year was computer-generated art and graphics. Six interactive graphics stations joined the Image Gallery. Fall brought a dazzling exhibit of SPOT satellite imagery. During school vacation weeks, local artists demonstrated their original techniques, and some participated in our annual Kids Computer Fair. A high point was the SIGGRAPH '89 Art Show, now traveling to other museums.

A new Resource Center provided state-of-the-art educational materials for visitors to try. Build Your Own Robot workshops brought in adult-child teams and many volunteers for a shared experience. These are only a few of the ways in which The Computer Museum fulfilled its mission of reaching out to visitors far and near.

JULY 1988

July 2-4 - The Computer Animation VideoFest

July 13-August 31 - Pilot PC Resource Center

AUGUST 1988

August 15-November 15 - Imagine: Art With the Macintosh

JANUARY 1989

January 14-16 - SIGGRAPH Festival The public premiere of the 1988 SIGGRAPH film show

FEBRUARY 1989

February - New exhibit software shows visitors how core memory works

February 20-23 - Second Build Your Own Robot, Logo, Computer Playspace, and Dancing Trees workshops

February 25-26 - Fourth Annual Kids Computer Fair introduces entertaining educational software via special interactive exhibits, demonstrations, resource table, and Robot Playpen

SEPTEMBER 1988

OCTOBER 1988

October 7, 1988 - The East Coast wins the First Computer Bowl

October 30 - Robert Abel, Odyssey Filmakers: **The New Age of Computers: Life in the Hypermedia Fast Lane**

NOVEMBER 1988

November 6 - Thomas A. DeFanti, Electronic Visualization Laboratory, University of Illinois: **Computer Graphics And Beyond: The Viewer As Participant.** The opening of The Interactive Image adds six state of the art graphics workstations to the Image Gallery

November 29 - Terra Firma in Focus: The Art and Science of Digital Satellite Imagery opens

DECEMBER 1988

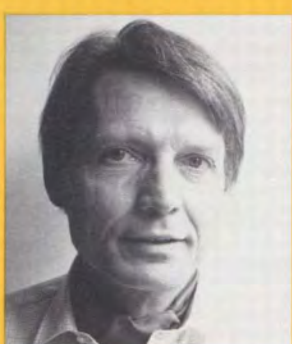
December 26 - First Build Your Own Robot workshop

December 26-31 - The Computer as an Artist's Tool educational program features Boston artists working in their media to create dramatic new images

© 1988 Hiroshi Kamoi

MARCH 1989

March 5 - Jean-Claude Risset, Directeur de Recherche, Centre National de la Recherche Scientifique: **Computer Sound Illusions: A Musical Resource For Now and the Future**



APRIL 1989

April 1-30 - Treasures Within Your Reach introduces visitors to online services from Prodigy Services Company, CitiNet, and CompuServe

April 16 - Third Robot-Building workshop

April 27 - During National Science & Technology Week, Museum joins all-day "hands-on science museum" for Congress on Capitol Hill, sponsored by the Association of Science-Technology Centers (ASTC)

April 29-30 - John Lasseter's 1989 Academy Award winner "Tin Toy" highlights SIGGRAPH Festival

MAY 1989

May 14 - With the New England Computer Arts Association, the Museum sponsors Creativity in the Computer Arts: A NEWCOMP Symposium, funded in part by the Mass. Cultural Council and the National Endowment for the Humanities

JUNE 1989

June 16 - New Resource Center opens in time for National Educational Computing Conference and features computer-based instructional software and hardware for teachers, students, and parents

June 30 - Computer Art in Context: SIGGRAPH '89 Art Show opens, setting visitor record for July and August and featuring over 50 2-dimensional works, installation pieces, animation, and moving sculpture from around the world, sponsored by the Association for Computing Machinery's Special Interest Group for Graphics and Interactive Techniques (ACM SIGGRAPH)

from the Director

The Computer Museum is in an exciting but critical stage in its development. In 1988-89, we worked hard on two fronts —to raise money for new exhibits and to place the funding of the Museum's day-to-day operations on a more secure footing. We have made great strides, and as we move into the 1990s, we face the challenge of building an endowment and purchasing the space in which we are housed.

Support from more than a hundred corporations and over a thousand individuals financed the "contributions" portion of the Museum's revenues. We are working to expand our circle of supporters, especially into the growing community of computer users.

The Museum Store and functions business grew significantly. For the first time in several years, our store has made a profit, owing to improvements by its able new manager, Christina O'Sullivan. Functions, the rental of our space for luncheons, dinners, receptions, and press conferences, continues to grow under Kathy Keough. Over 75 events, including several with more than a thousand people, brought an additional 12,000 visitors into the Museum.

In March, Janice Del Sesto joined our staff as Director of Development and Public Relations. With over a decade of fundraising and public relations experience, including our own Computer Bowl, Janice brings a great deal of wisdom and focused energy to the Museum. With the Board and newly formed volunteer committees, she has greatly accelerated our fundraising and increased international media coverage of the Museum.

The five-year plan created in 1988 for the refurbishment of Museum galleries with dramatic new exhibits has been converted into a master plan for implementation from 1989 through 1993 by Richard Fowler. Fowler, a designer on sabbatical from Britain's National Museum of Film, Photography and Television, will also design The Walk-Through Computer in the first phase of implementation.

A desire by other museums to develop computer-based displays led us to formalize a program for the distribution of our exhibits as "kits" under the direction of Dan Griscom, our able Exhibits Engineer. Contracts were signed with two Museums for five different exhibits. In addition, we prepared a proposal for seed money to fund this program.

Adeline Naiman, who joined us in August 1988, organized a first-rate education advisory committee. Individuals not only participate on overall educational planning but on the task forces for the planned exhibitions and programs.

Some highly significant artifacts were added to the collection, including Superpaint, the innovative graphics computer built at Xerox PARC in the early 1970s, and Johnniac, one of the pioneering computers from the 1950s.

The Computer Museum is the first, and remains the only, museum of its kind in the world. It attracts visitors from all over the country and abroad and reaches distant populations with traveling exhibits and exhibit kits. This year's *Annual* is testimony to a strong, devoted staff and an incredible cadre of volunteers committed to serving our diverse public. With your ideas and support, the Museum can bring exciting new exhibits and special programs to local, national, and international audiences and inspire millions of people with the extraordinary potential of computer technology.

Oliver Strimpel

computer Art in context

The Computer Museum opened "Computer Art in Context: SIGGRAPH '89 Art Show" on June 30th for a six-month stay. This show was a juried exhibition featuring more than 50 computer art works from around the world. It represented some of the finest work being done in computer art today and offered a new perspective on art-making, involving exciting new applications of computer technology.

The work varied in approach, method, concept, and format, but the computer was used as a creative tool in every case. Unlike some of the previous shows, the art (rather than the tool) was the focal point. The work ranged from the traditional computer tool, pen-plotter output, to the traditional art forms, such as a sculptured bronze whose shape was formulated by mathematical computation.

"Computer Art in Context" was the occasion for a unique collaboration among The Computer Museum, which offered a public venue for the art show, the professional meeting of the Association for Computing Machinery's Special Interest Group on

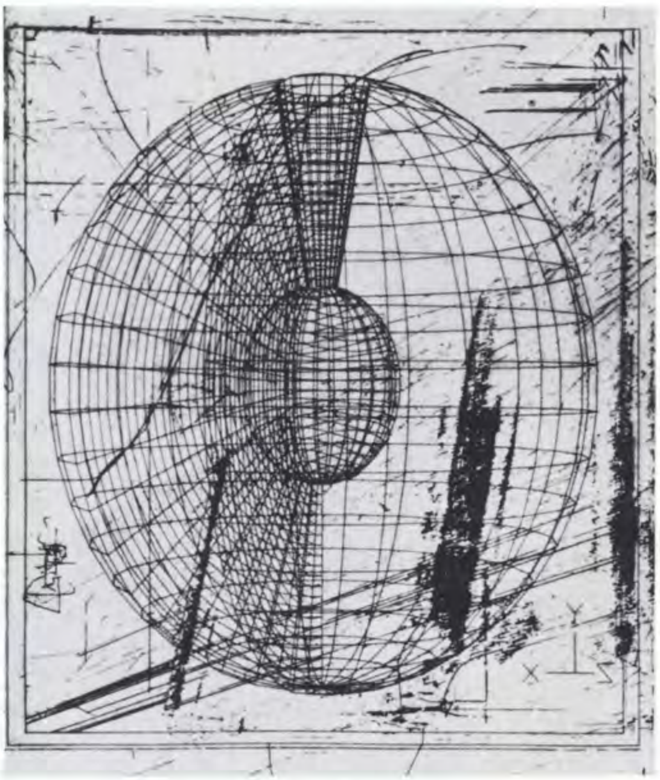
Nancy Freeman
All Sisters, Small Change © 1989

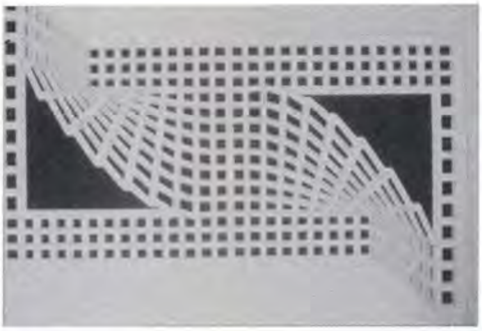
Barbara Joffe
Circus
cibachrome print 30" x 70", © 1989
collaborator: Computer Arts Institute, Scans

Computer Graphics (ACM SIGGRAPH), and *Leonardo*, the Journal of the International Society for the Arts, Sciences and Technology, that produced the catalog.

The SIGGRAPH conference, held in Boston in 1989, is a professional conference that supports an art show for its attendees. In addition, traveling exhibits derived from the show were created in 1983, 1985, and 1987. Last summer's opening at The Computer Museum was the first opening of the SIGGRAPH Art Show to the public and to the critics.

The catalog of "Computer Art in Context," published by *Leonardo,* includes full-color reproductions of all the work in the show and fourteen articles that provide the intellectual environment for the pieces. Roger F. Malina, *Leonardo* Executive Editor, prepared an article that traces the debate over the significance of art using computers through twenty-two years of the publication of the magazine. He concludes: "There is also a need for a new generation of art theorists and art historians to develop the critical and historical context within which the significance of individual computer artworks can be assessed. These theorists and historians should pay particular attention to art that could not have been made without the use of a computer and that exploits the unique capabilities of computers, electronics and telecommunications systems."





Daniela Bertol
Bending and Twisting; Hypothesis #3,
© 1988

Steven Herrnstadt
Global Pillage
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Brian Reffin Smith
Horse Text Piece
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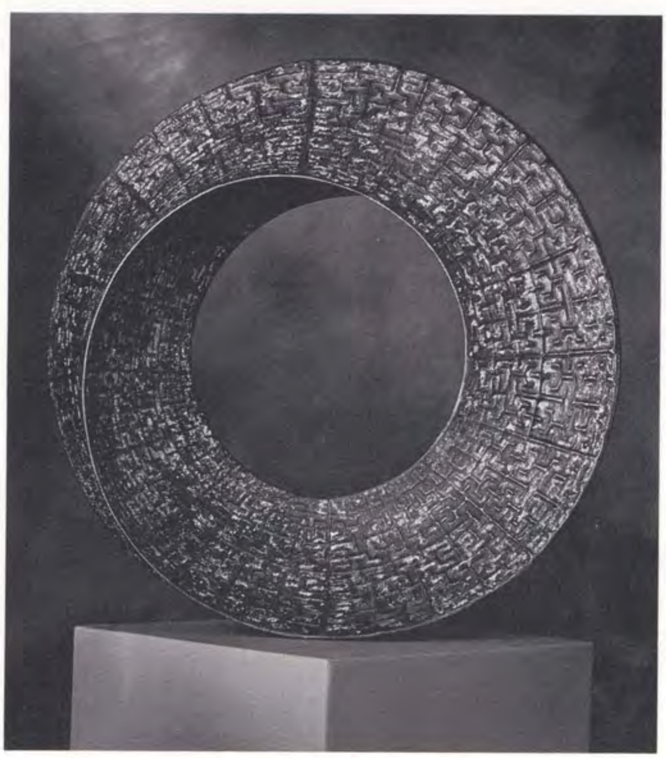


Helaman Ferguson
Umbilic Torus NC,
Silicon bronze, 27 x 27 x 9 in, ©1988
Collaborators: Paul Oliphyant-programmer.
Kent Kokohnen-Manufacturing engineer.
Computer Aided Manufacturing Lab.,
Brigham Young University. Casting by
Wasatch Bronze works, Lehi, Utah.

traveling Exhibits

In keeping with its worldwide mission, in 1988 the Museum began to implement a program of traveling exhibits. The first one, **Computers in Your Pocket: The History of Hand-held Calculators,** will travel through 1990. The second one, **Terra Firma in Focus,** opened at the Museum in 1988 and began traveling in the spring of 1989 with continuation through 1991.

COMPUTERS IN YOUR POCKET

This exhibit has not stopped traveling since its August 1988 debut at The Science Museum of Virginia in Richmond. Circulated by the Smithsonian Institution Traveling Exhibition Service (SITES), its itinerary includes 13 museums and science centers across the United States and Canada.

The exhibition, funded by Hewlett-Packard, has been "very popular," according to Betsy Hennings, SITES Project Director. It is a "wonderful demonstration of how real artifacts and interactive displays can be combined so that people can do and learn."

The collection of rare and unusual calculating devices from around the world chronicles the basic human need to count and remember with tools one can carry. It includes more than 60 artifacts, eight interactive elements, and one video. Among them: the oldest mechanical pocket calculator, designed by Englishman Samuel Morland in 1666, Napier's Bones (1617), and the first scientific hand-held calculator, the HP35 (1972).

TERRA FIRMA IN FOCUS

This exhibit opened on November 29, 1988, at The Computer Museum, with the sponsorship of the SPOT Image Corporation, The Analytical Science Corporation, and Digital Equipment Corporation. The exhibit highlighted scientific applications of remote sensing with large-scale black-and-white and color images taken by the SPOT satellite.

Based on the organization of the Museum exhibition, a 63-image set was selected to travel under the auspices of the Association of Science-Technology Centers (ASTC), Washington, D.C.

The traveling exhibit was booked to open at the Space Coast Science Center, Melbourne, Florida, and travel through 1991.

For information about either exhibit, call Gail Jennes, The Computer Museum, 617-426-2800.

enhancing the Graphics gallery

In 1984, "The Computer and the Image" was opened as a gallery to show how computers are used to manipulate images (image processing) and create synthetic images (computer graphics).

The arrival in Boston of the prestigious computer graphics conference of the ACM SIGGRAPH in the summer of 1989 provided the impetus to enhance this gallery. Three exhibits, running since 1984, and the film show were retired. Ten new hands-on interactive stations, a giant plot of a silicon chip, and a new show in the Animation Theater were installed.

The addition of the giant plot of a silicon chip realized a part of the original gallery plan never before implemented. Advanced Micro Devices specially produced a full-color 11-by-11-foot plot of their 29000, a highly sophisticated microprocessor.

"The Interactive Image" is a set of hands-on exhibits developed by the Electronic Visualization Lab at the University of Illinois, Chicago. Using an artistically designed video game-style interface with buttons and a joystick, visitors learn how to create computer-animated movies, generate kaleidoscopic patterns, process images of their own faces, and discover the beauty of the Mandelbrot Set and plant-like forms called graftals.

A highly informative new program on the rendering of three-dimensional objects was developed to our specifications by Hewlett-Packard. Visitors use knobs (with instant response) to swivel, zoom into, and illuminate the classic test object — a teapot — rendered by progressively more realistic methods, from wire-frame to smooth shading and ray-tracing.

Real-time realistic images can also be explored on a Titan computer from Stardent Computer. In one example, visitors control the speed and direction of simulated wind. They see, in real time, how a simulated flag responds to the effect of the wind on the flag as it flaps in the breeze. Such computer analysis would have been unthinkable on anything less than a supercomputer when the gallery opened in 1984!

New exhibits on flight and driving simulation offer exhilarating experiences for visitors. On an IRIS workstation donated by Silicon Graphics, visitors pilot a 747 over a synthetic mountainous terrain. And the Atari Games' "Hard Drivin'" simulator (on loan until spring 1990) actually mimics the force of the road on the steering wheel as the driver rounds a curve. The coupling of 3-D computer graphics (the view looking through the windshield) with mechanical feedback adds a compelling new dimension of realism to the simulation.

Perhaps the most practical new exhibit is "Design a Deck" from Innovis Interactive Technologies. Visitors use a computer and trackball to design a house deck complete with steps, railings, and flooring. The exhibit is a customized version of a system that is in widespread use in home-improvement centers.

The enhancement of "The Computer and the Image" was made possible, in part, by grants from the Association of Computing Machinery's Special Interest Group on Graphics and Interactive Techniques (ACM SIGGRAPH) and the National Computer Graphics Foundation.

Oliver Strimpel

Exhibit planning

The Museum has embarked on a major phase of new exhibit development. When our plans come to fruition, the Museum will be radically enhanced, with four major new exhibits covering almost half an acre.

In 1988, the Museum adopted a five-year exhibit plan calling for exhibits that treat four general themes: how computers work, the evolution of computing, the applications and impact of computing, and people in computing. New exhibits will be developed for each of the first three themes. The last theme will be addressed by weaving stories about people in computing into all exhibits, thereby imparting an engaging human element throughout.

During 1989, the thematic guidelines solidified into specific exhibit gallery plans. As visitors enter the Museum, they will be greeted by innovative and definitive exhibits on how computers work and on computer evolution. These will serve as introductions to the entire visit. Visitors will then encounter exhibits on computer applications and impact, an area which holds the greatest public appeal because it underscores the unprecedented value of these tools and shows how computers increasingly touch everyone's life.

The theme—how a computer works—will be addressed by a unique exhibit, "The Walk-Through Computer." Visitors will actually interact with it, walking into a giant working replica of a desktop computer. Development of this million-dollar project is in full swing. The exhibit opens in June of 1990.

The evolution of computing will be addressed in a 5,000-square-foot exhibit entitled "Milestones of a Revolution." The goal is to present a few key developments in computing within their proper historical context, together with a critical examination of the ways computers have affected people's lives. The preliminary exhibit plan has nine selected milestones, each with a recreated environment through which visitors will walk. Artifacts and period ephemera will be backed up by interactive video and graphics. This one-million-dollar exhibit is planned to open in the summer of 1991.

The third theme—computer applications and impact—is already featured in "The Computer and the Image" and in "Smart Machines." These address computer graphics, image-processing, artificial intelligence, and robotics. These galleries will be retained and two new ones will be added.

The "Computer Discovery Center" will address the applications of the personal computer to people's everyday work and play. Many hands-on exhibits will give visitors an opportunity to discover new ways of benefiting from using a personal computer. This is a joint project with The Boston Computer Society and is expected to provide many exhibits that can be sold to science and technology centers around the world.

"The Networked Society" will feature large-scale computer-based systems that underlie modern society. Examples are telephone networks and systems for online banking, international finance, airline reservations, news services, manufacturing, and retail inventory control. This final phase should be complete by 1993.

Oliver Strimpel

Education

The Museum is for everyone. People of all ages come here to find out about computers. Many are curious about how computers came about, what they used to look like, and who was involved in their development. Some want to get their hands on a computer and feel how it operates and how they can control it. Others want to see how the insides of their computer really work and what more they might accomplish. Old hands often want to reach out and touch an old friend. All visitors come to participate in the excitement that hums around the brave new computer-driven world.

How can the exhibits and educational programs meet the expectations of such diverse audiences? Certainly not by reducing information to the lowest common denominator but through a diversity of programs and a layering of information from simple to complex. Many exhibits are transparent to five-year-olds, who are growing up fearless in the electronic universe. Other exhibits offer new challenges and insights to experts, who may know some of the particulars but are enchanted to discover depths they never had occasion or time to plumb.

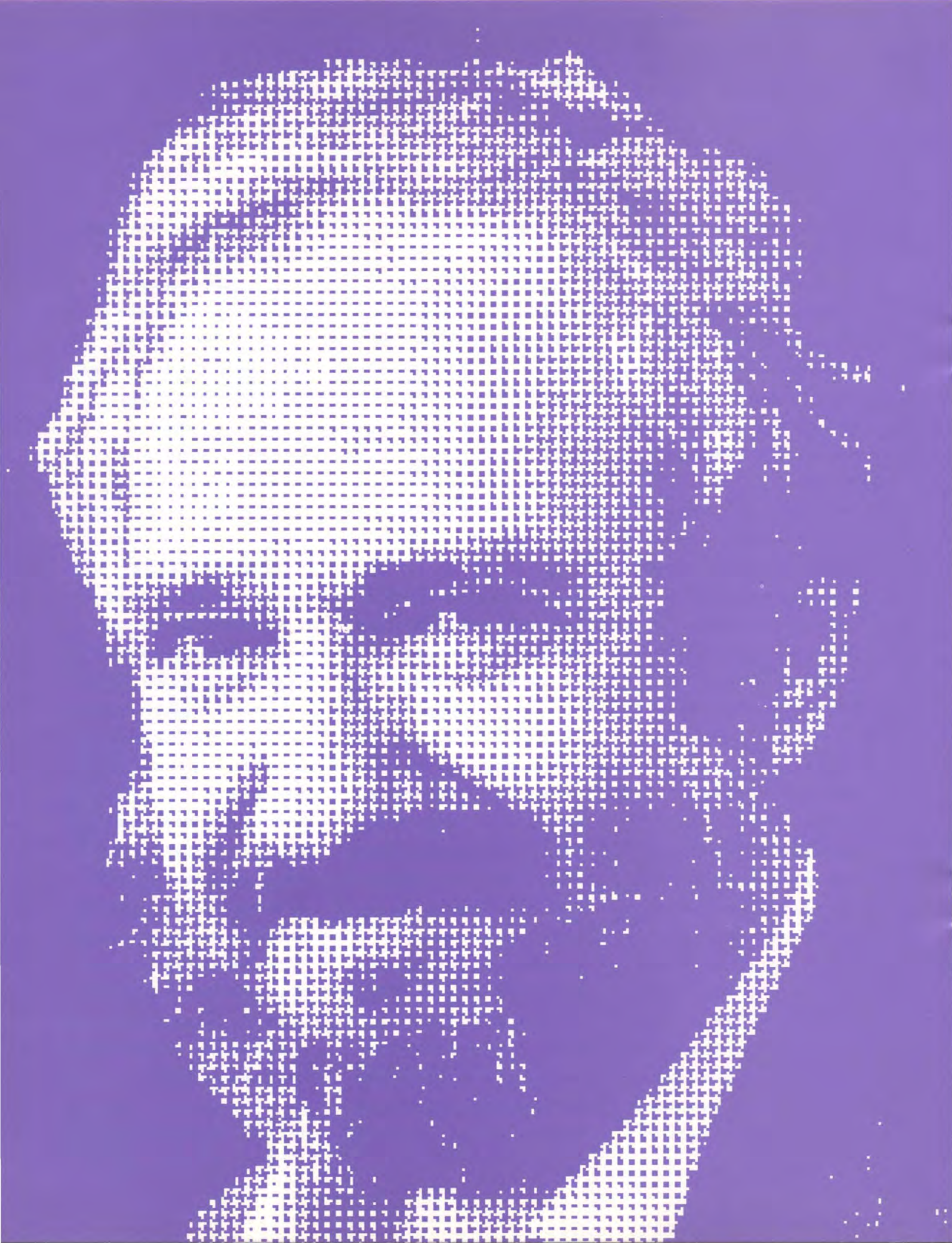
Our new educational Resource Center opened in time for the National Educational Computing Conference's June 1989 tenth-anniversary gathering in Boston. The Center affords parents, children, educators, and the general public opportunities to try out innovative software and hardware that schools can use to enhance learning. One of these is a set of multimedia materials for a dozen subject areas that offers film, photographs, and documents on laserdisk. Sensitive probes enable students to use the computer as a real-time scientific lab instrument. Young visitors take pleasure in operating our LEGO/Logo circus. *LogoWriter* allows beginning authors to enter and print out their creations. *MathCad* is a powerful algebra tool. *Puppeteers* gives visitors a chance to write a script, create their own characters, and see and hear their play acted out.

School holidays featured workshops in which adult-child teams built their very own moving robot. In December, professional artists demonstrated how they use computers as art tools. Our annual February Kids Computer Fair brought in many hundreds of parents and children to try out software for their homes and schools. In April, three telecommunications exhibits put visitors in touch with bulletin boards, databases, educational resources, and consumer services. In May, a computer-arts symposium brought composers, artists, dancers, and poets together to share their thinking and display their work.

Student groups from low-income districts and groups with special needs are admitted free or with reduced admission through our Ticket Subsidy Program supported by corporations and public agencies.

We have been preparing presentations for staff and volunteers to deliver inside and out of the Museum. The first two are on robotics and chips. A major effort for the coming year is outreach programs for The Walk-Through Computer, which promises to answer everyone's questions about how a computer works.

Adeline Naiman



computers in the Schools: momentum and inertia

Like bread with butter, the word "computer" goes with the word "fast." Computers work fast—millions of operations a second. They evolve fast—what they do and what they look like has been transformed beyond recognition in each decade. And they've brought about astoundingly rapid change in the way many things get done—very many things but not everything.

One of the things computers have not changed, despite frequent utopian predictions that they would, is school. You can't altogether blame computers; nothing else has changed schools very much either. As the computer is associated with quick change, school is associated with change that is sluggish, slow, and even retrograde.

Is this a case of the proverbial irresistible force meeting the immovable object? Which will give?

I personally believe that school is going to change so much that people of a not-very-distant future might not even want to call their learning places school. But when one looks at the computer presence in actual schools, one sees a mixed picture. There are wonderful signs of incipient real change. There are more prominent signs that "the system" is able to defend itself (like a living organism) against the foreign body; it is even able to use the computers to shore up its old structures. My optimistic belief that the forces of change will prevail is based on a theory of why school has resisted change. But first we must answer some questions.

Some school people will protest that it is unfair to represent school as something that does not change.

Of course, in one sense there is plenty of change. The buildings look different and many practices are more humane; dedicated teachers, administrators, and even parents work hard every day to make improvements. But it is interesting to establish a sense of degree of change by comparing schools with sectors of activity where change has been on another scale.

Imagine a party of time-travelers from the eighteenth century—a surgeon, a watchmaker, a banker, and a teacher—who are visiting to see how members of their professions do things in our times. Imagine the bewildered surgeon trying to make sense of the procedures used in a modern operating room or the watchmaker trying to understand how a digital watch is made! The banker might have a slightly easier time of it, but the idea of electronic transfer of funds and instant verification of credit anywhere in the world would surely boggle his mind.

The teacher would be in a very different position. He (only a man would have been allowed on such a trip) would be a little puzzled by some of the activities in a modern classroom and astonished at some of the equipment. But on the whole he would immediately understand the point of everything he might see. He would even be sufficiently at home to take charge if his host, the modern teacher, were called away. (Imagine the surgeon taking over the operation!)

Whether someone from another century could step into the job offers a rough-and-ready test to establish a difference between change and megachange. Let's use it to recast our question: Is megachange possible in education to a degree comparable with the revolutionary transformation of sectors of activity such as medicine, clockmaking, transportation, or communications? Is it desirable? Does the computer presence make it more feasible?

Now that they know what kind of change I have in mind, protesting educators might see me as wrong-headed, not for thinking that schools have not changed but for expecting them to do so. They might argue that surgery and clockmaking and the like are susceptible to technologically supported megachange just because they are intrinsically "technical" activities. But such things as loving and eating and learning are "natural" activities. They can be supported by technology but are not susceptible to radical transformation. Whether food is cooked on a wood fire or by microwaves or not at all, you still open your mouth and put it in.

I agree: learning is a natural act. I am thinking of a baby learning to relate to its parents, to talk, to walk, and to manipulate things and people. Learning is natural—but school is not. School learning is an artificial creation, and its characteristic methods are intrinsically technical even when they do not use anything we would popularly call technology. Acquiring one's native language by immersion in a culture is natural learning in its purest form; teaching a language by the numbers, following a tightly laid-down curriculum, is about as technical as you can get. The difference between natural learning and technical teaching is even reflected in grammar: "the baby learns to talk"—"the teacher teaches children fractions." Who is the subject, who is the object, who is the agent, who is the patient?

Of course, what I am saying is a caricature. Many teachers work hard to encourage more natural learning in their classrooms, and some schools are committed to a policy of encouraging them to do so. Nevertheless, I maintain that the technical side of teaching is inherent in the established model of school: it is inherent in the concept of a linear curriculum; it is inherent in the kind of testing used to measure success; it is inherent in the kind of work that children are expected to do in classrooms; indeed, it is inherent in the very idea of "class"—of children segregated according to age.

My view of how computers can contribute to megachange in learning has a touch of paradox: this most advanced of all technologies will contribute most powerfully to education by making it less technical!

Two examples of how computers are used in schools will begin to clarify what I mean. The first makes the technical side of school even more technical. Here the computer is used as an automated spelling and grammar teacher. Sentences appear on the screen. The student is invited to say which words are incorrectly spelled and which is a noun or a verb or whatever. The computer keeps track of everything the student has ever done and uses its more or less elaborate (or, as they say, "intelligent") algorithm to decide on a suitable comment and to choose the next problem.... And so on; you get the idea—even the time traveler would quickly grasp it.

In this example, the computer is an active agent; it makes active interventions: it (pronoun, subject, agent) teaches (verb) the child (noun, object, patient). The example clearly shows how computers can strengthen the technical side of education. The second example takes a first step towards showing how computers can support natural learning. The computer is used as a word processor. Like pencil and paper, it serves as a medium for writing. Here the computer is not doing something to the child; the child is not the object of the transitive verb "teach." The student is the active agent, the subject of the sentence, "I am a writer!" The computer is used not to improve teaching but to improve writing and permit the child a stronger sense of being a writer.

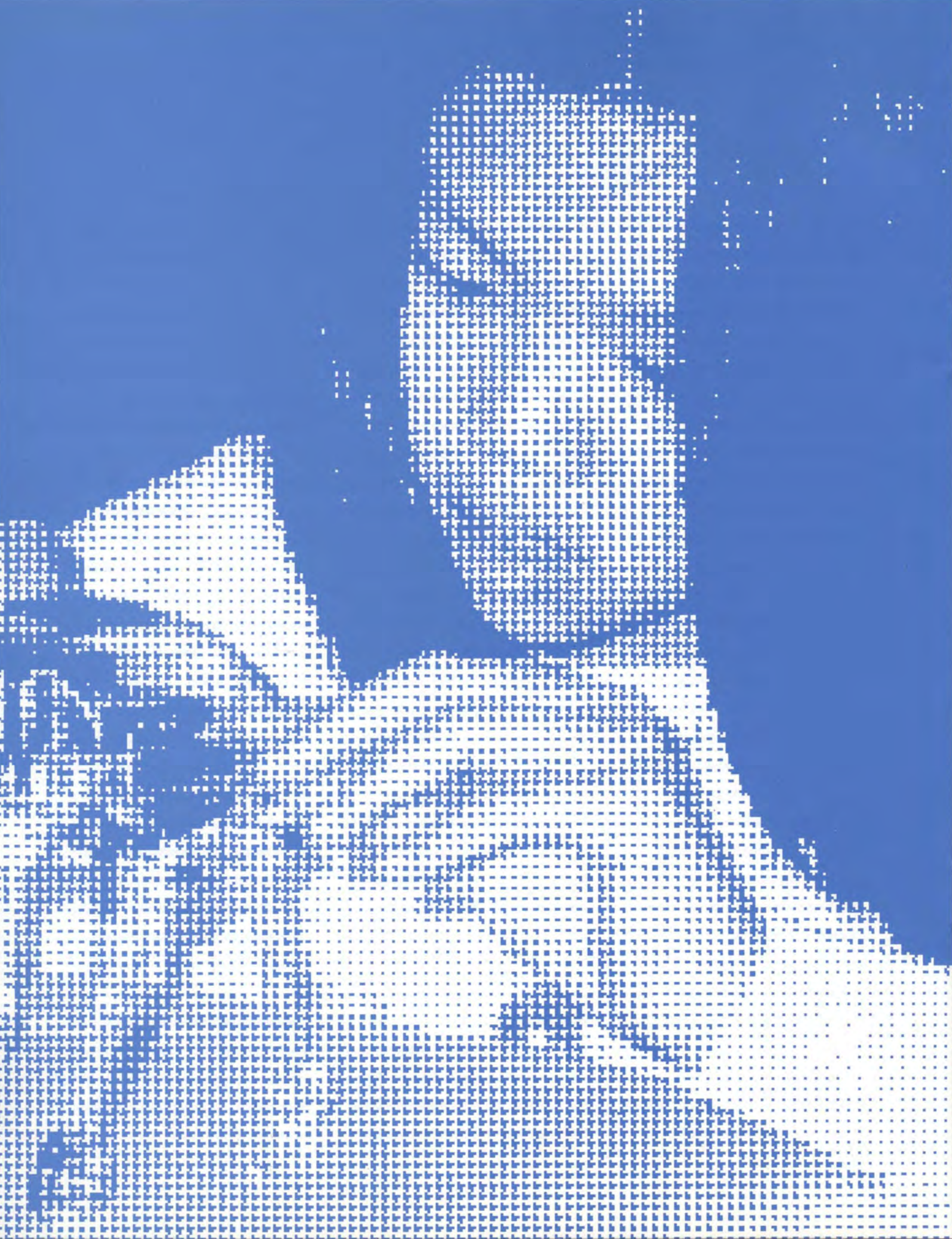
Nothing in what I am saying is meant to devalue the importance of teachers. Quite the contrary. The image of children using word processors provides a hint at richer opportunities for teachers to work as participants in a process of natural learning. For the fluidity of words electronically inscribed on screens allows the writer, even a young one for whom forming the letters by hand is still a chore and changing them a mess, to relate to text as something malleable. And this means that comments on the text are not judgments on a finished product but suggestions for improving it.

In my view this changed relationship of teacher to student contains the seeds of megachange in what school is about. To look at it more deeply we turn from writing to mathematics.

Indeed, thinking about teaching mathematics in grade school gives the best insight into why school has adopted its technical approach to teaching. Natural learning occurs best when knowledge is part of life. Babies learn to talk because they live in a world where language is used. But the mathematics taught at school does not play a significant role in the lives of most children. And so school has been forced to adopt its technical strategies of breaking knowledge up into little, meaningless items and packing them into children's minds for use "when you grow up."

The situation is far worse than in the case of writing, for at least anyone who has seen a book and has made up a story has the elements needed to imagine the process of writing. And if would-be writers have pencil and paper they can try it for themselves. But where in life are there examples of creative use of mathematics that children can see and imitate? The blame for this shortage is not on the shoulders of schools or teachers. It is not their fault that our culture is so poor in interesting mathematics. We cannot expect them to change the culture. But we can hope that they will take advantage of changes that come about.

A walk through The Computer Museum is enough to show signs of dramatic change in the presence of mathematics in our culture. Think, for example about the implications



of computer art. In some cases, mathematical ideas are visible in the final product. Other works are opaque to the mathematics that might have been used in making them, just as one perceives an automobile functionally or aesthetically without awareness of the mathematics that went into designing it and making it. But there is a difference. The car does not incite you to imitate the mathematics.

The same walk through The Computer Museum shows examples of children engaged right there in creating computer art in ways that make mathematical knowledge very relevant to their personal projects.

What would the time-traveling teacher make of seeing these children programming computers to produce animations on their screens? Imagine him in a learning place for children (maybe it calls itself a school) toward the end of this century. Children of different ages are deeply engaged in personal creative projects, consulting one another and the adult who seems to be in charge.

These children are learning about mathematics—and physics and control engineering, and about color and form and perception—by working on projects where they use the knowledge. They get it when they need it, not when the curriculum says so, and they get it sometimes from other kids, sometimes by just plain slugging it out, sometimes from books, and sometimes from the teacher. In a lot of ways, this is more like the child learning to walk and talk and argue in a family that does all those things than like following a curriculum in today's schools.

I must answer one last objection to my picture of how change can happen. "Anyone who is in touch with the reality of schools knows that you just can't do this. First, there aren't enough computers in schools. Second, those that are there are not powerful enough. Third, the software systems don't exist. The teachers don't know enough. These cultural trends are just beginning. And so on and so on."

Well, of course that is all obviously true. But so what? About a hundred years ago two bicycle makers called Wright dreamed of a world of aviation. When their first flight hopped about as far as the wingspan of a modern big plane, they could have decided to go back to making bicycles. And people in schools can decide, and many do, to adapt their use of computers to present-day conditions in schools. Others dream and try to use what they have in hardware and knowledge to strive towards what they know the future will be like.

Seymour Papert

Dr. Papert, Professor of Media Technology and Director of Epistemology and Research at Massachusetts Institute of Technology, joined The Computer Museum Board of Directors in June 1989 and serves on the Education Committee. He is the author of Mindstorms: Children, Computers and Powerful Ideas, *which has been translated into 11 languages.*

Johnniac

Johnniac, constructed between 1950 and 1953, was built following the same design as the IAS (Institute for Advanced Study) computer at Princeton. The IAS project team was led by John von Neumann, Arthur Burks, and Herman Goldstine, who had all worked on the ENIAC and the EDVAC, and by Julian Bigelow. A condition of the funding by the Atomic Energy Commission was that engineering plans be delivered to five other computer development centers: Los Alamos, where the MANIAC was built and still resides in the Museum there; the University of Illinois for the ILLIAC; Oak Ridge National Laboratory for the ORACLE; Argonne National Laboratory for the AVIDAC; and the Rand Corporation for Johnniac. The IAS machine is in the collection of the National Museum of American History where it will be displayed in their new exhibit on The Information Age opening in May 1990.

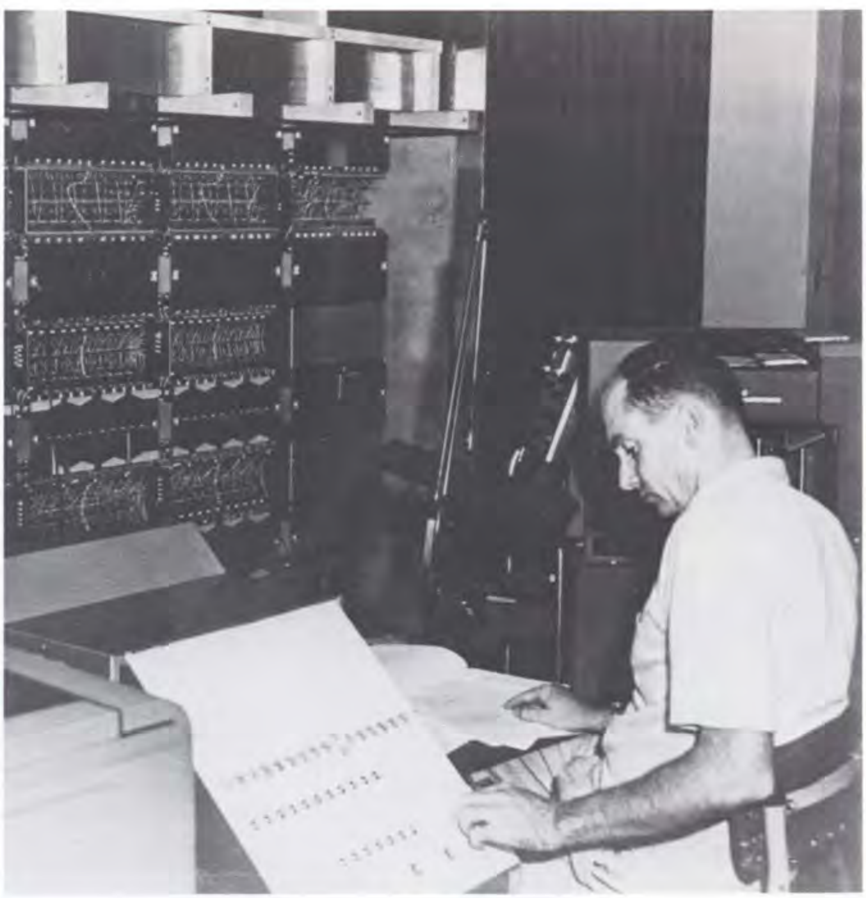
The commercialization of scientific computing did not occur until the mid-fifties, when IBM, UNIVAC, English Electric, and Ferranti put the laboratories out of the business of building computers. In 1950, when the IAS-type machines were funded,

Facing Page
John von Neumann

Above
Keith Uncapher is at the Johnniac console.

most computers were built by small teams in laboratories for their own use. The Computer Museum holds three complete machines in this class: the Whirlwind built at MIT, the TX-0 built at Lincoln Laboratory, and now Johnniac.

With the support of the U. S. Air Force, The Rand Corporation project team of Cliff Shaw, John Williams, George Brown, and Bill Gunning started the project in 1950 and had the machine running by April 1953. They decided to name it "Johnniac" in honor of the IAS machine's principal designer, mathematician John von Neumann (The last three letters of "Johnniac" stand for "integrated and automatic calculator.")



Testing of the Johnniac involved programming the computer to work on an endless calculation while workers checked each connection. A memo from this time states, "Applications for wire-wrigglers now being accepted."

The overriding concerns in the design and construction of the five-ton Johnniac were reliability and ease of use. During the three years of development, the operational, as opposed to experimental, nature of the machine was continually borne in mind. The designers followed the plans for the IAS Computer with one exception: they decided to use the Selectron tube memory developed by Jan Rajchman at RCA. The Selectron had been developed under contract for the IAS machine but was delivered so late that the IAS machine and all of the other clones fell back on the memory device it was intended to replace, the Williams' tube memory developed by F.C. Williams at Manchester University in England. With the Selectron tube, Johnniac could access four times as much primary, random access memory, i.e, 4,096 40-bit words versus 1,024 40-bit words in the IAS. More important, by the time Johnniac was operational in 1953, core memory had been developed and tested for the WHIRLWIND at MIT, rapidly becoming the dominant form of random-access primary memory. Johnniac's Selectron-based architecture allowed for the replacement of Selectron tubes with the first commercial core memory in 1955.

Power and refrigeration systems for Johnniac were heavily over-engineered: the original main power switch was so large the engineers were actually embarrassed enough to replace it with a smaller one. The air-conditioning machinery doubled the weight of Johnniac, bringing the total weight of the installed computer to ten tons. Equipment failure was dealt with automatically, with Johnniac initiating protective steps and recording the entire event. Occasionally human intervention was necessary, as co-designer Willis Ware related in 1965, at the ceremony marking Johnniac's de-commissioning: "When it came time to service the machine, someone had to open a door. It was like standing in the deep freeze, and we quickly bought ski jackets — with hoods — for everyone. The machine also acquired one of its early names — the *Pneumoniac* ."

The sheer size and complexity of Johnniac were invisible to its users, many of whom used JOSS (Johnniac Open Shop System), the first truly interactive language designed for time-sharing systems. JOSS was developed by J.C. Shaw, T.O. Ellis, I. Nehama, A. Newell, and K.W. Uncapher. While JOSS itself is no longer in use, it influenced the style of interactive languages that followed it.

The limitations of punched card input and output frustrated both the developers and the users of Johnniac. Their scientific problems needed graphical interfaces, so Johnniac was used for the development of the Rand tablet, the first digitizing tablet, and the refinement of on line graphics printers and plotters.

Johnniac tended to run relatively simple programs during the day; night-time use was reserved for solving of extended computations. This division of computing activity led to the rumor that Johnniac was afraid of the dark. Johnniac's average add time, including time needed to access the memory or storage, was 25 microseconds, and multiplications could take 400 microseconds each. With many scientific programs, Johnniac was set up to "crunch numbers" unattended for hours at a time. Astonishingly, Johnniac calculated with near-perfect accuracy only when the lights were on. It turned out that the neon tubes in the I/O section of the machine required ambient light in order to function properly.

Rand retired Johnniac after 13 years and 50,000 hours of operation — with only two transistor failures in over fourteen million transistor-hours, and a 0.92 good/attempted-to-run operating ratio. The occasion was marked by the brief ceremony referred to above. On 18 February, 1966, the original project leader Cliff Shaw programmed Johnniac to execute a sixty-second countdown and then shut itself off.

After display in the Los Angeles County Museum of Natural History, Johnniac was placed in storage for several years. With the assistance of the Los Angeles Museum, The Rand Corporation, and members of the original Johnniac team, The Computer Museum has arranged to obtain Johnniac for its permanent collection.

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new Acquisitions

Fifty artifacts were added to the collection this year, bringing the total number to 1025. One offer in ten was accepted. Donations often include documentation, photographs, and other materials related to the listed artifacts.

Some of these artifacts were saved thanks to friends' suggestions on which the Museum acted quickly. We depend on you to let us know when computers are being decommissioned, a pioneer is retiring and cleaning out his office, or where we might look for a buried computer treasure.

The Museum continues to upgrade management of the collection and optimize use of storage areas. Archival, photograph, film/video, and book collections complement the artifact collection, preserving a wide spectrum of materials significant to the history of computing.

La Radiotechnique terminal, one of many used with France's successful telecommunications network.

COMPUTERS

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Gavilan Computer Corporation
Gavilan SC Mobile Computer, 1983
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X978.89
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Grid Systems Corporation
Compass Computer 1101, 1983
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LNW Research Corporation
LNW, 1980
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MicroOffice Systems Technology, Inc.
RoadRunner, 1983
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Rand Corporation
Johnniac, 1953
Los Angeles County Museum of Natural History
X1006.89

Royal Precision
LGP-30, 1958
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X972.89

Sord Computer Systems, Inc., and DCP Ltd
Sord, 1981
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X1008.89

Symbolics, Inc.
LM-2, 1985
Gift of Symbolics, Inc.
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Texas Instruments
Explorer Workstation, 1986
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Three Rivers Computer
PERQ 1981
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Superpaint, 1973
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SUB-ASSEMBLIES

Burroughs Corporation, Electrodata Division
Prototype pneumatic flip-flops, 1970
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National Bureau of Standards
Standard Western Automated Computer (SWAC)
Logic module, 1951
Gift of Roy Saltman
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Remington Rand, Eckert Mauchley Division
Electro-mechanical relay modules, 1950-51
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TRANSDUCERS

Digital Communications Associates, Inc.
IRMA Decision Support Interface Board, 1989
X989.89
IRMA-2 [IBM 3278/79] terminal emulation board, 1989
X990.89
IRMA-3 [IBM 3278/79] terminal emulation board, 1989
X991.89
IRMA-3 Convertible 3270 Adapter Hardware, 1989
X992.89
Gift of Digital Communications Associates, Inc.

Grinnell Systems division of Gulton Company
GMR 27-30, 1984
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Macintizer 6 X 6, 1988
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La Radiotechnique
NUW 101, 1981
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X971.89

Spiras Corporation
Spiras Model LTE, 1971
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MEMORIES

Digital Equipment Corporation
DEC Mag Tape TE 16 nine channel, 1982
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RX01, 1982
X1000.89
Gift of Digital Equipment Corporation

Sperry Rand Corporation
UNIVAC 1 mercury delay line, c. 1954
Gift of William Agee
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MICROPROCESSOR BASED DEVICES

Croton
Terrestrial Quartz Watch, 1972
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Pulsar
Pulsar Time Computer, 1972
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Calculator c. 1935
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EPHEMERA

Comptometer Company
Comptometer School Certificate of Completion, 1945
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The Superpaint system created this impression of the rings of Saturn.

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OTHER

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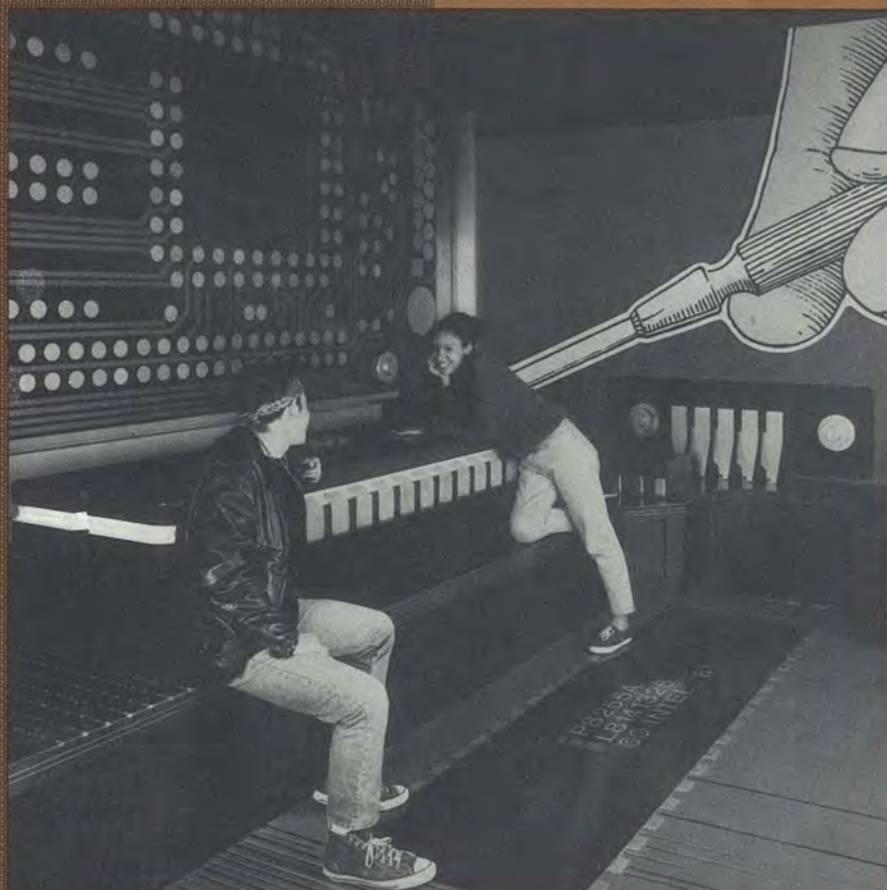
The Computer Museum

Annual Report 1990



The Museum's mission is threefold:

- *To educate and inspire people of all ages and backgrounds from around the world through dynamic exhibitions and programs on the technology, application, and impact of computers.*
- *To preserve and celebrate the history and promote the understanding of computers worldwide.*
- *To be an international resource for the research into the history of computing.*

The Computer Museum
***Annual* 1990**
July 1, 1989 - June 30, 1990

Fact Sheet

Boston Opening: November 14, 1984

Background: In 1974, Ken Olsen and Bob Everett saved the MIT Whirlwind computer from the scrapheap. They determined a need to preserve the history of computers and in 1982 The Computer Museum was founded. A public, non-profit organization, it remains the world's only museum devoted solely to computers and their impact on society. The Museum has the richest collection of historical computers and robots in the world.

Facilities: 53,000 square feet; six exhibition galleries; 275-person auditorium (3,200 square feet); Museum Store.

Annual Operating Budget: $2 million. Income sources: Donations-34%, Memberships-13%, Admissions-26%, Store-16%, Functions-7%, Other-4%.

Audience: 150,000 visitors/year (40% students); over 1 million served through traveling exhibits.

Members: 1200 individuals from 45 states and 13 countries; 150 corporate members worldwide.

Museum Hours: Winter: Tuesday - Sunday, 10am to 5pm, Summer: Daily, 10am to 6pm, Fridays until 9pm.

Admission: $6.00 for adults; $5.00 for students and seniors; free for Museum members. Half price Saturday, 10am-noon. Group rates by arrangement.

Contents

From the Chairman

The past fiscal year has been filled with good news for the Museum. Dr. Oliver Strimpel was appointed Executive Director, the Museum was awarded first time grants by several major national foundations, and the Museum ended the year with an operating surplus. It was also the year when the Museum funded, developed, and opened the largest and most successful exhibit in its history—The Walk-Through Computer™.

This year's annual report departs a bit from the usual annual report format in that it focuses on the conception, design, and construction of one exhibit. But this is an extraordinary story. It is a testimony to the vision and persistence of Oliver Strimpel, and his ability to attract the best possible designers, illustrators, engineers, and advisors to the Museum.

The history of the exhibit's development is not unlike the creation of a new technology. It includes false starts, serendipitous opportunities, intense creative activity, and timely financial support. As this report describes, The Walk-Through Computer project received the benefit of extraordinary volunteer, professional, and financial resources. On behalf of the Board of Directors, I thank the many people, companies, and foundations that contributed to the exhibit and the Museum, thereby making this past year such a great success. We invite new friends to join us and share the experience of building an important international institution.

Gardner C. Hendrie
Chairman of the Board of Directors

This has been the best year in The Computer Museum's history from both a programmatic and financial perspective.

On the programmatic front, we concentrated on pushing ahead with our long range exhibit development plan for the remaining space in the Museum. The plan calls for exhibits that address four general themes: how computers work, the evolution of computing, the applications and impact of computing, and people and computing.

This past year, we successfully completed an exhibit which addresses the first theme. The Walk-Through Computer™ introduces visitors to the workings of computer hardware and software technology. Thanks to the commitment of the sponsors who funded this groundbreaking project and an immensely talented team, we managed to complete the extraordinarily challenging task of building a giant working replica of a computer in record time. The feature article in this report tells the story of its creation.

With the help of a planning grant from the National Endowment for the Humanities, we also began developing an exhibition that deals with the second theme, the evolution of computing. Opening in June 1991, "People and Computers: Milestones of a Revolution" will present nine key milestones in the evolution of computing within their proper historical context, together with a critical examination of the ways computers have affected people's lives. The centerpiece of each milestone will be a life-size re-creation of a computer environment typical of each era. This project is being directed by our most experienced exhibit developer, Greg Welch, who developed the Museum's successful traveling exhibit, "Computers in Your Pocket," among other projects.

Looking ahead to 1992-93, two other major exhibitions will treat the many uses of computers. The first, the Computer Discovery Center, will focus on the applications of the personal computer to people's everyday work and play. Developed jointly with The Boston Computer Society, this exhibition will offer hands-on experiences with word processing, graphics, calculating, education, special needs, desktop publishing, and multimedia production. The second, The Networked Society, will reveal the large-scale commercial applications that underpin modern society, from travel and communications to finance and retailing.

In response to requests for our exhibits from museums and science and technology centers around the world, we have begun an Exhibit Kits Program. This Program has enabled us to create and distribute copies of our most popular and effective exhibits. A prototype of one Kit was installed in the Franklin Institute's new Future Center where it has become one of the most popular exhibits in their computer exhibition! With seed funding from the National Science Foundation, the Hearst Foundation, and the American Association for Artificial Intelligence, implementation has begun under the direction of the Museum's Exhibits Engineer Dan Griscom.

The Kits enhance the Museum's national educational impact while providing an important new source of revenue to support the Museum's education programs.

The Museum's artifact acquisitions included narrowly saving a 1953 computer— Gene Amdahl's WISC; another highlight acquired for the collection is Ivan Sutherland's helmet from the late 1960s, a forerunner of today's virtual reality head-mounted displays.

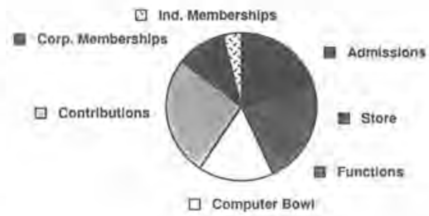
The Museum continues to strengthen its financial status. In the fiscal year ending June 30, 1990, the Museum finished with a balanced operating budget of $1.5 million. We substantially increased our revenues from admissions, the store, and functions (rental of our space for receptions, press conferences and other activities). In addition, the Annual Fund Appeal and Corporate Membership Program have gained momentum, with significant growth in each area. In April, we held our Second Annual Computer Bowl®, won by the West Coast team in a most dramatic finish. The Bowl has become an important source of support for the Museum.

With The Walk-Through Computer, a $1 million project, the Museum reached a new level of visibility, locally, nationally, and internationally. Our educational video *HOW COMPUTERS WORK: A Journey Into The Walk-Through Computer* extends the educational impact of the exhibit to millions of people beyond our walls.

The Museum has an extraordinary power to expand people's horizons through its unique mix of activities for informal learning. This year, with The Walk-Through Computer, we have taken a big step forward in developing this capability.

Dr. Oliver B.R. Strimpel
Executive Director

Operating Income



Operating Expenses

BUILDING THE WALK-THROUGH COMPUTER

Building The Walk-Through Computer™ was a large and complex undertaking. It covers 5,300 square feet and weighs more than eight tons. The giant ribbon cables are composed of a third of a mile of colored two-inch plastic tubing and weigh 1,500 pounds. Ten computers, nine videodisc players, five video projectors, nine video monitors, and a slide projector control the lighting and special effects, and interactive stations. Ninety minutes of original computer animation were produced. More than 800 square feet of silk were used for silk-screening and 325 sheets of plywood make up the core construction. Some 2,000 feet of Tivoli™ lighting cover the floor. More than 100 gallons of lacquer, vinyl, and epoxy paints in 200 custom-matched colors were used. Almost 340 lighting units of various kinds provide the 10,000 watts of light built into the exhibit.

From design to implementation, more than 150 people—carpenters, model makers, electricians, electrical and mechanical engineers, lighting designers and technicians, software engineers, computer animators, illustrators, typographers, painters, silk-screeners, and volunteer jacks-of-all-trades—worked directly on the exhibit. They made The Walk-Through Computer a reality.

Origins: January 83-September 86

The origins of the idea for a larger–than–life exhibit go back to 1983, when Oliver Strimpel decided to come to The Computer Museum. He had worked at The Science Museum in London and at Britain's National Museum of Photography, Film, and Television. Like The Computer Museum, these institutions combined the preservation of history through collections of artifacts with a mission to educate the public through dynamic exhibitions. Both museums had built large-scale models: The Science Museum, a nuclear reactor, and the Bradford Museum, a reflex camera. In the summer of 1983, the National Museum of Photography opened as a roaring success, and Oliver came to The Computer Museum in January 1984 as Curator.

In November 1984 when the Museum opened at its Boston location, the first exhibit seen by visitors was a very large computer of the 1950s, the SAGE. The exhibit was intended both to present an example of computing in the days of vacuum tubes and to reveal and explain the function of the various components common to all computers. The exhibit worked well in its first objective, but quite poorly in the second. For example, while it was awe-inspiring to compare the SAGE's huge drum unit with a small floppy disk of today, this did not help visitors grasp what a floppy disk was or how it worked.

In 1984, the debate shifted to whether it was more pressing to concentrate on explaining how computers work or whether further exhibits on computer applications, such as "The Computer and the Image" gallery (which Oliver developed for the original Museum opening in 1984), should be built. The latter view prevailed, with the result that in 1986 Oliver started work on "Smart Machines," a gallery on artificial intelligence and robots, which opened in 1987 as the first addition to the Museum since its opening.

The SAGE Exhibit. Oliver tried to figure out how to use the components of the SAGE computer to show how computers work. While the huge difference between historical components and today's equivalents is a fascinating story, it does not directly help in the understanding of computers.

Concept Stage: October 86-July 88

In 1988, Gardner Hendrie, Chairman of the Exhibits Committee and of the Museum's Board, led the formulation of an exhibition policy. The committee concluded that the exhibitions were to be primarily educational, with a wide appeal that would inspire people, especially younger visitors. Exhibits should principally address four questions: "How do computers work?", "Where do computers come from?", "What do computers do?", and "Who made computing develop?" As the answers to the first two questions would constitute a good introduction to the Museum as a whole, it was decided to build them near the Museum entrance.

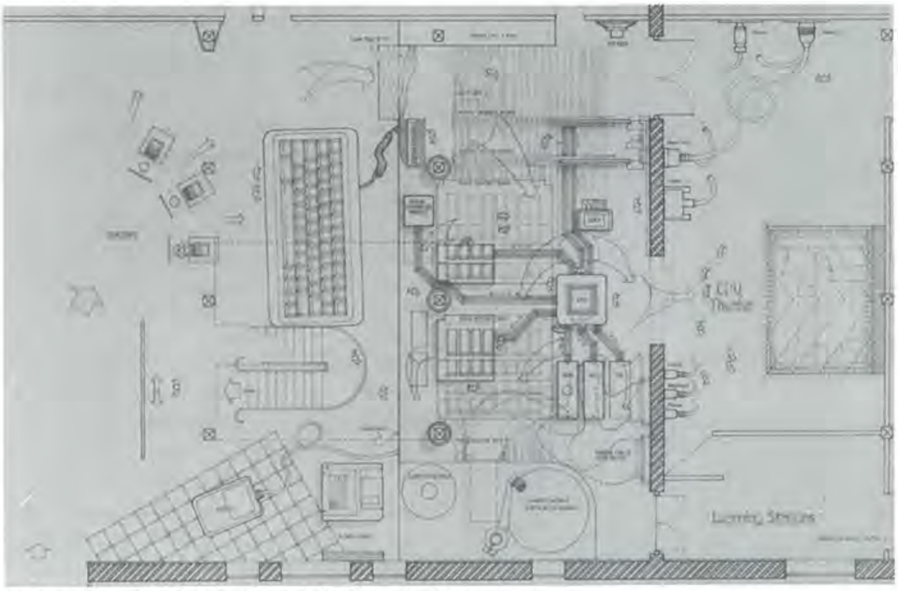
Oliver was intrigued by the challenge of addressing the first question and decided that something extremely dramatic and larger than life would be needed. He had pictured a giant landscape of the inside of a computer that would make visitors catch their breath when they first saw it. He knew that the correct choice of designer would be absolutely critical in this kind of project.

At this point, Richard Fowler, the designer with whom Oliver had worked on his last Science Museum project in England, made a fortuitous visit. Richard and Oliver talked about the overall plan for the Museum and about building a giant computer that would answer the question "How do computers work?"

Before the idea could go farther, Oliver knew that potential exhibit supporters had to see a drawing of an oversized computer in the Museum space before they would believe that this was possible, let alone fund it. Richard, with his experience of large-scale exhibits (a nuclear reactor, a television studio), was the obvious designer for the job. Then, Founding President Gwen Bell, on a visit to England, secured a year's leave of absence for Richard to come to Boston to design the giant computer.

Seed Stage: August 88-June 89

In November 1988, Oliver presented the idea to the Board of Directors with Richard's first drawings that showed the exhibit and its location on the fifth floor, replacing part of the SAGE exhibit. The plan called for a mix of realism and abstract representation that is strikingly similar to the final version. For example, Oliver described a "processor island"



1989 concept drawing for The Walk-Through Computer.

The prototype 1:1 board for The Walk-Through Computer

"Real" computer architect Dave Patterson helped ensure the realism of the giant computer's design.

that combined computer animation of a fetch/execute cycle with views of a real microprocessor under magnification—precisely the effect built into The Walk-Through Computer's microprocessor. The exhibit was projected to cost $750,000.

In March 1989, Mitchell Kapor had agreed to a $250,000 gift from the Kapor Family Foundation for a major, substantive project at the Museum. Here, we felt, was a perfect candidate! In July, Oliver made a presentation to Digital Equipment Corporation. Of all the Museum's exhibit plans, the giant computer captured their imagination the most. The one-year contract with Richard Fowler was confirmed, and an opening date for the exhibit set for June 23, 1990.

Before the exhibit ideas solidified, the Museum wanted to solicit the widest possible expert advice on the wisdom of building a larger-than-life computer. To this end, Oliver established an advisory committee. Early meetings of this committee focused on the basic design concept for the exhibit. Three competing ideas emerged. One, similar to Oliver's original proposal, called for both the inside and outside of the computer to be based on the real physical hardware, with cutaways and insets featuring computer animations and smaller physical models. Some advocated an enormous contoured landscape of a greatly enlarged microprocessor. Others felt priority should be given to input and output devices because these provided a bridge between the exhibit and visitors' prior experiences.

A second idea, referred to as the "Alice in Wonderland" model, would have had a realistic exterior with doorways opening into unexpected places. One doorway would lead into the computer's chassis, while a second would be a sort of "rabbit hole" into space representing the realm of software. Museum Director of Education Adeline Naiman was especially concerned that children would have a sense of moving into another world at another scale.

A third concept was totally abstract—the flow of logic and data inside a computer would be represented by a system of "whirling ping-pong balls." This approach stemmed from the desire to explain the essence of computing using a very simple implementation. It was advocated strongly by those who felt that the Museum's current exhibits were too hardware-oriented. Philip and Phylis Morrison, who had helped conceive the Giant's Desk Top at the Boston Children's Museum, described it as an exhibit that was really popular with long staying power. Signe Hanson, from the Children's Museum, warned of the heavy wear and tear on such models. Their enthusiastic caution and experience helped guide the rest of the group.

As July and the arrival of Richard, the exhibit designer, drew near, Oliver pressed the advisors to reach a conclusion. The critical element to them was: What would a typical visitor — and we thought of an eleven-year-old as our example — relate to best? The decision became clear: the first, realistic model would work best because it would be identified with something visitors had already seen.

Some members of the exhibit's Advisory Committee are shown here. Standing from the left: Robert Semper, Jonathan Rotenberg, Daniel Dennett, Richard Rubinstein, Signe Hanson, Art Bardige, Lynn Rankin, Dan Griscom, Michael Chertok. Sitting from the left: Philip Morrison, Gwen Bell, Allison Druin, Phylis Morrison, Adeline Naiman, Oliver Strimpel.

Design Stage: July-December 1989

As soon as Richard arrived in June, he and Oliver set the goal of completing the design, hiring the project team, securing the funds, and determining the giant computer's program and the animation of the internal workings by the end of December. If this was achieved, an opening in June 1990 would be feasible.

The Design

Richard quickly came up with the idea of perching a giant monitor on the sixth floor, resting on top of a chassis on the fifth floor. This exploited the only two-story vertical space within the building to house a giant computer in its typical configuration. The ceiling height limited the maximum scale-up of the monitor to a factor of twenty. The flatter shape of the computer chassis and motherboard, however, permitted a scale-up factor of fifty inside the computer.

As thinking progressed on the interior structure of the giant computer, a gap in the Advisory Committee became apparent—no one had ever designed a real computer. Fortunately, computer architect David Patterson, Professor of Computer Science at Berkeley, a leading advocate of RISC architecture, and Computer Museum Board member Gordon Bell, Chief Scientist at Stardent Computer, were delighted to work on this problem. These two "real" computer architects became the team's mentors, and ensured the realism of the giant computer's hardware design.

Initially, a Harvard architecture had been chosen in which separate sets of connecting wires (buses) on the motherboard are used for instructions and data. It was hoped that this would help visitors distinguish instructions from data as they watched a program executing in slow motion inside the giant computer. But both Dave and Gordon resisted. "That is not what most computers are like," they said. "If you want this to be realistic, and look like the desktop computer that a visitor might go home and open, then a serial, Von Neuman architecture is the correct choice. You'll just have to work out a way to explain it."

By late December, the computer architecture team was given some additional constraints. The Museum had decided to use an Intel 486 microprocessor, a DEC 8-platter five-inch hard disk drive, and four banks of RAM chips (SIMMS) in the exhibit. The team then realized that if all the components were incorporated, there would be no room for people. David remarked, "This is the first time that I've had to be constrained by the fact that people need to fit around the processor." This led to the the idea of "steam-rollering" some of the components into the floor so that their outlines were visible as flat shapes on the floor.

Gordon and Dave suggested that just as the first drawing had helped crystallize ideas, an actual motherboard should be fabricated and used as a basis for the exhibit design. Immediate priority was given to the preparation of circuit drawings for building the "1:1 board." Donald Glass, president of DGA Associates in Wilmington, Massachusetts, lined up the necessary suppliers to build the prototype.

Just as the inside of the computer changed, the outside evolved. Some of the keys on the keyboard were steam-rollered to provide a "walk-through" keyboard that would include a cut-away view of the inside of one key. A pointing device was needed. But a twenty times life-size mouse would be larger than a bumper car and would not be safe, especially for children. A stationary trackball was selected as the alternative. The trackball details were solidified by a lucky event. While visiting Scott Fisher at the NASA Ames Research Center in December, Oliver was introduced to the designer of the Kensington trackball. And by January 1, on schedule, Kensington Microware Ltd. was providing the information needed to reproduce their trackball design faithfully on a twenty times life-size scale.

Richard Fowler, Exhibit Designer

Chip Morrison, Exhibit Developer

Dan Griscom, Technical Consultant

Alan Symonds, Technical Director

The Team

In addition to Richard as the exhibit designer, three other people became project leaders. Donald "Chip" Morrison, who was about to complete his Ph.D. from the Harvard Graduate School of Education, was signed on as Exhibit Developer. He would plan the educational messages and write all the exhibit text. Dan Griscom, Exhibits Engineer at the Museum, took on the role of determining the metaphors that would be used inside the computer to show how the computer worked. Alan Symonds, a theatrical lighting engineer who had worked on the Smart Machines Theater in the Museum's Smart Machines gallery, was signed on as the Technical Director for special effects and electronics.

In addition, two outside contractors were engaged. F.W. Dixon Company, of Woburn, Massachusetts, an experienced exhibit and model-making firm, was selected as the main fabricator. The contract, signed in early September, gave Dixon just 10 months to complete the construction. The three-dimensional fabrication would eventually involve 35 Dixon employees, four supervisors, fifteen subcontractors, and more than a hundred other vendors.

The second was award-winning illustrator, David Macaulay, author of *The Way Things Work*. David was intrigued by the prospect of applying his talents to an exhibit. He enthusiastically moved beyond his role as an advisor to become the Exhibit Illustrator. This allowed us to place most of our explanations of how the components worked into illustrations, keeping text (which most visitors are reluctant to read) down to a minimum.

Choosing an Application

Throughout the fall, the advisors and staff were grappling with the question: What should The Walk-Through Computer be doing? Not only would this determine what appeared on the screen and how the keyboard and trackball would be used, but it would also provide the framework for the explanations of what the various components were doing inside the computer. Thus it was decided that the application had to (1) involve both processing and memory (requiring significant use of disk); (2) require a genuine, but brief (no more than 90 second) interaction with the visitor; (3) be graphical; (4) be fun for all ages; (5) be a typical type of task

World Traveler was selected as the program to run on the giant computer because it met all seven criteria.

appropriate for a computer; (6) use a readily explainable algorithm, and (7) be implementable in time.

For several months, "face matching" was seriously considered. This program would capture an image of a visitor's face with a TV camera, compare the visitor's features with those of celebrities, and select the closest match. It would be popular because people are always fascinated by exhibits that involve their own face. In fact, it met all the criteria except the last one: none of the team or volunteer consultants could get a prototype to operate.

In December, the second candidate application, "World Traveler," was selected. In World Traveler, the visitor selects a region of the world using keys on the keyboard. The computer then shows a map of that region and invites visitors to select a starting city and a destination city by moving an arrow on the screen with the giant trackball. The computer searches for the shortest path between the two cities. It then steps through the route on the map, segment by segment, showing images of the cities passed through along the way. World Traveler appeared to meet all of our criteria well: processing was required to find the shortest route; disk access would be needed to retrieve the images of the cities; the interaction with the trackball and keyboard was an integral part of the program; the maps and city images were graphical; the element of surrogate travel made it an exciting program to use; route-finding and image retrieval were representative of widespread search and database applications; a search algorithm seemed easy enough to explain, and lastly, the program could be implemented in-house.

Viewports

A major series of discussions centered on the design of the "viewports," the visitors' view inside the giant computer's components, such as the CPU, the graphics board, the RAM, and the disk drive. On the one hand, it was desirable to show visitors what they would actually see. In the case of the CPU, RAM, and UART (interface chip), it would be the etched patterns on the surface of a silicon chip. On the other hand, visitors might want to see what each component was actually doing as it executed the World Traveler program. As we tried to reconcile the realistic "silicon" view with an explanation of the function being performed, it became apparent that any attempt to superimpose the two in the same image would lead to a less clear view of each one separately.

Realism was pursued first. The most authentic view would be a high resolution photographic image of the chip surface. Engineers at Digital Equipment Corporation had shown members of the team some video sequences of working chips taken through an electron microscope. The team was thrilled to see the actual voltage levels change while the chip was operating. The decision was made to incorporate electron microscope sequences into the silicon view.

But now a bridge was needed between a photographic blow-up of a chip and the electron microscope sequences so that visitors would know they were looking at two views of the same thing. Swivel 3D, a program for doing three-dimensional animation developed by San Francisco-based Paracomp, seemed to provide an answer. Special animation would be

The keyboard is swung into position. This photo appeared on the "Works in Progress" page of the New York Times Magazine.

generated to "fly" into the electron microscope view from the photographic view. When Sean McKenna, Vice President of Marketing at Paracomp, was presented with the project needs, he offered the Museum six weeks of service from Drew Huffman, their top animator. The decisions to construct a prototype printed circuit board as the basis for fabricating the giant motherboard and to acquire the scanning electron microscope images took the design team to the diametric opposite of the abstract "ping-pong ball" model. A motto pinned up in more than one office during this period expressed this tendency in one telling phrase— "Make It Real."

Fund-raising

In September, Mitchell Kapor committed his $250,000 grant towards The Walk-Through Computer. A month later, Digital Equipment Corporation made a three-year grant to the Museum, starting with $150,000, plus equipment, for The Walk-Through Computer. Within weeks, a $250,000 grant from the Alfred P. Sloan Foundation put the project within $100,000 of its goal. In December, a fundraising trip to California brought in Apple Computer and Intel, each with a $50,000 donation and a commitment for technical and equipment help with the project.

Larry Tesler, then Vice President of Research and Development at Apple, said, "I'll get you nine Macs, including a machine that you will want .... but I can't tell you what it is." It was to be one of the first Macintosh IIfx's, whose speed was to become critical for the World Traveler application running on the giant computer.

At Intel, David House and the 386/486 microprocessor marketing/engineering organization provided the funds and expert advice. In discussions with the group, we decided to base the giant CPU on the recently introduced 486 microprocessor. Ann Lewnes from the group was invited to participate in one of the final brainstorming sessions. A month from the design completion deadline, Ann and Steve Blank from SuperMac, Jon Rubinstein from Stardent, Sally Rosenthal from Digital Equipment Corporation, Gordon and Gwen Bell, and Oliver Strimpel generated ideas about the special effects to reveal the flow of information along the motherboard. Ann Lewnes said it was like listening to a session of Intel engineers while they were still free to play with the design specifications of a new product.

At this point, it was becoming clear that the $750,000 budget set 18 months earlier might be too low. Fortunately, several other funders added their support: AT&T, intrigued by the project's educational potential, committed $50,000, and Maxell committed $25,000 (in addition to their $12,500 contribution of the previous year). By January 1, 1990, $825,000 had been raised.

Designing the Publicity Roll Out

In late December, Jan Del Sesto, Director of Development and Public Relations, and Gail Jennes, Public Relations Manager, were given the go-ahead to call together the Museum's crack PR consultants. The group, including Christopher Morgan, Roxanne Frisiello, Sheryl Schultz, Wendy Germain, Richard Eckel, Lewis Karabatsos, and Joe Grillo, developed a roll out strategy to publicize the exhibit internationally. They decided to obtain early coverage by going after the British press and the "Works in Progress" page of the *New York Times Magazine*. This was successful, and the exhibit's appearance in the *London Daily Telegraph* and the May 20th issue of the *New York Times* helped attract unprecedented international coverage for the opening.

Specifications: January-March 1990

By January 1st, the general form of all the computer's components was determined; the project now entered a phase of converting the general into the specific. Designs were sent to Dixon and converted into working drawings; fabrication at the Dixon workshop began, starting with the giant monitor and keyboard. A similar process started with David Macaulay. The Museum provided him with real components to dismantle, and explained processes to him in detail. He then translated the material into illustrations which were critiqued and steadily improved over several iterations. Many of the developments were now taking place in parallel, as the size of the team increased and individual team members took on separate tasks. In February Oliver was named Executive Director, placing great demands on his management skills as he took on new responsibilties while continuing to direct The Walk-Through Computer project.

Application Program

David Greschler, an experienced Hypercard programmer, was hired to implement the World Traveler program. It became clear that the best approach was to use Supercard, a program similar to Hypercard but with color. The compute-intensive parts of the program, such as the route-searching, would be implemented in the programming language C as external commands. Major cities around the world would be represented, resulting in some four hundred possible destinations. Tom Restivo was employed to collect, select, and digitize the city photographs. It was also decided to give the computer sound, prompting visitors as they used World Traveler and saying the names of the cities along the selected route.

Viewport Animation

Once World Traveler was selected as the application, Dan Griscom, Drew Huffman, Alan Symonds, and Chip Morrison began to spell out the nature of the visitor's journey into the program. Drew started to create animated sequences using Swivel 3D that showed zooms onto the microprocessor and the disk drive.

At the same time, key members of the team were once again pointing to the need for something more than authenticity. Although engineers and other knowledgeable visitors would appreciate the realism, concern was growing that the average visitor would have difficulty understanding what the computer was actually doing. There was a need, in other words, for a "functional" view of the computer that would complement the "silicon" view.

Seeds for the second breakthrough lay in the donation of another animation product, Macromind Director, from Macromind, Inc., in San Francisco. Dan Griscom, the Exhibits Engineer, took the program home one weekend in early January and came back the following Monday with a short computer animation involving a video image of his own hand carrying chunks of "data" around the screen. Everyone on the team who saw the animation realized at once that the long-sought "functional view" had been found. It was simple, told the story, and was fun. It was soon agreed that the viewports would have to alternate between functional and silicon views.

David Macaulay, who had joined the team as illustrator, was given real components to dismantle. He then translated them into drawings.

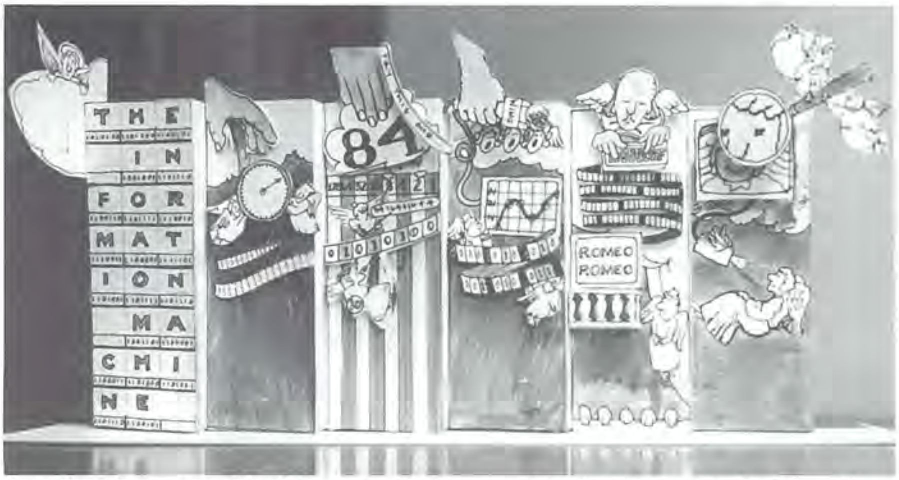
Gordon Bell remembers, "We made an immense breakthrough when we decided to show three levels in the viewports—the functional level of the fetch-execute cycles, the photograph of the silicon, and then a fly-down to the gate level with an electron microscope view."

After much debate, the activities inside and outside the computer were decoupled. A full interaction with World Traveler takes about 90 seconds. If the interior were animated at that speed, visitors would only see a blur of light. The decision was made to slow the elapsed time for a World Traveler interaction inside the computer by a factor of about ten, allowing time to show a functional representation of each step of a search. The search would be standardized for a starting city of Columbus, Ohio, and a destination of Boston.

David Greschler, Programmer

Learning Stations

It was expected that for many visitors, The Walk-Through Computer would raise more questions than it answered. How do chips really work? What is the connection between the circuits on the chip and the manipulation of information? How are computers made? Learning stations located nearby would offer visitors some of the answers, with



A cardboard prototype of the Information Machine panels by David Macaulay. Each type of information was presented graphically in a large illustration next to a hands-on interactive enabling visitors to enter their own information and see it encoded as a pattern of bits.

Dean Winkler, Special Effects Video

more explanatory depth and a longer interaction time. Education Coordinator Natalie Rusk had been working with students in grades 7-12 in the Brookline, Mass., Public Schools to find out what they wanted to know about computers. This influenced the design of all the learning stations. One station was created specifically to answer a common question: "What happens when a key is pressed?"

"Journey of a Keypress" shows the sequence of activities involving the UART, CPU, RAM and video display board, all working together to input a single press of a key at the keyboard and display it on the screen.

"Digging Deeper," the most ambitious station, makes the connection between low-level software and the hardware. Visitors step through the machine-level instructions for the addition of two binary digits, seeing animation taken from the microprocessor's viewport. This and other animation show how logic gates are used to add the binary digits. Then each gate would be shown as an electronic circuit, and as it might appear on a silicon chip.

"Design your Own Computer" invites visitors to combine different processors, video boards, and amounts of RAM to create their own computer. A spinning globe on the simulated computer's screen gives instant feedback on the computer's performance, while an "invoice" gives cost.

"Manufacturing Computers and Software" gives visitors short video introductions to three topics: fabrication of integrated circuits, assembly of computers, and the design and implementation of a software product. The video material was developed by Intel, Apple Computer, and Lotus Development.

The final learning station offers visitors the chance to write and run their own simple program. The challenge here is to instruct a man to find his dog by giving directions on how to go through a simple maze.

Software Theater

The realistic hardware inside The Walk-Through Computer does not reveal how software is made or how it operates. Tony Fernandes, a software engineer at Lotus, became the advocate for a separate space, devoted entirely to the explanation of software. He produced a sequence that served as an inspiration, helped convince the team to create a software theater, and urged Lotus to fund it.

BBC producer Jon Palfreman and Nancy Linde, at work on *The Information Age*, a six-part television documentary for PBS on the history of the computer revolution, accepted the job of producing the film in time for the opening. Working with Museum staff, the pair eventually produced a script that called for an animated character to tell the software story using two human programmers, Edwin and Edwina as foils.

One of the major challenges was to explain the heart of the program, the algorithm. This turned out to be a flaw in the selection of World Traveler. The search for the shortest road path between two cities involved building up and walking through a tree structure. Jon and Nancy felt it was just not possible to sustain the general public's interest through an explanation of so abstract a concept. Instead, a smaller piece of the program was explained—how the identity of a city is determined from the location pointed at by the trackball.

The next step was to find someone to do the animation. Dean Winkler, a long-time Museum supporter and Vice President and Director of Creative Services at Post Perfect Inc., a special effects and production facility in New York City, was intrigued with the project. A week after Oliver re-established contact, Dean was at the Museum meeting with Palfreman and Linde to draw up a preliminary plan. Everyone was thrilled to know that there would be spectacular graphics and an extremely professional look to the theater.

The Information Machine

Richard Fowler, along with educators Natalie Rusk and Chip Morrison, felt that visitors needed an introduction to basic concepts before entering The Walk-Through Computer. They lobbied to build a set of educational interactive panels at the beginning of the exhibit. Gwen Bell cautioned against adding non-budgeted items, but the educational arguments were compelling. Oliver and Chip determined that the goal of the introduction was to demonstrate how data in the form of numbers, text, sounds, or pictures, as well as instructions, were all different forms of information that could be converted into a pattern of binary digits. This would explain why the computer, an Information Machine, was so universal in its application. It was decided to design and build the "Information Machine" panels with our own carpenters, Tom Merrill and Don Greene, and to allow David Macaulay free rein in the graphics.

Mark Siegel, Richard's design assistant, took over the three-dimensional design for the interactive stations. Peter Miller, who had worked on the design of the motherboard, was assigned to create the hardware needed to drive the six interactive demonstrations. By early April, cardboard models were ready for Natalie to conduct formative evaluation. This resulted in many significant changes, many of them suggested by Museum interpreters or the public.

Building Components

F. W. Dixon, the main contractor, had scheduled completion for June 1, allowing three weeks for the installation of the lighting, video, and sound. But the 1:1 scale motherboard was late, and since Dixon was going to scale the 50:1 motherboard directly from it, the whole schedule started to slip.

By the end of March, the space was ready for installation. The SAGE exhibit had been removed and a hole had been cut in the brick wall on the fifth floor to connect the motherboard to the Software Theater. The 25-foot-long keyboard, the power supply unit, the trackball, the floppy disk, and giant monitor were largely complete at Dixon's workshop.

For many weeks, Dixon and Richard searched for a material that would simulate the translucent green plastic of a computer's printed circuit board and yet be durable enough to withstand the feet of many thousands of museum-goers. The ideal plastic subfloor with embedded neon tubing, covered by a transparent capping layer made of durable resin, had to be rejected when it proved impossible to find a glue that would bond the two layers together.

The monitor is installed in two pieces.

Dixon's workmen open up the brick wall.

The giant power plug outlet is delivered.

Reluctantly, the team conceded that visitors would have to be confined to walk on certain areas of the motherboard only, where the flooring would consist of a sturdy plain green linoleum to be imported from Germany. This flooring was strong enough to hold embedded strips of Tivoli floor lighting representing the data channels along the bus. The remainder of the motherboard would be raised, and would be made of translucent Lumacite which would be lit from below as well as with embedded Tivoli.

Funding closes

Throughout this period Oliver continued to raise money with additional funds coming from Kensington Microware Ltd., Lotus Development Corporation, and Cirrus Logic. The total cash raised amounted to $887,500.

Implementation April 1-May 15, 1990

In early April, a five-man rigging crew from Dixon hoisted the computer's giant monitor into place on the sixth floor. A team of Dixon workers then set up shop in the gallery and quickly installed the keyboard, front chassis wall, and power supply.

Chip, Oliver, and Natalie continued writing the script for the panels. It was an exacting task, and the text passed through many cycles of editing.

World Traveler

By this time, David Greschler had a prototype of World Traveler running for North America. Extending the program to the remaining continents involved looking up and entering a great deal of data on city locations and road connections. Dan desperately needed David to help with the

At Dixon's workshop, Project Manager George Vanikiotis, Jr., puts finishing touches on the floppy disk.

Natalie Rusk worked with students to find out what they wanted to know about computers.

viewport animations so several excellent volunteers were recruited: Ellie Kerns from Waltham, Mass., did Africa, Pamela Bugg from Boulder, Colorado, did Asia, while Museum Interpreters Tim Granlund and Norman Simpson took care of Europe, Oceania, the Middle and Far East, and Central and South America.

Animating the Viewports

The team decided to create six different viewports: two views of RAM, one each for the CPU, the hard disk, the video board's digital-to-analog converter, and the video memory. Each viewport showed the functional view synchronized to simulate the execution of World Traveler slowed down tenfold. At this speed, a visitor could comfortably watch the execution of a complete cycle of the World Traveler. The scanning electron microscope silicon view filled inactive, dull phases of the cycle.

Altogether 90 minutes of computer animation were made using MacroMind Director on the Museum's Macintoshes with the help of SuperMac's color monitors and accelerators. This was a formidable amount of work, and was completed by Dan Griscom and David Greschler in just six weeks.

Lighting Effects

Each animated instruction in the viewports actually represented thousands of machine-level instructions. Each data object represented entire images or sounds consisting of thousands of bits. Thus each step shown in the viewports corresponded to thousands of clock cycles. The flow of data would therefore have to be represented impressionistically, with wires lighting up during periods of communication between the various components.

Alan Symonds explored neon lighting, edge-lit plexiglas, Tivoli, and other systems. In the end, with the delay in the specification of the motherboard, the decision to use Tivoli was more or less forced onto the team. It was flexible, available, and used safe low voltage. However, this choice sacrificed the ability to show directionality of flow; the entire wire would have to light simultaneously.

Installation: May 15-June 6, 1990

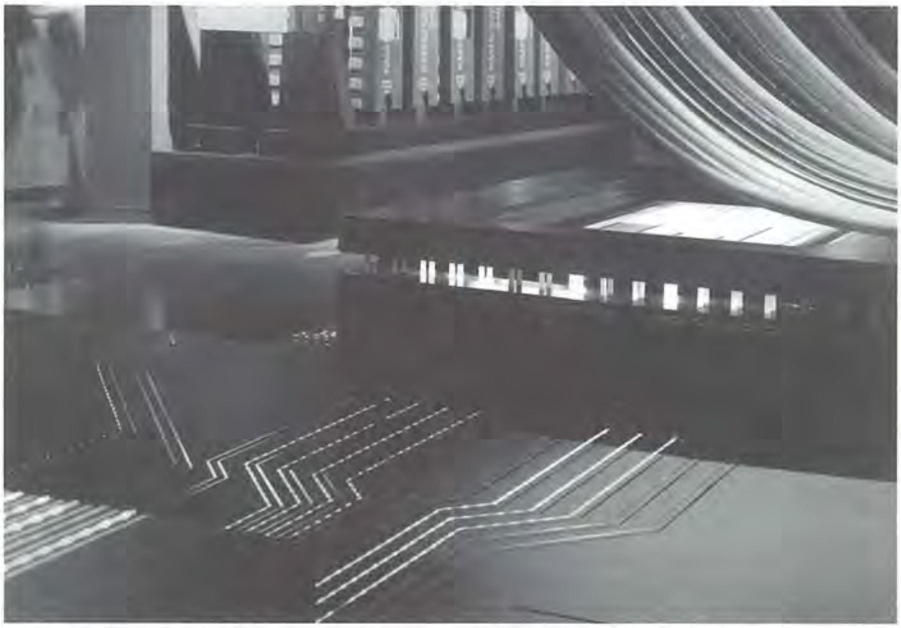
Time was running out, but the team refused to cut corners, choosing instead to work late into the night. Oliver added extra helpers to the team and strove to keep morale high during the stressful weeks leading up to the opening.

In late May, the exhibit text panels were still being reviewed by school children and educators. Then, starting June 1, Ted Groves, a new addition to the staff as graphic designer, integrated the text and David Macaulay's illustrations to create the final panel art. Batches of panels were sent out to be silk-screened. After many long days and nights on the Macintoshes, Dan and David completed the 90 minutes of animation for the viewports. Dan decamped to Post Perfect in New York for a week of all-night sessions to convert the Macintosh animation into video, perform on-line editing, and press the video disks.

Meanwhile, Dixon's crew was falling behind schedule. Extra carpenters were hired to build the Software Theater walls and seating. George Vanikiotis conceded that his Dixon crew would probably be there until the last minute. The team would not have the luxury of installing the electronics, lighting, and video equipment after construction had been completely finished; everyone would have to work simultaneously.

Alan's workers grew in numbers. He learned that theater lighting specialist Gayle Jeffery was between off-Broadway engagements, and she joined the crew along with David Ammar and Adam Kibbe. As soon as the decision was made to use Tivoli for the motherboard lighting, electronics engineer Michael Callahan started a production line for the 20 controller boxes needed to drive the 338 lighting instruments that included 2,000 feet of Tivoli lighting, almost half a mile of ribbon cable, and 208 pins for the CPU and UART chips. All this lighting inside the giant computer was controlled by a real computer— a MicroVAX 3400 System, donated by Digital Equipment Corporation, using custom software running under the VMS operating system. A scripting language specially written for the exhibit by software engineer David Fagan let Alan set up a cuing script for the many special effects devices using a set of simple, flexible commands. This enabled him to tune the lighting for the best effect.

A Dixon workman routs out grooves to accommodate the lights representing bus wires.



Tivoli lighting was selected to represent connections between components on the motherboard.

Meanwhile, the Software Theater production was in full swing, with a team of animators working at Post Perfect to create the artificial eyes that were to represent the video's narrator. A set was created in the Museum's auditorium to film Edwin and Edwina acting the roles of the World Traveler's programmers. However, the script called for some filming in The Walk-Through Computer itself. With the schedule slipping, the exhibit would be complete just days before the opening. Nancy and Jon were used to tight production schedules, and planned a shoot for the Sunday before the Thursday opening, allowing just three days for off-line and on-line editing and disk pressing.

Nancy Linde, Assistant Video Producer

Jon Palfreman, Video Producer, Software Theater

By Monday, June 4, the work in the motherboard area blocked visitor access to the personal computer and graphics galleries. Visitors were re-routed down the back fire stairs to reach the rest of the Museum.

Peter Miller had completed the motherboard electronics and was devoting his time to developing the Information Machine stations. His sonorous baritone earned him the role of The Walk-Through Computer's voice; he patiently pronounced hundreds of city names into a microphone for The Walk-Through Computer's real computer, the Macintosh IIfx, to digitize and store. No one anticipated the research required to find the correct pronunciation of 400 city names from around the world. Fortunately, volunteer Pamela Bugg took on that task.

Julie Bingham, director of language products at Symantec Corporation, arranged for the donation of some computers for the Information Machine interactives, and some programming time, two items not in the budget.

The Learning Stations were progressing under the guidance of Chip. Volunteer Barry Kort, a visiting scientist at Bolt, Beranek, and Newman, answered a call for a Macromind Director expert and spent hundreds of hours finishing the Learning Stations. Karyn Scott of VideoLogic managed to obtain donations of a computer, color monitor, and a videodisc player for the interactive video learning station on computer manufacture.

Completion: June 6-20, 1990

The countdown moved to days. Richard arrived at 5am with the Dixon crew, about the time that Alan Symonds and his team of theater people were breaking for a few hours rest. Every evening, twenty to forty employees and volunteers worked late, gathering around long tables for Chinese food or pizza.

With the cuing software complete, Alan moved the MicroVAX down into its room next to the motherboard and took up almost 24-hour residence in the gallery. Michael Callahan arrived with a truck full of controller boxes for the lighting, and then installed the audio system throughout the exhibit.

During this last week, the media hounded the Museum for previews. As the attention of major publications and television networks mounted, the public relations team could no longer resist their requests. Film crews were allowed to shoot, halting work for half hour periods here and there. Tension grew, but the team was also excited at this foretaste of the enormous exposure that was to come. *Newsweek* writer John Schwartz was so intrigued that he stayed for a whole day, while Natalie found some Lego to entertain his three-year-old daughter.

On Thursday, June 14, one week before the first opening party, Alan calculated that he and his crew were about a week behind; it looked as if they would be working round the clock!

The noise in the galleries was ear splitting, as the fabrication crew raced to finish routing the grooves for the Tivoli lighting in the motherboard flooring in time for the weekend volunteers. This lighting would run through the floor, recessed into the linoleum to simulate the bus and other connections between the computer's components. The installation of the Tivoli lighting was an exacting job for crews of about six volunteers at a time. First the plastic housings had to be cut to fit into the grooves that snaked across the motherboard. Next, fragile chains of lights had to be cut and threaded through the housings. Finally, each housing had to be glued into its proper place in the floor. Other volunteers painted and installed spotlights. Alan put Gordon Bell to work inside the hard disk, where the DC motor strained to spin the large solid plywood platters. Meanwhile, up in the offices, a team was pressing on to complete the programming of the Learning Stations. It was a productive weekend.

By Monday morning, Alan said that he had made up several days' work. Then, the trackball failed. Alan and Gayle Jeffery took it apart. It needed a better solder connection at a critical component; only two hours were lost.

With the Tivoli lights installed in the floor, the wiring could be completed to simulate the data movement along the bus, up the pins and into the CPU. Marketing Director Noel Ward, Gordon Bell and several other volunteers completed most of this wiring on Monday night.

By Tuesday morning, Peter had completed recording the voice of the World Traveler program.

Meanwhile, Tom Flotte, a pathologist at Massachusetts General, arrived at the Museum almost every other day with improved versions of a program for one of the Information Machine stations.

On Wednesday, the Software Theater film arrived and was tuned for its three-projector screen. The Learning Stations were installed. Everything was coming together.

The final push toward opening night.

Opening: June 21, 22, 23, 1990

On Thursday morning, at 4:30 am, after David had spent the night fine-tuning the World Traveler application, he found that when he tried to hook it up to the giant monitor, nothing happened. Fortunately, the NBC crew who appeared at 5am was planning to shoot inside the machine.

Oliver had arisen before 5am, to be ready on-camera for the *Today* Show. After working through the night, Alan and his crew had managed to get most of the Tivoli floor lights working. At 7:35am, just after the newscast, Oliver was interviewed live from New York as he sat on the CPU inside The Walk-Through Computer.

As soon as the NBC crew left, the workers came back in! By 9am, Dan Griscom had fixed a loose wire in the trackball, and the World Traveler program showed up on the screen. The team had eight hours to finish. By now most of the Tivoli was running, all the viewports were on, the slowed-down sound on the mother-board was working and the hard disk was spinning. At 6pm, everything was shut down to await the official opening at 7pm. Moments later the first guests gathered excitedly around the outside of the giant computer.

Finally, at 7pm, the time had come. Gardner Hendrie, Chairman of the Board, Mitchell Kapor, the principal sponsor, and Oliver Strimpel, the project's originator, opened the exhibit with speeches and a demonstration.

In his remarks, Gardner Hendrie said, "The Walk-Through Computer fits the Museum's educational mission perfectly, as it provides a truly accessible intro-duction to computer technology."

Mitchell Kapor pointed out the special significance of this innovative educational exhibit at a time of crisis in the nation's educational system. Then Oliver Strimpel commented wryly that while the rest of the world had spent 40 years making computers smaller, faster, and cheaper, The Computer Museum had spent one year building one of the world's largest, slowest, and most costly computers!

Then came the moment everyone was waiting for. With Oliver providing commentary, Gardner switched the power on and, within seconds, World Traveler's spinning globe appeared. Gardner then selected and pushed the North American function key. Mitchell rolled the trackball to start a journey in San Francisco and end it in Boston. Sure enough, the giant screen showed the computer searching for the shortest route, finding it, and then showing pictures of the cities seen en-route to Boston to the accompaniment of Peter Miller's sonorous digitized voice.

Mitchell Kapor is the first to put World Traveler through its paces.

Friends from Intel Corporation join Oliver Strimpel to look at the giant CPU. From left to right: Dennis Carter, General Manager, End User Components Division; Lisa Dreske, Marketing Communications, Sales Promotions Manager; Kevin Teixeira, Marketing Communications Program Manager; Oliver Strimpel; Clif Purkiser, Corporate Development Manager, EUCD; Ann Lewnes, MIS Programs Manager; Jim Jarrett, Vice President of Corporate Communications.

The Walk-Through Computer was up and running before a rapt audience of sponsors and Museum Board Members.

But one significant problem emerged in the Software Theater. While the video was a splendid production, the World Traveler's programmers Edwin and Edwina had been cast as caricatures of eccentric programmers. Many guests, including the educators on the Advisory Committee, felt strongly that this was not the way to portray programmers for the next generation.

Friday, June 22

The crew went back to work first thing in the morning! For one thing, the start-up procedure had not yet been simplified, and Alan was the only person who could boot up The Walk-Through Computer lights and video. More work was also needed to mount pieces of the Macaulay graphics on the Information Machine panels.

That morning, at the Museum's Annual Meeting, the Board of Directors and Trustees enthusiastically applauded the work of the staff. On Friday night, Oliver led further opening ceremonies, this time for Museum members, friends, and workers on the project.

Saturday, June 23

At 10am on Saturday morning, there was a line of visitors at the door for the exhibit's public opening! The first people into the exhibit were Dora Ullian, of Newton, Mass., her son Ben, 4, and niece Jessica Nutick, 24.

Jan Del Sesto was duty officer and sat at the front desk all day, helping our front desk staff as they got used to handling 1,000 people a day, an event that was to become routine over the summer.

Aftermath: June 24 to July 4

Oliver went home and collapsed ... but he couldn't sleep. What was he going to do about the Software Theater! The following day he closed the theater down; later in the week, he decided to recast Edwin and Edwina but keep the same script.

Richard left for England on Sunday, just two days after the exhibit opened, ending an exciting and highly productive 13-month stay. On Monday morning, everyone else came in to assess the situation and compile the punch list of items that needed modification and completion. The intense pace of work continued until the Fourth of July weekend, when almost everyone took a break.

Final Completion: July

The main items on the punch list were completed. The start-up procedure was simplified to the throwing of a single switch. The last signs were installed. The Walk-Through Computer began to seem like part of the Museum.

Meanwhile, the Museum experienced record attendance, with 25,000 visitors for the month of July, an increase of 75% over the previous year's figures. It looked as if all the effort had really been worth it.

Training: August-September

By August, the revised Software Theater was operational, the exhibit development and Dixon crews had left, and the Museum was filled with people and a dramatic new exhibit.

Observation of visitors made it clear that many needed some help in order to derive the maximum benefit from the exhibit. Natalie Rusk, Dan Griscom, and others developed an explanatory guided tour. For school groups, a parts search was instituted, in which students become detectives trying to match actual components with the giant ones in the exhibit. For the general public, regular tours were started on busy days, and the interpreters were coached on how to help visitors at other times.

Oliver Strimpel (third from left) explains how the disk drive was built to supporters from Digital Equipment Corporation. From left to right: Lewis Karabatsos, Corporate Community Relations Communications Manager; Rose Ann Giordano, Vice President, U.S. Marketing; Nancy Dube, Manager, Corporate Community Relations; Grant Saviers, Vice President, PC Systems and Peripherals; Dorrit Saviers.

Visitor Leland Brown explores the "Journey of a Keypress" learning station.

National Outreach: October-December

In the spring, the Museum received funding from the Intel Corporation Foundation to produce a video based on the exhibit. Aimed at middle school students, the video would increase the educational impact of The Walk-Through Computer to an audience of millions. Entitled *HOW COMPUTERS WORK: A Journey Into The Walk-Through Computer*, the video was introduced in November.

Upgrades: 1991-1992

As technology progresses, the Museum will enhance the exhibit. One of the earliest upgrades will be better color. Although hardware donations were received for 24-bit color, Supercard, the program used to drive the application, only accepts 8-bit color. This limits the pictures of cities shown on the big screen to 256 colors, imposing a severe restriction on their clarity.

Many visitors seem confused by the giant components on the motherboard which are unlabeled, such as resistors and capacitors. A potential remedy is to name each component. Keeping the world map updated will require constant attention; fortunately, David was at the Museum the week that Germany was unified and he was able to unify the country on the World Traveler map! Changes such as these will continue to improve the exhibit.

Enhancing the Exhibit: 1992-1995

The Walk-Through Computer's specifications—the 486 micro-processor, 16 megabytes of RAM, and an eight-platter hard disk drive—should keep it "current" for several years. But optical discs, CD ROMs, and other technologies will soon prevail. While The Walk-Through Computer's architecture will not change, new components could be inserted to keep it up-to-date. A new application program could be written, and corresponding animation generated for the viewports.

In 1976, few people foresaw the significance that the personal computer would have a mere five years later. Is our vision of 1995 any clearer? Surprises that lie around the corner will affect the lifetime of the exhibit. How long can the exhibit live with upgrades? When will the Museum's mission to explain the technology of computing need an entirely new approach? Time will tell.

Museum visitors enjoy the giant trackball (above) and the interactive Information Machine panels (below).

An interpreter gives a tour of The Walk-Through Computer.

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The Walk-Through Computer Team

Exhibit Staff:
Dr. Oliver Strimpel, *Project Director*; Richard Fowler, *Designer*; Donald Morrison, *Exhibit Developer*; Alan Symonds, *Technical Director*; Dan Griscom, *Technical Consultant*; Peter Miller, *Electrical Engineer*; Mark Siegel, *Assistant Designer*; David Greschler, *Programmer*; David Fagan, *Programmer*.

Contractors:
F. W. Dixon Company, *Fabricator*; David Macaulay, *Illustrator*; Ruth Murray, *Assistant Illustrator*; Jon Palfreman, *Video Producer* (Software Theater); Nancy Linde, *Assistant Video Producer* (Software Theater); Michael Callahan, *Sound and Video Consultant*; Jane Cuthbertson and Ted Groves, *Graphic Designers*.

Special Consultants:
Animators: Drew Huffman (*Paracomp*), Dean Winkler (*Post Perfect*); *Project Consultants*: Tony Fernandes (*Lotus Development Corporation*), Mitchel Resnick (MIT); *Programmer*: Tom Flotte (Mass. General Hospital); *Engineers*: Joe Siegal (*Digital Equipment Corporation*), Len Dougherty (*Digital Equipment Corporation*); *Researcher*: Marcia Cohen (*Bingham, Dana, and Gould*).

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Art Bardige, Director, Learningways; C. Gordon Bell, Chief Scientist, Stardent Computer Inc.; Daniel C. Dennett, Professor of Cognitive Science, Tufts University; Allison Druin, Tell Tale Technologies; Signe Hanson, Director of Exhibit Design, Boston Children's Museum; Gardner Hendrie, Sigma Partners, Chairman of the Exhibits Committee; Danny Hillis, Founding Scientist and Director of Research, Thinking Machines; David Macaulay, author and illustrator; Philip Morrison, MIT Institute Professor; Phylis Morrison, curriculum developer and producer of science materials and programs; David Patterson, Professor of Computer Science, University of California (Berkeley); Jonathan Rotenberg, founder and Chairman, The Boston Computer Society; Richard Rubenstein, Manager of Technology Assessment, Digital Equipment Corporation. Museum staff: Oliver Strimpel, Executive Director; Adeline Naiman, Education Director; Michael Chertok, Education Coordinator; Dan Griscom, Exhibits Engineer; Gwen Bell, Founding President, and Chip Morrison, Exhibit Developer.

In 1990, the collection spaces of the Museum were reorganized and a survey of the conditions was undertaken with support from a conservation grant from the Institute for Museum Services. As a result, all the collection spaces are being monitored with recording hygrothermographs and are maintained within acceptable temperature and humidity parameters. In addition, acid-free boxes have been acquired for the storage of the document collection.

The permanent collection currently numbers 1,049 artifacts. This year only 37 artifacts were accepted out of a total of 300 considered. In contrast, the document, photograph, and film and video collections are growing rapidly. This change can be attributed to the primary sources of the different collections. Most computer artifacts are offered to the Museum when they are decommissioned from use by a corporation or institution. Ten years ago, when the Museum started collecting, some vacuum tube and transistor machines were still being decommissioned. Today, with much greater standardization, fewer machines are being decommissioned that fit the criteria for acceptance into the collection—that they are the first, the classic, or a special example.

In contrast, most documents and photographs are acquired from individuals who are moving or retiring—or from their heirs. Again, ten years ago, many of the pioneers were still going strong. Now, sadly, we have the task of accepting materials from relatives of people who have died. While we accepted ten boxes of early material from Alan Perlis' office at Yale, we were also able to supply Sydelle Perlis with several videotapes of Alan in action.

The increasing rate of accession of film and especially videotape has occurred since film and video are a growing and valuable record of the wide-ranging applications of computing. In particular, the Museum has collaborated with PBS's Boston affiliate WGBH-TV in a search for material for their six- part television series *The Information Age.* We expect the film and video collection will grow dramatically in the future, preserving an active record of the people, settings, and machines which make up the history of computing.

"The fundamental idea behind the three-dimensional display is to present the user with a perspective image which changes as he moves," Ivan Sutherland wrote. "The image presented by the three-dimensional display must change in exactly the way that the image of a real object would change for similar motions of the user's head."

New Acquisitions Highlights

Sutherland's Experimental Vision System
Beginning in 1966, with funding from ARPA and the Office of Naval Research, Ivan Sutherland led efforts to create computer-generated, interactive, three-dimensional visual environments. By 1970 a simulated or "virtual" environment had been realized using a helmet, which incorporated a pair of small CRTs, projecting images through mirrors to the user's eyes. The helmet was attached to a large device known as the "Sword of Damocles" which hung from the ceiling and tracked movements of the user's head. Innovative hardware and software generated images consistent with the movement of the user.

WISC

In the early 1950s, Gene Amdahl, a PhD student in physics at the University of Wisconsin, undertook to build a computer for his doctoral dissertation. The WISC (Wisconsin Integrally Synchronized Computer) project, supported by the Wisconsin Alumni Research Foundation and the University of Wisconsin College of Engineering, was completed in 1953. Only a handful of computers existed when WISC was proposed, and during the late 1940s and early 1950s many universities and laboratories went ahead and built their own machines.

The WISC design was governed by requirements for ease of construction and simplicity of operation. WISC was a small machine with a long word length (50 binary digits) and floating point arithmetic. It incorporated 1,800 vacuum tubes and 350 diodes. The storage system was a 1,024 word magnetic drum. The name WISC is derived from the computer's ability to carry out four instructions simultaneously (integral synchronization) resulting in efficient use of the slow access time of the drum. A flexowriter and paper tape were used for input/output.

After Amdahl graduated and went to IBM Corporation, the WISC was used at the University of Wisconsin's Department of Electrical Engineering. Graduate students and faculty used the computer for both engineering and scientific computation, modelling, and training.

WISC was decommissioned in the early 1960s and the machine's sole maintenance engineer stored the entire computer in his basement for years. Eventually, realizing that he was sitting on a piece of history, he called Amdahl Corporation, the firm Amdahl had started after leaving IBM, and spoke with a Vice President of Sales, who arranged for one of the firm's trucks to pick up the computer from the engineer's house. Amdahl Corporation staff set WISC up on the loading dock and surprised Gene by presenting him with his own computer. In 1990, Gene gave WISC to The Computer Museum.

The donation to the Museum consists of the console, the CPU and power supply cabinets, a full set of diagrams, and documents relating to the construction of the machine. The presence of bills from suppliers like HeathKit indicate that this was a small project, run by a single person operating with a small budget and with little bureaucratic interference. For example, the handles on the console doors are the kind that one would buy in a hardware store for use on kitchen cabinets.

Amdahl gave a talk on the early days of computing at The Computer Museum in 1983 as part of the Museum's Pioneers of Computing lecture series. Preserved on videotape in the Museum archives, his lecture captures a physicist's struggle to build a revolutionary new tool.

Computer Space, 1971
First commercial coin-operated video game

Cray 1M/4400, 1976
Supercomputer with power of Cray 1 in smaller package

Artifact Collection

The 37 artifacts collected in 1990 represent some extremely important additions to the Museum's collections. The Collections Department was surprised to have found that the Museum had not collected the classic IBM PC announced in 1981. Now it is not only in the collection but on display. Similarly, the Museum acquired a Cray 1M for the collection and for the exhibit of Four Classic Computers.

In the future, the Museum hopes to place more emphasis on collecting some non-US machines so its holdings from Germany, Japan, France, England, and other countries will be more representative. In addition, the Museum will continue to pursue the survivors from previous generations.

Computers

Cray Research, Inc.
Cray 1M/4400, 1976
Supercomputer with power of Cray 1 in smaller package
Gift of Cray Research, X1043.90

ETA
ETA 10, 1988
Innovative supercomputer with the fastest vector performance of the time
Gift of ETA, X1041.90

International Business Machines Corporation
PC, 1981
Classic 256K personal computer
Gift of Harvard Business School, X1039.90

Northstar
Horizon, serial number 1,1979
First personal computer sold with integrated mini-floppy disc drive. This machine was purchased by the father of the founder of the company.
Gift of Gene Grant, X1033.90

University of Wisconsin
WISC (Wisconsin Integrally Synchronized Computer), 1953
Gift of Gene Amdahl, X1040.90

Sub-assemblies and components

General Electric Company
Vacuum tube-based flip-flop, 1948
One stage of a shift register for special purpose digital radar-tracking machine
Gift of Gene Grant, X1024.90

Austek Microsystems, Ltd.
A38152
First cache controller on a microprocessor board
Gift of Craig Mudge, X1035.90

Intel Corporation
4004 - 1971
8008 - 1972
8080 - 1974
8086 - 1978
8088 - 1979
80286 - 1982
80386 - 1985
80386SX - 1988
80486 - 1989
Series of microprocessors that have become industry standards
Gift of Intel Corporation, X1036.90

Massachusetts Institute of Technology
Whirlwind I modular components
Flip-flop storage registers
Gift of Brian White, X1031.90

Texas Instruments
960A, 1971
Computer and communications multiplexor for up to 256 terminals
Gift of Texas Instruments Corporation, X1027.90

Transducers

Bell Laboratories
Graphics 1, 1965
Graphics console used in development of remote, time-shared system
Gift of University of Florida, X1029.90

Paradyne Corporation
MP 48 model 2448 modem, 1978
First microprocessor-controlled modem
Gift of Colin Povey, X1014.90

Ivan Sutherland
Experimental vision system
Gift of Ivan Sutherland, X1044.90

Tarbell
Tarbell cassette interface rev. C model 1001, 1975
Kit cassette interface board, cables, and software
Anonymous gift, X1023.90

Univac Division, Sperry Rand Corp.
Uniscope 300, 1967
Programmable visual display communication terminal
Gift of Unisys Corp, X1047.90

Univac Division, Sperry Rand Corp.
Uniset, 1961
Airline reservation terminal
Gift of Unisys Corp, X1048.90

Memories

National Cash Register, Inc.
CRAM film, ca. 1960
Film memory medium in portable cartridge
Gift of Dr. Carl Hammer, X1030.90

Univac Division, Sperry Rand Corp.
FH400, 1959
Flying head magnetic drum
Gift of Unisys Corp, X1049.90

Wang Laboratories Inc.
Core memory board, 1967
Magnetic core supplemental random-access memory for Wang calculator
Gift of Richard Rubinstein, X1018.89

Microprocessor-based devices

Compucomp
Compucomp
Programmable calculator
Gift of David L. Pelz, X1026.90

Nutting Associates
Computer Space, 1971
First commercial coin-operated video game
Gift of Alan Rifkin, X1025.90

Card Data Processing Equipment

Remington-Rand
Multi-control Reproducing punch, 1948
card punch
Gift of Unisys Corp., X1045.90

Remington-Rand
Counting sorter, 1948
card sorter
Gift of Unisys Corp., X1046.90

Slide Rules

John E. Fuller
Fuller's Computing Telegraph, 1865
Specialized circular slide rule for the grain exchange
Gift of The Cobb Family, X1038.90

Robots

Stanley Reifel
Sherbot, 1978
Home-built robot controlled by a Polymorphic Systems microprocessor.
Gift of Stanley Reifel, X1037.90

Other

Hickok
Model 539C, 1970
Industrial and laboratory portable tube tester
Gift of Brian Saper, X1032.90

H.P. Peterson
"Mona by the Numbers", 1965
Computer graphic line-printer portrait
Gift of Henry S. Forrest, X1028.90

Unknown manufacturer
Paper tape splice jig and other paper tape handling materials, ca. 1960
Gift of Bruce Cardin, X1034.90

Indecks Company
Research device, 1968
Card based storage and retrieval system
Anonymous donor, X1042.90

Study Collection

The study collection is administered and stored separately from the artifact collection. The items in this collection are used for educational, exhibit, and research purposes. They often duplicate items in the artifact collection.

Atari
PONG game case
Gift of Alan Rifkin, S#78

Milton Bradley Electronics
Electronic Grand-Master computerized chess game
Gift of Howard Cannon, S#79

David G. Hammel
Remote transaction system patent prototype
Gift of the family of David G. Hammel, S#80

Wright Line
Model 2600 manual card punch
Gift of University of Massachusetts, S#81

International Memories Incorporated
Model 7720 hard disk drive
Gift of Applied Management Systems Incorporated, S#82

Honeywell, Honeywell Bull, and General Electric Corporation
Collection of printer and reader heads, including Braille read and print heads
Gift of J. G. Bunner, S#83

Facsimiles of punched cards for the Hollerith Electronic Tabulating Machine
Gift of Professor Owen Gingerich, S#84

Collection of punched cards for programming and business use
Gift of John J. McCaffrey, S#85

Slide rules and drawing instruments from the collection of Dr. Carl Hammer
Gift of Dr. Carl Hammer, S#86

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The West Coast Team won The Second Annual Computer Bowl, April 27, 1990. From the left: P.C. Letter *Editor-Publisher Stewart Alsop II, Microsoft Corp. Chairman Bill Gates, venture capitalist John Doerr, Chuck House, of Hewlett-Packard, and Larry Tesler, of Apple Computer, Inc.*

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The Computer Museum

Annual Report 1991

Inside this year's *Annual,* you will find a guide to *People and Computers: Milestones of a Revolution.* The June opening of this definitive historical exhibition capped another year in which The Computer Museum successfully advanced its educational mission. Funded in part by a major grant from The National Endowment for the Humanities, the exhibit uses the Museum's unique collection to help the public better understand the evolution of computers over the last 50 years and the changes they have made in our daily lives.

***People and Computers* and the Museum's many other national and local programs were propelled by the enthusiastic support of many individuals, corporations, and state and federal agencies. On behalf of the Museum's Board of Directors, I gratefully acknowledge all of you who helped make fiscal year 1991 such a resounding success.**

Gardner C. Hendrie

Gardner C. Hendrie
Chairman of the Board of Directors

THE COMPUTER MUSEUM, INC.
BALANCE SHEET / JUNE 30, 1991

	Operating Fund	Capital Fund	Plant Fund	Totals 1991
ASSETS				
Current assets:				
• Cash and equivalents	$120,568			$120,568
• Receivables and other assets	113,981	$148		114,129
• Store inventory	72,764			72,764
• Interfund receivable		207,798		207,798
Total current assets	307,313	207,946		515,259
• Net property and equipment		11,328	$2,277,160	2,288,488
Total assets	$307,313	$219,274	$2,277,160	$2,803,747
LIABILITIES AND FUND BALANCES				
Current liabilities:				
• Accounts payable and other current liabilities	97,078	121,927		219,005
• Interfund payable	207,798	—		207,798
Total current liabilities	304,876	121,927		426,803
Fund balances:				
• Unrestricted	2,437	12,675	2,277,160	2,292,272
• Restricted	—	84,672	—	84,672
Total fund balances	2,437	97,347	2,277,160	2,376,944
Total liabilities and fund balances	$307,313	$219,274	$2,277,160	$2,803,747

STATEMENT OF ACTIVITY for the year ended June 30, 1991

	Operating Fund	Capital Fund	Plant Fund	Totals
Support and revenue:				
• Unrestricted gifts	$496,004	$87,938		$583,942
• Restricted gifts	129,643	1,065,056		1,194,699
• Memberships	256,859			256,859
• Admissions	524,090			524,090
• Store/Functions	466,368			466,368
• Investment gain	43	4,140		4,183
• Other	1,814	13,314		15,128
Total	1,874,821	1,170,448		3,045,269
Expenses:				
• Exhibits and education	453,166	134,134		587,300
• Marketing and membership	320,608			320,608
• Depreciation			$458,246	458,246
• Supporting Services:				
Management and general	251,509	67,069		318,578
Fund-raising	192,971	185,445		378,416
Bldg opns. & mortgage debt	286,200	147,377		433,577
• Store/Functions	347,656	—	—	347,656
Total	1,852,110	534,025	458,246	2,844,381
Excess/(deficiency) of support and revenue over expenses	22,711	636,423	(458,246)	200,888
Fund balance, beginning of year	(213,274)	651,683	1,737,647	2,176,056
Add/(deduct) transfers				
• Plant		(997,759)	997,759	
• Unrestricted	193,000	(193,000)	—	—
Fund Balance, end of year	$2,437	$97,347	$2,277,160	$2,376,944

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The past fiscal year has been far and away the most successful in the Museum's history. It began with the opening of *The Walk-Through Computer*™, a two-story-high working model of a desktop computer. The bold nature of this project captured the imagination of the media. Since its inception, features have appeared in print, on TV, and radio in over 65 countries, generating an estimated 350 million media impressions to date. People poured into the Museum, boosting the number of visitors by 44% over the previous year. The Computer Museum became known around the world as the place with the giant computer.

During the past year, the Museum developed the major exhibit *People & Computers: Milestones of a Revolution,* addressing the question "How did computers evolve?" This was the second phase of our exhibit development plan designed to produce exhibitions that answer questions including "How do computers work?" (realized by *The Walk-Through Computer*) and "What can computers do?" The latter theme, currently realized by the existing *Smart Machines* and *The Computer and the Image* galleries, will be dramatically expanded with *Tools & Toys: The Amazing Personal Computer,* exploring the myriad uses of personal computers. Originally known as *The Computer Discovery Center, Tools & Toys* is a joint project with The Boston Computer Society. It will open to the public on June 13, 1992.

Visitors' positive reactions so far are a testament to the wisdom of our advisors and the immense dedication and ingenuity of Museum staff, brilliantly led by Greg Welch.

This year's *Annual* contains a booklet based on *People and Computers.* The exhibit was designed to make the history of technology accessible to visitors from very diverse backgrounds. Visitors' positive reactions so far are a testament to the wisdom of our advisors and the immense dedication and ingenuity of Museum staff, brilliantly led by Greg Welch. The exhibition opened 5,000 square feet (a 20% expansion) of Museum exhibit space—on time and on budget, itself a major accomplishment, occurring with just a year of lead time. With the opening of *People & Computers,* several of the collection's "crown jewels" have gone on public view for the first time. The exhibition also helped spur on the Museum's active collecting, resulting, for example, in the acquisition of a much sought-after IBM System/360.

After a national search for a Director of Exhibits, it became apparent that the Museum's own experience in building exhibits about computers was unique. Greg Welch's experience at the Museum, culminating in his leadership of the *People & Computers* project, also includes the development of *Computers in Your Pocket,* the Museum's first traveling exhibit, which toured nationwide under the auspices of the Smithsonian Institution Traveling Exhibition Service. Greg also developed a broad international perspective during a year-long Harvard fellowship to study the museums of Europe. His background, coupled with his enormous energy and enthusiasm, made him the best qualified to lead our original, fast-paced development program, and in January I appointed him as Director of Exhibits.

The Museum made major strides in extending its reach beyond its walls this year. Exhibit Kits, copies of our interactive exhibits, were installed in three other museums. The St. Louis Science Center installed the entire first series of nine Kits. Over 6,000 copies of our first educational video *How Computers Work: A Journey Into The Walk-Through Computer* have been sold. Further materials, such as educator kits that meet the needs of teachers, are in the works. In all our activities, we pay special attention to reaching underserved communities.

During the last week of April, many Museum staff and friends descended on Silicon Valley for the Third Computer Bowl. The Valley's enormous enthusiasm, support, and appreciation of our mission were extremely encouraging, enabling us to make this Bowl our most successful fundraising event to date.

The success of both the exhibits and outreach activities resulted in the growth of the Museum's base of support. Our operating budget grew 27% to $1.9 million and remained balanced. In addition, nearly a million dollars was raised for the exhibit development program.

On behalf of the staff and our many visitors, I thank the numerous individuals, corporations, and foundations who have contributed to the Museum, enabling us to deliver quality education to all who benefit from our programs. As always, we eagerly seek new friends to join us in the adventure of growing this one-of-a-kind international institution.

Oliver Strimpel

Dr. Oliver Strimpel
Executive Director

Computers
Apple Computer, Inc.
Macintosh 512, 1985
Used to produce desktop-published school paper; on display in *People and Computers* exhibit
Gift of Granada High School, X1074.91

Datavue Corporation
Spark, 1985
Laptop computer, peripherals
Gift of Steven B. Leeland, X1090.90

Digital Equipment Corporation
PDP-8e, 1971
Used to control brain tissue testing equipment at West Haven Veterans' Administration Medical Center; on display in *People and Computers* exhibit
Gift of Dr. Truett Allison, X1075.91

Digital Equipment Corporation
PDP-8a, 1975
Embedded in lighting controller for Broadway show *A Chorus Line*; on display in *People and Computers* exhibit
Gift of Gordon Pearlman, X1060.91

ElectroData Division of Burroughs Corporation
Datatron Model 205, 1954
First general-purpose computer sold by Burroughs Corporation
Gift of Southeastern Massachusetts University, X1055.91

Institute für Informatik, Switzerland, and Brigham Young University
Lilith personal computer, 1980
Graphical user interface computer tailored to programming language Modula-2
Gift of Tektronix Corporation, X1051.91

Intel Corporation
iPSC, 1985
128 processor parallel computer; marked "First Production System"
Gift of Robert Brams, X1076.91

International Business Machines Corporation
IBM System/360 Model 30, 1965
First line of compatible computers, peripherals, programs; on display in insurance company setting in *People and Computers* exhibit
Gift of Frost and Sullivan, X1059.91

IXO Corporation
IXO Telecomputer, 1978
Briefcase-size modular computer, display, modem, printer
Gift of Brian Randell, X1088.90

Sun Microsystems, Inc.
Sun 1, 1982
First Sun graphics workstation
Gift of Sun Microsystems, Inc., X1073.91

Televideo Systems, Inc.
TS 802, 1981
Personal computer with CP/M operating system
Gift of Don Wolman, X1089.90

Analogue Computer
Northrop Aircraft, Inc.
MADDIDA magnetic drum differential analyzer, 1947
Engineering prototype for airborne navigational calculator
Gift of Los Angeles County Museum of Natural History, X1050.91

Sub-assemblies and components
International Business Machines Corporation
IBM 1720 SMS mercury-wetted switches, 1959
Standard Modular System components developed for process-control computer system
Gift of Howard L. Funk, X1069.91

MasPar Computer Corporation
MP-1 components: array control unit, processor board, 1990
Parallel computer scalable from 1,024 to 16384 processors
Gift of MasPar Computer, X1062.91

MIT Instrumentation Laboratory, C. S. Draper Laboratories, Raytheon Company
Apollo Guidance Computer Block 1 components, 1962
3 logic prototypes and 1 finished logic module from first production phase of first integrated circuit digital computer
Gift of Eldon Hall, X1067.91

MIT Instrumentation Laboratory, C. S. Draper Laboratories, Raytheon Company
Apollo Guidance Computer Block 2 components, 1962
1 sense amplifier prototype and 2 logic prototypes from second production phase of first integrated circuit digital computer
Gift of Eldon Hall, X1068.91

Sun Microsystems, Inc.
Sun 2 cpu and other boards, 1983
Networked graphics workstation
Gift of Sun Microsystems, Inc., X1053.91

Sun Microsystems, Inc.
Sun 3 cpu board, 1986
Single-board workstation
Gift of Sun Microsystems, Inc., X1054.91

Trilogy Corporation
Prototype and production logic components, 1984
First wafer-scale integration
Gift of Gene Amdahl, X1086.91

Union of Soviet Socialist Republics
Minsk 32 logic module, 1973
A copy of the Digital Equipment Corporation PDP-8, the Minsk 32 was particularly known for its reliability
Gift of U.S.S.R. State Academy of Finance, X1084.91

United Technologies Mostek
Mostek chip die, wafer, chips, 1976
Domestically-produced Dynamic Random Access Memory (DRAM) integrated circuits
Anonymous Gift, X1087.91

Transducers
Digital Equipment Corporation
PDP-7 console, 1967
One of a line of 12-bit computers; on display in *People and Computers* exhibit
Gift of Digital Equipment Corporation, X1072.91

Recognition Equipment, Inc.
Electronic eye, 1968
Light-sensing device consisting of array of discrete components
Gift of Reid Dennis, X1056.91

Recognition Equipment, Inc.
96 element Photodiode Array, 1970
Integrated circuit light-sensing device
Gift of Reid Dennis, X1057.91

Recognition Equipment, Inc.
512 Element LSI Scanned Array, 1972
High resolution integrated circuit light-sensing device
Gift of Reid Dennis, X1058.91

Tektronix Corporation
Type 543A oscilloscope and stand
Computer test equipment; on display in *People and Computers* exhibit
Gift of Michael Callahan, X1061.91

Versatron Corporation
Foot Mouse, 1990
Anonymous gift, X1081.91

Memory
Union of Soviet Socialist Republics
Ural 11-B core memory plane, 1969
The Central Statistical Department of the Supreme Soviet used Ural 11-B computers from 1969 to 1977
Gift of U.S.S.R. State Academy of Finance, X1083.91

Digital Calculators
Dennert & Pape KG
Aristo M 36 Pocket calculator, 1974
Gift of Hermann Zapf, X1070.91

Wang Laboratories, Inc.
Model 360 Scientific calculator, 1967
Four interlinked calculators with shared logic and storage registers
Gift of Dan Freitas, X1052.91

Slide Rules
The Binary Slide Rule, 1940
Gift of Herbert and Louise Spirer, X1066.91

Cabric Limited
Cylindrical slide rule, 1910
Gift of Herbert and Louise Spirer, X1063.91

Dennert & Pape
Hohenrechenscheiber cylindrical slide rule
Gift of Herbert and Louise Spirer, X1064.91

George W. Richardson
Richardson's Direct Reading Slide Rule, 1912
Gift of Herbert and Louise Spirer, X1065.91

Ephemera
Remington Rand UNIVAC
UNIVAC Solid State 80 scale model, 1960
Gift of the Family of Dr. Donald G. McBrien, X1080.91

Other
Dr. Donald G. McBrien
Core memory learning aid
Memory addressing learning aid
Binary adder learning aid
Professor McBrien fabricated these learning aids to communicate principles of computing to students in his classes on computing, the first offered at Boston University
Gift of the Family of Dr. Donald G. McBrien, X1077.91 to X1079.91

Richard O. Spencer
Stylist's rendering of the Johnniac computer, 1950
Rand Corporation engineers designed the Johnniac's case and framework to Institute of Advanced Studies guidelines and this drawing.
Gift of Raymond Clewett, X1082.91

TAB Corporation
Punched card carrying case, 1970
Donated by Dr. J. Paul Hartman, X1085.91

Weston Electrical Instrument Corporation
Model 270 tube tester, 1949
Used on UNIVAC 1 computer in Boston
Gift of Joseph C. Macura, X1071.91

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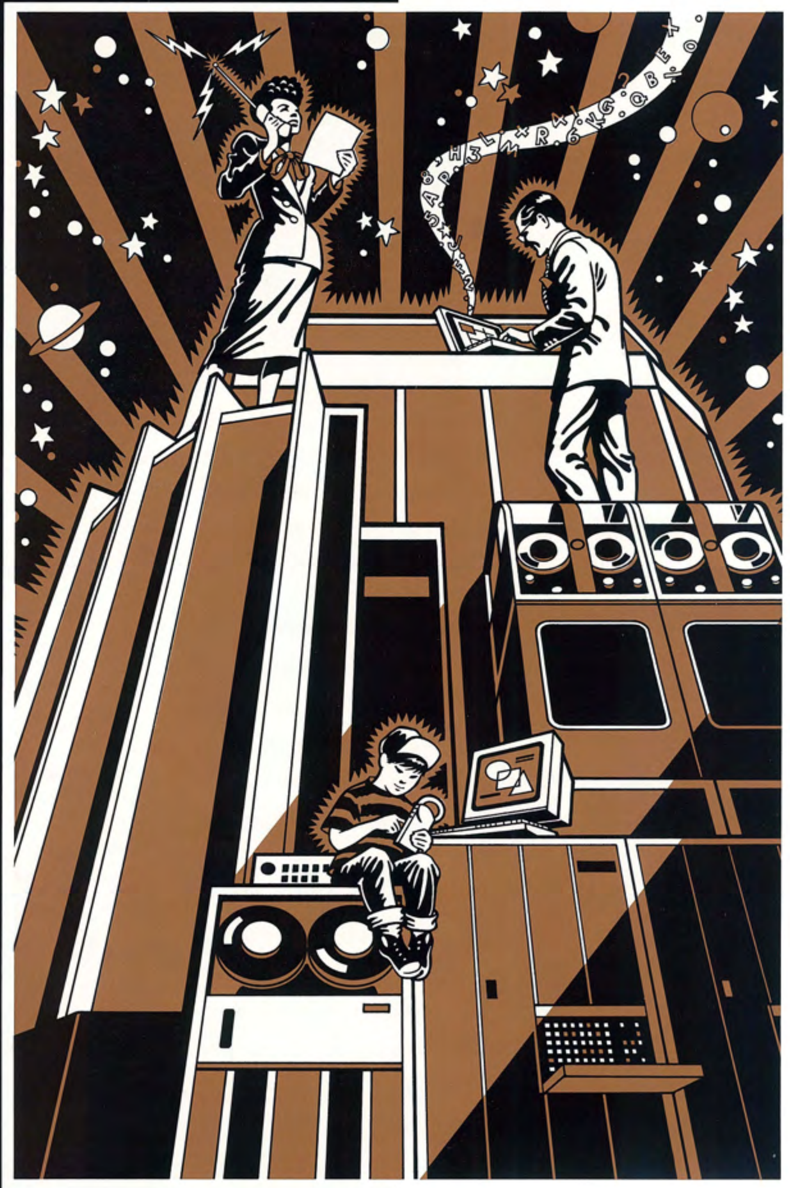
PEOPLE and COMPUTERS

Milestones of a Revolution



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This 18-screen Video Archway dramatizes 50 years of computer history in 90 seconds, and forms the entrance to the exhibit.

The past fifty years have witnessed immense technological change. Foremost among those changes has been the explosive growth in computer technology that has been called the Computer Revolution. This booklet is a companion to the exhibition *People and Computers: Milestones of a Revolution.* Through a series of nine milestones this exhibition portrays important eras in computer history. The milestones explore the historical forces that shaped major advances in computing technology. They also investigate the effect these advances have had on our world.

When computers were invented in the 1940s, their impact was revolutionary, offering a thousand-fold improvement over hand-operated, mechanical calculators. Since that time, computers have incorporated new inventions such as integrated circuits, microprocessors, and new computer languages. Today's desktop computers are a thousand times faster than the first million-dollar mainframes that launched the Computer Age.

Each of the nine milestones depicted in this booklet typifies a new way of using and thinking about computers. Together, they create an outline of the course of the Computer Revolution, from punched paper cards through personal computers. This booklet combines photographs of the exhibition itself with vintage photographs depicting the historical context of the various milestones in the Computer Revolution.

The changes in computer technology were not linear and direct, but had false starts, dead ends, and led to unexpected applications. While each new development offered advantages, it also created and compounded problems. For example, the ability to organize data on every person electronically helped the operation of governments and corporations, but threatened the privacy of individuals. Computers created new jobs, but they also made others unnecessary.

The Computer Revolution is not over. When you finish this booklet, we hope you will ask yourself: "What have computers meant to me and my family? And how will they affect my future?"

MECHANIZING NAMES AND NUMBERS

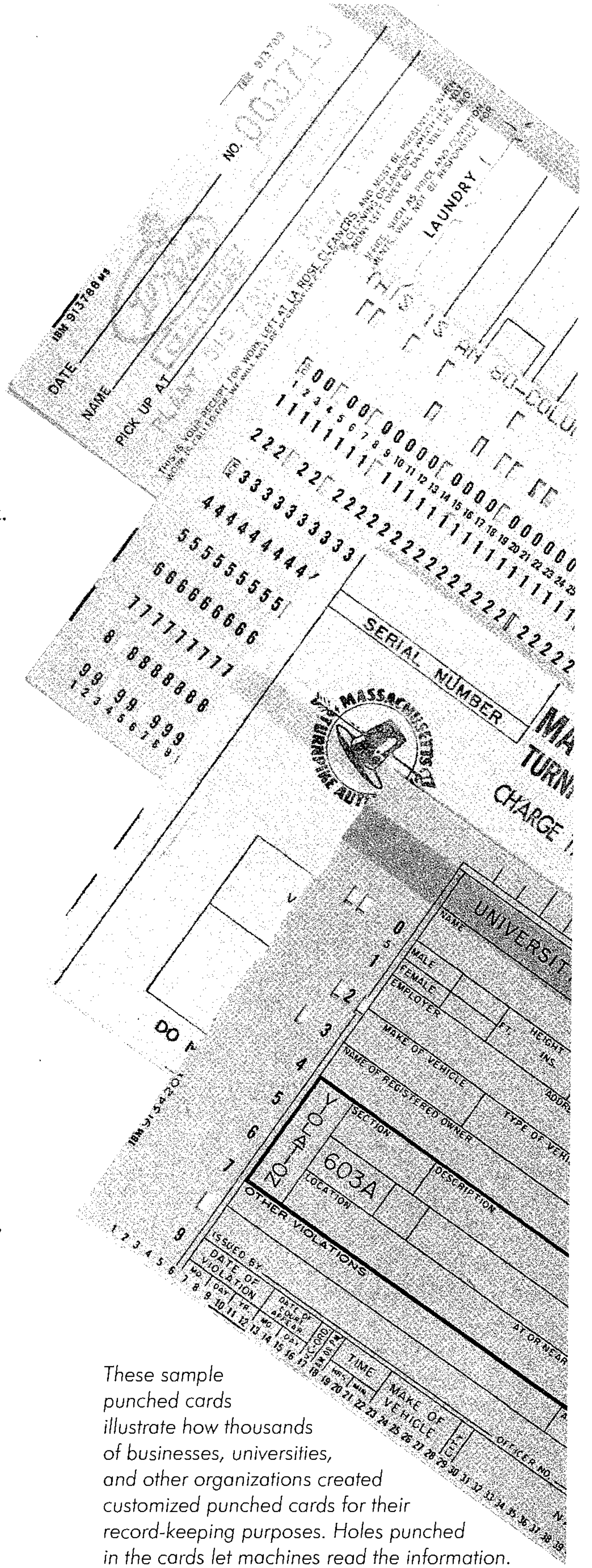
Governments keep records on their citizens. Before the advent of machinery for processing information, this painstaking work was done by hand. The invention of punched card equipment in 1890 changed all this. Bureaucracies came to depend on these machines which processed information using gears, switches, and paper cards. Punched card data processors were ancestors of the computers we use now.

Census clerks took over seven years to tabulate and interpret the results of the 1880 Census. By the time the statistics were ready, over 10 million new immigrants had entered the United States, making the results virtually worthless. A faster process had to be found to compile the results of the next census. A Census Bureau employee named Herman Hollerith invented a better way to get the job done. He devised mechanical machinery to read a pattern of holes punched in paper cards. Each hole represented information, such as a person's country of birth, age or sex. Using this system, Census Bureau workers tabulated information on 64 million people in six weeks, at a savings of over $5 million.

In 1896, Hollerith established the Tabulating Machine Company to sell his invention to government agencies, both in the U.S. and abroad, and to railroads and other business. This launched the punched card office machine industry. By the 1930s, police departments, schools, and many other government agencies and businesses depended on these machines for record-keeping and accounting. Herman Hollerith's original company became part of IBM. By the end of the 1930s, many companies, such as Remington Rand in the U.S., Powers-Samas in England, and Bull in France, were producing data processing equipment.

During the Great Depression many people faced financial hardship. One of the programs created in response to this crisis in the U.S. was the Social Security Act of 1935 to ensure pensions for millions of citizens. To administer this program, the federal government turned to punched card equipment.

Starting in 1937, the U.S. Social Security Administration used IBM punched card machines to keep records on over 27 million people. The key was punched paper cards that stored records of each individual's contributions to the system. Clerks used special typing machines to punch a person's Social Security number, name, and employer onto paper cards. Mechanical machines were then used to process this information: some sorted cards, some added numbers, and others printed out reports for policy makers to study. Day after day, hundreds of clerks carried thousands of cards from one machine to the next. These machines were essential for the timely distribution of over 30,000 Social Security pension checks a month.



These sample punched cards illustrate how thousands of businesses, universities, and other organizations created customized punched cards for their record-keeping purposes. Holes punched in the cards let machines read the information. A particular pattern of holes in a column of the card corresponded to a given letter of the alphabet or digit.

Photograph: David

Courtesy of the Dorothea Lange Collection, The City of Oakland, The Oakland Museum

Times were hard in the 1930s. Millions of people lost their jobs, homes, and hope. To get the United States back on its feet, the Congress and President Franklin D. Roosevelt set up new federal agencies that required more detailed data about human needs to deliver expanded human services.

The Electronic Computer is Born

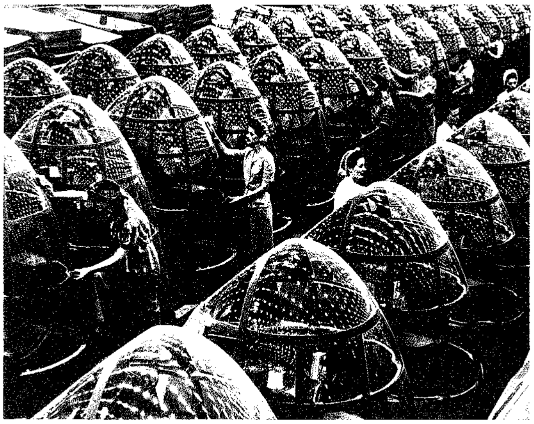
Before World War II, solving complex mathematical problems took a long time and required the coordination of dozens of people working with mechanical calculators. These workers were often called "computers." With the War, the British and U.S. governments funded major efforts to develop automatic calculating machines. By and large, the British focused on tools for cracking coded messages, and the U.S., on tools to achieve accuracy in firing from ships and in the field. The modern electronic computer sprang from these efforts.

One such effort was Project Whirlwind at the Massachusetts Institute of Technology (MIT). Like many other early experimental computers in the U.S., Whirlwind was built with government support—close to $4.5 million over the course of the project. Started during World War II by the U.S. Navy, Whirlwind continued to receive military support after the War and led to many important advances in computer technology.

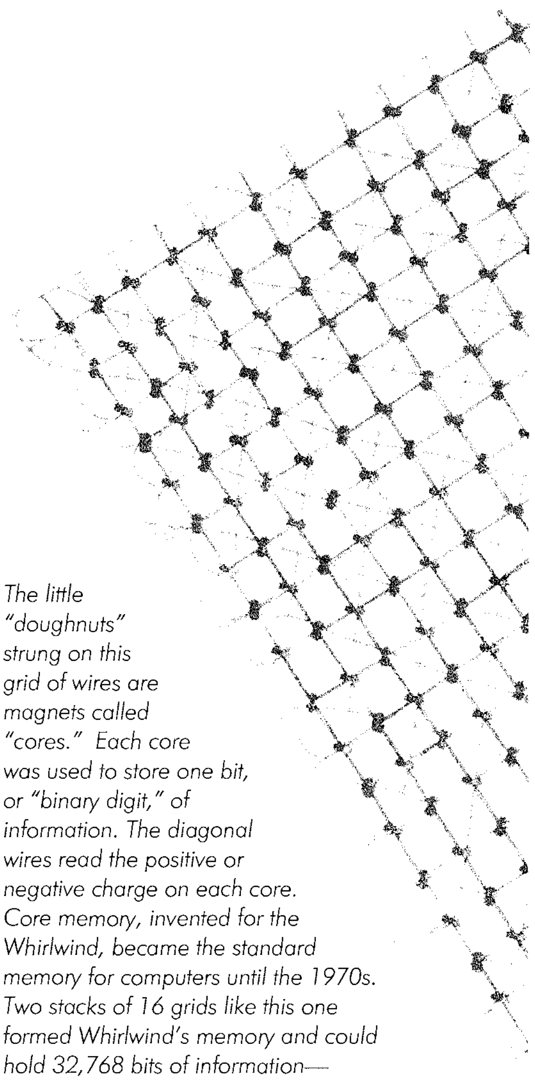
Jay W. Forrester led the team at MIT that developed the Whirlwind computer. The original goal had been to build a machine for training Navy pilots during World War II. Simulating the response of an airplane meant executing complex calculations as rapidly as the pilot moved the controls. At the time, it proved difficult to build a computer which was that fast.

The Whirlwind's circuitry depended on over 12,500 vacuum tubes. Since vacuum tubes burned out, Forrester and his team worked to increase their reliability, designing the computer so that the vacuum tubes could be periodically checked and those in imminent danger of failure could be easily removed and replaced. In search of ever greater speed, the engineers constantly refined their designs. The development of faster, more reliable circuits and memory enabled Whirlwind to meet its original goals for speed, but by then the War was over, and the purpose of the project had changed.

After the War, the Air Force took over support of the project, and Whirlwind became a prototype for an air defense computer system that tracked every plane flying over North America. The Whirlwind also became a resource for academic research. The machine was never idle; when it was not doing work for the Air Force project, MIT professors took the opportunity to assign it calculations that would otherwise have taken hundreds of hours to solve by hand. Using the computer, they tackled such problems as designing optical lenses, controlling machinery, and studying economics, to name just a few.



World War II forced nations to build planes, tanks, ships, and guns in greater variety and number than ever before. Around the world, money and minds focused intently on developing new technologies. These efforts produced many important inventions: jet engines, rockets, radar, the atom bomb, and the computer.



The little "doughnuts" strung on this grid of wires are magnets called "cores." Each core was used to store one bit, or "binary digit," of information. The diagonal wires read the positive or negative charge on each core. Core memory, invented for the Whirlwind, became the standard memory for computers until the 1970s. Two stacks of 16 grids like this one formed Whirlwind's memory and could hold 32,768 bits of information—or 4K bytes.

Courtesy of The Computer Museum

Courtesy of The Computer Museum

Joe Thompson, one of Whirlwind's full-time operators, was hired right out of high school. He is shown preparing instructions for the computer on a "Flexowriter." The racks of switches and lights along the wall of the control room allowed the operator to check that Whirlwind's circuitry was running correctly. The Whirlwind control room and computer occupied 3,100 square feet, the size of a ten-room house.

A Big Machine for Big Business

In the years following World War II, factories pressed into service during the War returned to commercial use. Similarly, the computers that were developed for military use were adapted for peacetime activities in government, business and education. By the end of the 1950s, thousands of computers were in use by business and government alike.

The first machines to make the jump from government and scientific applications to practical uses in business were the UNIVAC I (short for UNIVersal Automatic Computer) in the U.S. and the LEO I (short for the Lyons Electronic Office) in England.

UNIVAC sprang directly from ENIAC, a pioneering computer developed for the U. S. Army during the War by John W. Mauchly and J. Presper Eckert, Jr. While most people still saw the computer as a tool for science and engineering, Eckert and Mauchly recognized its potential for business data processing. Inspired by their vision, they founded a company to produce the UNIVAC I, a computer specifically designed to meet the needs of business. Early customers for the million-dollar UNIVACs included General Electric, Metropolitan Life, and the U.S. Census Bureau.

G.E. purchased their UNIVAC in 1952 when they consolidated all their major appliance manufacturing into a single factory in Louisville, Kentucky. Post-war demand had increased sales of stoves, refrigerators, and washing machines. Meeting this demand meant keeping track of all the wire, plastic, steel, springs, and other materials that went into the appliances and paying a growing workforce. In addition to the $1 million price tag, G.E. had to provide specially climate controlled conditions and a large team of technicians and consultants to install the machine and keep it running. G.E. also retained the services of Arthur Anderson, a large accounting firm, to assist them in getting the UNIVAC up and running for the first time.

Since this was one of the first commercial applications of a computer, no off-the-shelf software, operating systems or databases were available. Only after months of work, did the team of G.E. and Arthur Anderson experts succeed in completing programs that instructed UNIVAC I to perform its giant task: keeping track of the millions of parts in the factory's inventory and calculating paychecks for the plant's 12,000 employees, with their own tax deductions, Social Security payments, wages, overtime, and health benefits.

In England, LEO I was patterned after the Cambridge University EDSAC, one of the world's first stored program computers. In this case, the Lyons Tea Company faced the daunting task of supplying hundreds of tea shops with tea, biscuits, and cakes according to ever changing demand. To assist them in processing thousands of orders every day, Lyons decided to build their own computer. After the first machine was installed and working successfully, Lyons went into the business of manufacturing computers to meet the growing need of other businesses for data processing systems.

By the mid-1950s, managers around the world saw the computer as a symbol of a thriving, modern enterprise—the latest tool for scientific business administration. Orders for computers soared to the thousands. The UNIVAC I and LEO I had broken open the market for business computers.

Using computers in business was part of a larger trend: automation. Machines that seemed to think and work tirelessly were viewed with great expectation and trepidation. Some people claimed this technology would free humans from boring, repetitive labor; others feared it would put people out of work.

Courtesy of The Computer Museum

This is a typical UNIVAC I installation of the 1950s. Here you see the computer's console and tape drives.

After World War II, economies boomed. People bought cars, refrigerators, and washing machines in unprecedented numbers. Factories churned out more and more products. To keep up with demand and to gain competitive advantages, a handful of large companies began to see the emerging computer as a tool for managing their vast operations.

Marching Orders for a Corps of Computers

Toward the end of the 1950s, government and business invested in more and more computers produced by a growing number of companies. Each manufacturer's machines were unique and only followed their own instruction code. No common languages like BASIC or PASCAL existed. Customers complained that it took too long to get their expensive machines into operation, and no common basis existed for training the growing population of programmers. The difficulty of programming was a major obstacle to the growth of computer use.

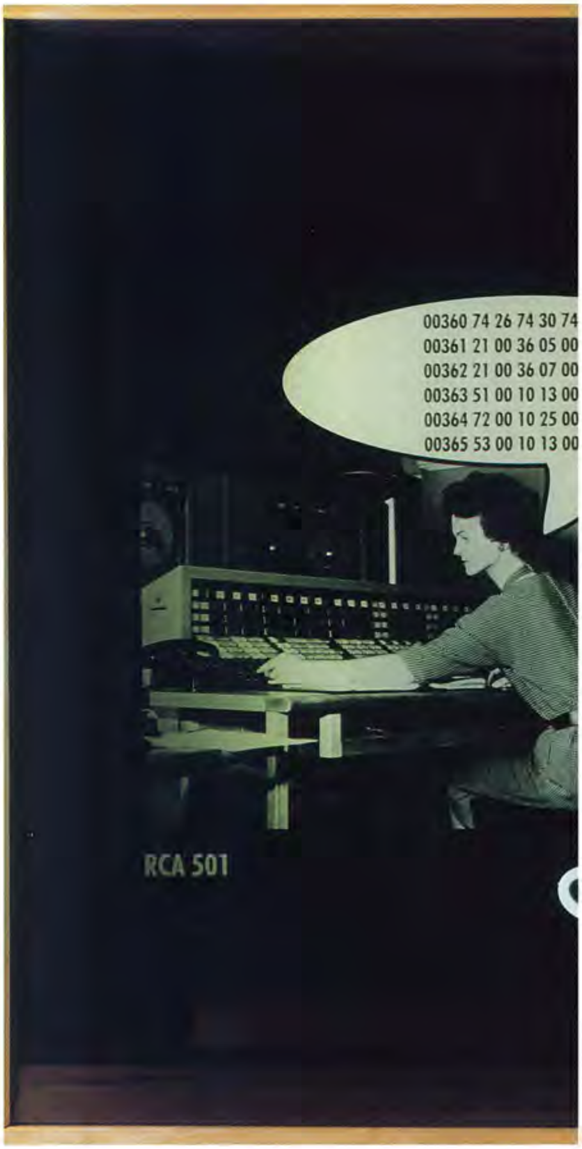
In May 1959, at a meeting in the Pentagon, representatives from ten computer manufacturers, seven government agencies, and 11 large users formed a committee to figure out a single way to program business problems.

After six months of work and debate, members of this committee issued a report describing a language for programming business problems. They called it COBOL (short for COmmon Business-Oriented Language). COBOL offered several advantages over programming a problem in the obtuse code of individual computers: it used symbols and words familiar to business people to express instructions, and with only minor modifications, a program written in COBOL could be run on any computer that used the language.

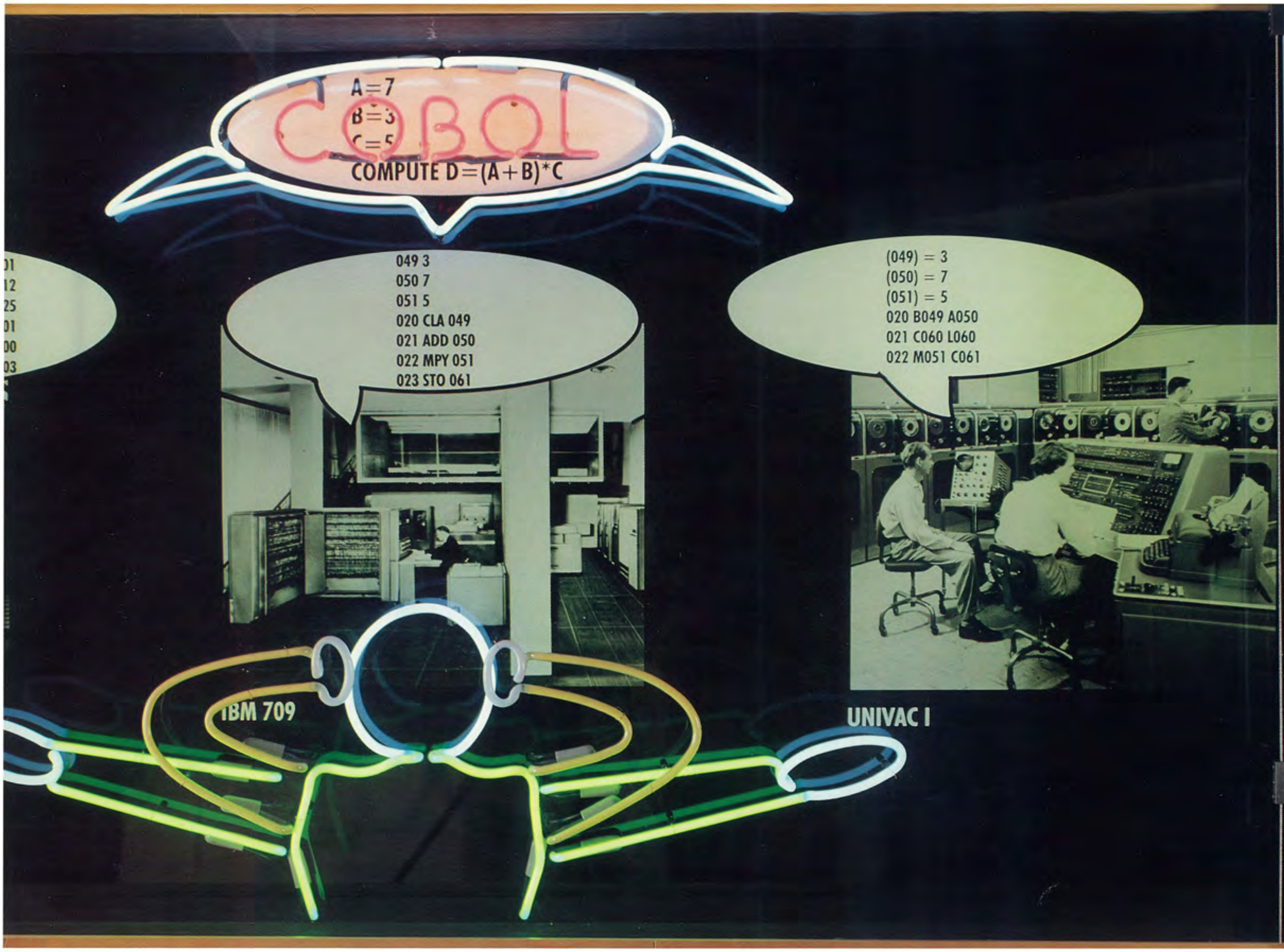
The key to COBOL and other early programming languages was a special program called a *compiler*. A compiler program took the COBOL commands written by the programmer and automatically translated them into the series of minute instructions which that particular computer actually executed. This made writing a program in COBOL much quicker and easier than having to write out the instructions the computer executed. It also permitted the same program to run on different machines.

COBOL was not the only important programming language to emerge during this period. Others included: FORTRAN (short for FORmula TRANslator and used for scientific problems), APT (Automatically Programmed Tools for controlling machinery), and LISP, the language that virtually launched the field of artificial intelligence. Programming languages allowed the development of curricula for training programmers and other users. This meant people could be trained in the use of one language and work on many different machines.

Certain languages, such as FORTRAN, enjoyed wide use and became "de facto" industry standards. In contrast, COBOL, and later ADA, a subsequent language, became standard languages by decree. The Defense Department required that all its administrative computers have COBOL compilers. But these standards were not universal; by the 1970s, hundreds of different programming languages were in use.



COBOL allowed different computers to "speak" the same language.




Courtesy of the Associated Press

In 1961, an East German soldier escapes to the West as the Berlin wall goes up.


Courtesy of the John F. Kennedy Library

President John F. Kennedy gives his 1961 inaugural address in Washington, DC.

Big Business Buys The Computer

By the mid-1960s, computer data processing had become a crucial part of business. Designed to satisfy both business and scientific users, computers came in a range of sizes and prices, starting at $50,000. But most were large "mainframe" computers that processed customers' orders, issued bills, kept personnel records, and performed many other functions central to commercial enterprise. The IBM System/360 was typical of computers during this period.

The IBM System/360 was actually a family of computers that came in various sizes, all of which could use the same tape drives, printers, and other "peripherals." As their business grew, customers could simply expand their computer system. Switching to a more powerful computer no longer meant writing new programs. This "modular" approach to building computers was one reason the System/360 sold so well.

The Travelers Insurance Companies exemplified how large corporations came to rely on computers. At its central data processing center in Hartford, Connecticut, The Travelers recorded and managed the more than 1.5 million insurance policies written by its agents nationwide, and processed over 16,000 claims every day from around the country. Enormous computer tape "libraries," or "data banks," stored information about the company's customers. As The Travelers computerized more and more insurance policies, it added more computing power and memory to handle the additional information.

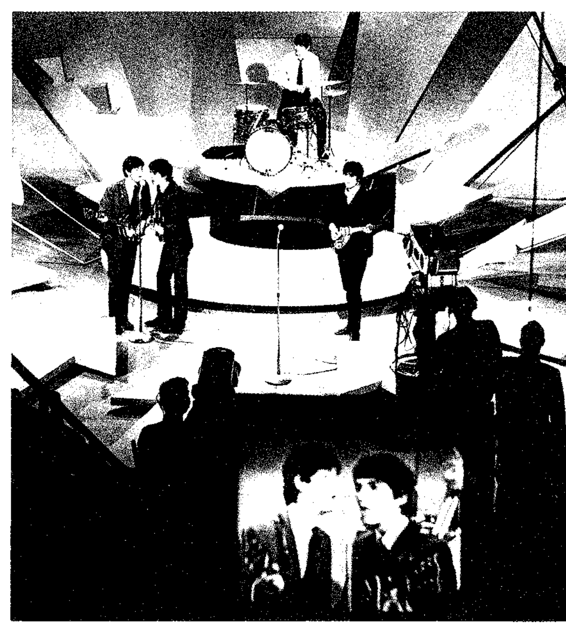
The Travelers used its computer primarily for electronic record keeping on a vast scale. For example, in a single day the computer might be fed 3,000 claims for fire damage to private homes. The computer's central processing unit would then hunt down the policy record for each customer whose house had caught fire, verify that the damage was covered by the policy, record the claim, and print a check to pay for repairs.

In the 1960s, computers could generally run only one program at a time, and were shared by dozens of users. Most people who used computers for problem-solving never actually saw or touched the machine. Full-time operators ran the programs. Users had to wait until the computer could run their job. If there were errors, they had to correct them and then start again at the end of the line.

This method of operation was called "batch processing." For example, a programmer working on a new customer database would write a program, have it punched on cards, and then hand it over to the computer operator. The operator would run the job when its turn came and hand the results back to the programmer who had submitted it. This often took hours, sometimes days. If there were a problem, or "bug," in their code, programmers had to find and correct it by hand and then start over at the end of the line of jobs waiting to be processed by the computer.

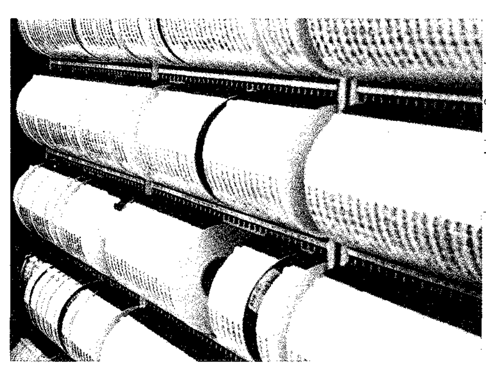
The large mainframe computers of the 1960s required specially made computer rooms that were heavily air conditioned and had extra space in the floors, ceilings, and walls for cables and wiring. Clattering and whirring equipment filled these rooms with a constant din. Access to computer centers was generally restricted to operators and service people, who exercised strict control over the use of the machines.

New technologies raised new dilemmas. During the 1960s, governments and big corporations began to build huge stockpiles of information using computers. Enormous databases kept medical records, bank account records, criminal records, driver's license records, income tax records, etc. Almost every United States citizen was affected. Some people began to joke about computers, blaming them for making mistakes on their bills. Others began to be concerned about the potential threat computers posed to their privacy. A 1965 proposal to create a nationwide, unified government database met with strenuous opposition.



Courtesy of the Bettmann Archive

The Beatles appear on Ed Sullivan's television show in 1964.



Courtesy of Digital Equipment Corporation

This is a computer's "library." The reels of tape magnetically stored volumes of information in a form the computer could read.

Mainframe computers required their own special facilities. Here, a technician installs cabling for a new tape drive.

Unleashing The Computer

Smaller, cheaper, more efficient components resulted in smaller cheaper computers that didn't need their own special environmental controls. Relying at first on transistors and then on more compact integrated circuits, *minicomputers* spread to many new and smaller-scale uses. From the first manned mission to the moon to operating rooms and theaters, the minicomputer went where no computer had gone before.

In 1965, Digital Equipment Corporation announced the PDP-8, one of the most popular minicomputers. This new breed of computer opened up a new universe of applications. These computers were small enough that they could be used where mainframes could never fit (including inside other pieces of equipment) and inexpensive enough that customers who could never have afforded a full-scale mainframe could buy a computer of their own.

The Surgeon and the Computer

In the early 1970s, medical researchers and surgeons at the Yale Medical School and the West Haven VA Medical Center in Connecticut began experimenting with a PDP-8e to assist in neurosurgery. Before using the PDP-8, brain surgeons had to keep patients awake during surgery and manually prod the brain to identify the cerebral cortex. Damaging the cortex could leave the patient paralyzed. By hooking the patient up to the PDP-8, the researchers could stimulate nerves in the patient's body and electronically map the cortex while the patient slept. This method was not only faster, but also much less gruelling on both patient and surgeon.

A Chorus Line

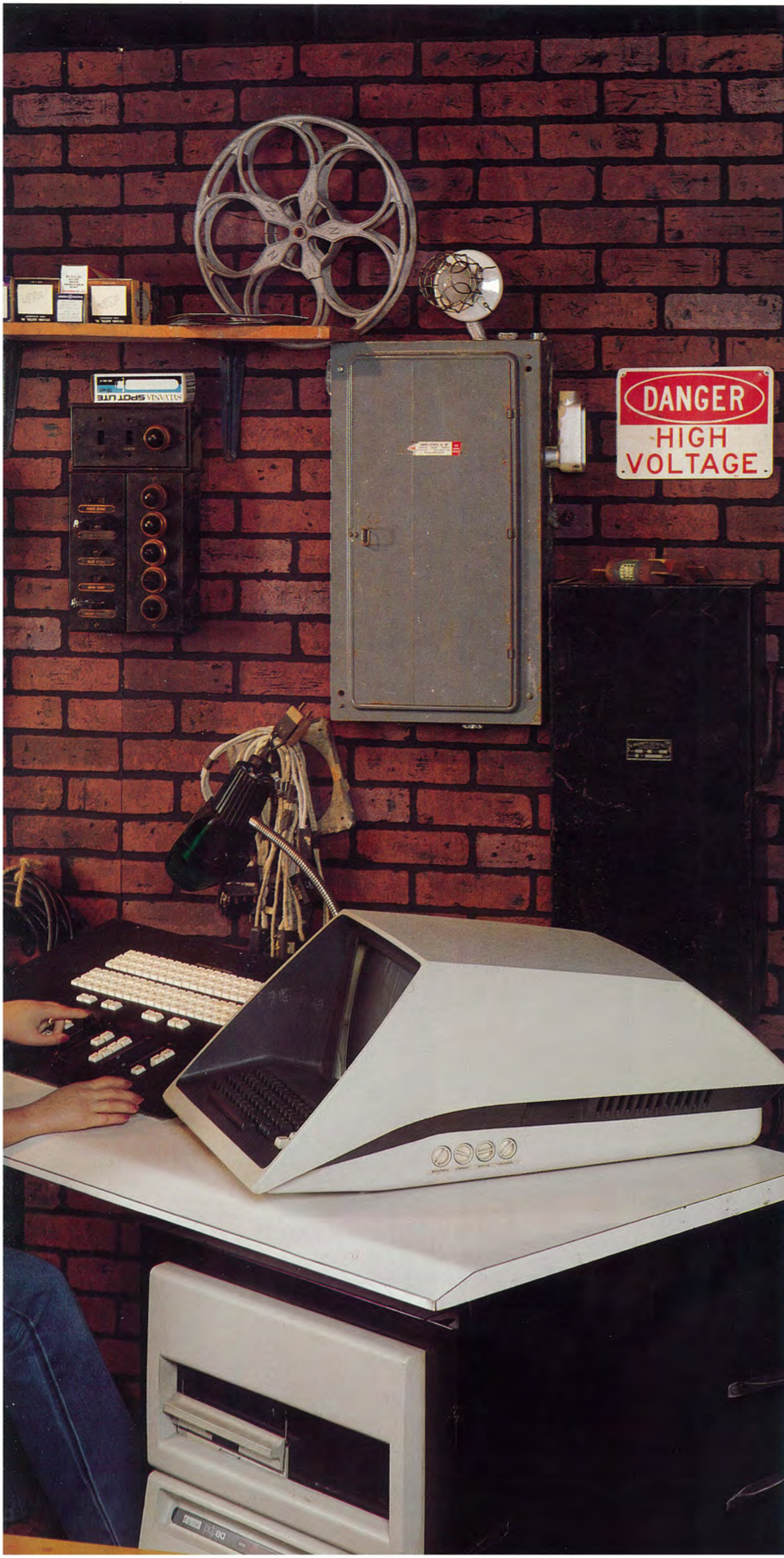
At the Shubert Theater in New York City, the Broadway show *A Chorus Line* played to sold-out audiences for years. Most of the audiences didn't know there was a electronic stagehand on the job to help things run smoothly.

"Sam" was the nickname given to the LS-8 light controller by its operators. A lighting designer programmed Sam to remember and execute all the lighting effects for the show. Sam could flash lights faster and more precisely than any technician could by hand. That was key to running *A Chorus Line*—Sam had to keep pace with 17 whirling dancers. It would have taken eight lighting technicians to put on the show Sam and its single operator did. But computerized lighting had one drawback. If a dancer tripped or missed a cue in the middle of a special effect, Sam kept right on going.

Electronics Diversified, Inc., built the LS-8 light controller around a PDP-8a computer. The PDP-8a served as Sam's "brain" and memory. From 1975 to 1987, Sam controlled the lights for every show of *A Chorus Line* at the Shubert Theater.

Embedding a minicomputer inside another piece of equipment, be it an assembly line robot, automatic potato picker, or lighting controller, became a typical way of using computers.

The dancers in A Chorus Line *were not the only ones who had to make some quick changes backstage. The PDP-8a embedded inside the lighting board console stored thousands of pre-programmed lighting cues. With the touch of a button, the lighting technician could trigger a whole effect involving hundreds of lights.*



The rack of equipment to the left of the operating table contains a PDP-8e minicomputer.

The biggest scientific project of modern times, the race to put a human being on the moon, contributed to the smallest, most efficient tool in history: the integrated circuit. With it came smaller computers.

Milestone 7

A Small World Still Has Big Problems

As scientists pierced the frontiers of knowledge, the problems they struggled with became ever more complex. To assist them in their research, scientists sought ever faster, more powerful computers. The fastest computers of their day came to be known as "super-computers."

When introduced in 1976, the CRAY-1 computer was by far the fastest in the world, performing 166 million operations per second. Such calculating power helped change the way scientists used computers for research. With the CRAY-1, scientists could construct and study complex mathematical models of objects or events too dangerous, inaccessible, or big to experiment with directly.

Meteorologists at the European Centre for Medium-Range Weather Forecasts (ECMWF) in Reading, England, used the CRAY-1 super-computer to predict the world's weather for extended ten-day forecasts. The mathematical calculations used to chart weather patterns and track major storm systems were performed by the CRAY-1 computer.

To make its weather predictions, the ECMWF built a computer center the size of a small factory and filled it with an array of computer equipment. The CRAY-1 supercomputer was its heart. "Talking" to a person would only slow down the CRAY-1, so other computers were used to feed it data and instructions rapidly.

Forecasting the weather was exactly the type of enormous arithmetic problem that demanded the use of supercomputers like the CRAY-1. The ECMWF fed the computer the temperature, humidity, baro-metric pressure, wind speed, and wind direction from satellites, 9,000 weather stations, 750 weather balloons, and numerous ships and planes around the world (80 million bits of information total). From these readings, the CRAY-1 calculated the estimated conditions for every point on a grid covering the globe's atmosphere. (With points spaced 200 km apart and 15 layers deep, there were 273,630 points in all.) Then, applying the physical laws describing the behavior of gases and fluids, the computer figured out how the weather conditions at each point of the grid would affect the points surrounding it 15 minutes later. The CRAY-1 system repeated this last step 960 times, and 500 billion calculations later the meteorologists had an approximate view of the weather around the world for the next ten days. Of course, as with all such predictions, the accuracy of the forecast was limited by the simplifying approximations made by the programmers.

It's not hard to understand why this global weather model required a very fast and large computer. Neither a minicomputer nor a data-processing mainframe could have handled all the data and calculations fast enough. The CRAY-1 computer produced the forecast in just five hours.

Supercomputers were not cheap (the CRAY-1 computer system cost $8,000,000 in 1976), but some jobs, both then and now, could not be done without them. For example, defense laboratories use supercomputers to simulate new weapons under design. Environmental scientists use them to study different scenarios to explain global warming. Aircraft companies use supercomputers to test the design of airplanes before they start construction. Oil companies use them to map the Earth's interior. The weather forecast still comes to you thanks to supercomputers like the current CRAY, NEC and Fujitsu machines.

From a room in Reading, England, a meteorologist at the European Centre for Medium-Range Weather Forecasts studies the prediction of the world's weather for the next ten days. The charts on the wall show the European forecast for June 11-21, 1979. The mathematical calculations used to produce these charts were performed by a CRAY-1 computer.

Courtesy of the Jimmy Carter Library

Egyptian President Sadat, U.S. President Carter and Israeli President Begin sign the Camp David Peace Accord in 1978.

The speed of the CRAY-1 is partly attributable to the tightly packed circuits arranged in a semi-circle to minimize the distance between the computer's parts. The CRAY-1 is so fast that if the electricity had to travel too far, the computer would have to wait for it. The "seat" houses the equipment that supplies power to the rack of circuitry above it. A pump circulates Freon (the liquid used in air conditioners) through the cast aluminum racks to keep the computer cool.

Computing Power For People

During the 1980s, technology expanded the possibilities of personal choice. With automatic teller machines (ATMs) people could do their banking whenever they chose. VCRs let people watch movies and television shows on their own schedule. The inexpensive personal computer allowed people to use computers more freely for work, play, and self-expression.

In 1971, the invention of the *micro-processor* set the stage for the personal computer. By 1974, enthusiasts designed and built their own "home-brew" computers based on this inexpensive "computer-on-a-chip," and small companies began to sell do-it-yourself computer kits for hobbyists. In growing numbers, these *micro-computer* owners swapped programs and ideas, pioneering the use of computers by individuals.

By the late 1970s, the Apple II, TRS-80, and Commodore PET were sold as complete units in retail stores. Then, in August 1981, IBM introduced its Personal Computer. Two-and-a-half years later, in December 1984, Apple Computer responded with its Macintosh. More than any other personal computers, these two transformed the way people and organizations thought about and used computers. Low-cost systems, sold with word processors and spreadsheets, expanded the use of computers to individuals and within large organizations. By the late 1980s, resources that had been concentrated in central computing facilities during the 1950s and 1960s started to migrate to desk tops.

Ready-made, shrink-wrapped, load-and-run software programs enabled practically anyone to use these personal computers without any knowledge of programming or electronics. The software that helped make the IBM PC a success was *Lotus 1-2-3*—a *spreadsheet* program. Businesses of all sizes bought the PC and *1-2-3* for analyzing complex charts of financial information. This combination of hardware and software helped make the personal computer a part of everyday business life.

In 1981, the IBM Personal Computer (PC) sold only 20,000 machines. In 1983, sales had grown to more than 500,000, prompting over 150 companies to try to market imitations. Compaq was the first of many "clones" with the ability to run the same software. Within a few years a whole industry of PC *clones*, *peripherals*, and software arose, all built around the basic design of the IBM PC.

One reason for this was a program made by a company called Microsoft. MS-DOS (for Microsoft Disk Operating System) administered the IBM PC's operations. Any computer that used MS-DOS could run any software written for the PC. And conversely, any program written to run with MS-DOS would work with any *PC-compatible* computer, or "clone." In this way, MS-DOS contributed to explosive growth in the personal computer market. By 1990, Microsoft had sold over 12 million copies of MS-DOS, two million more than the best selling record album of the year.

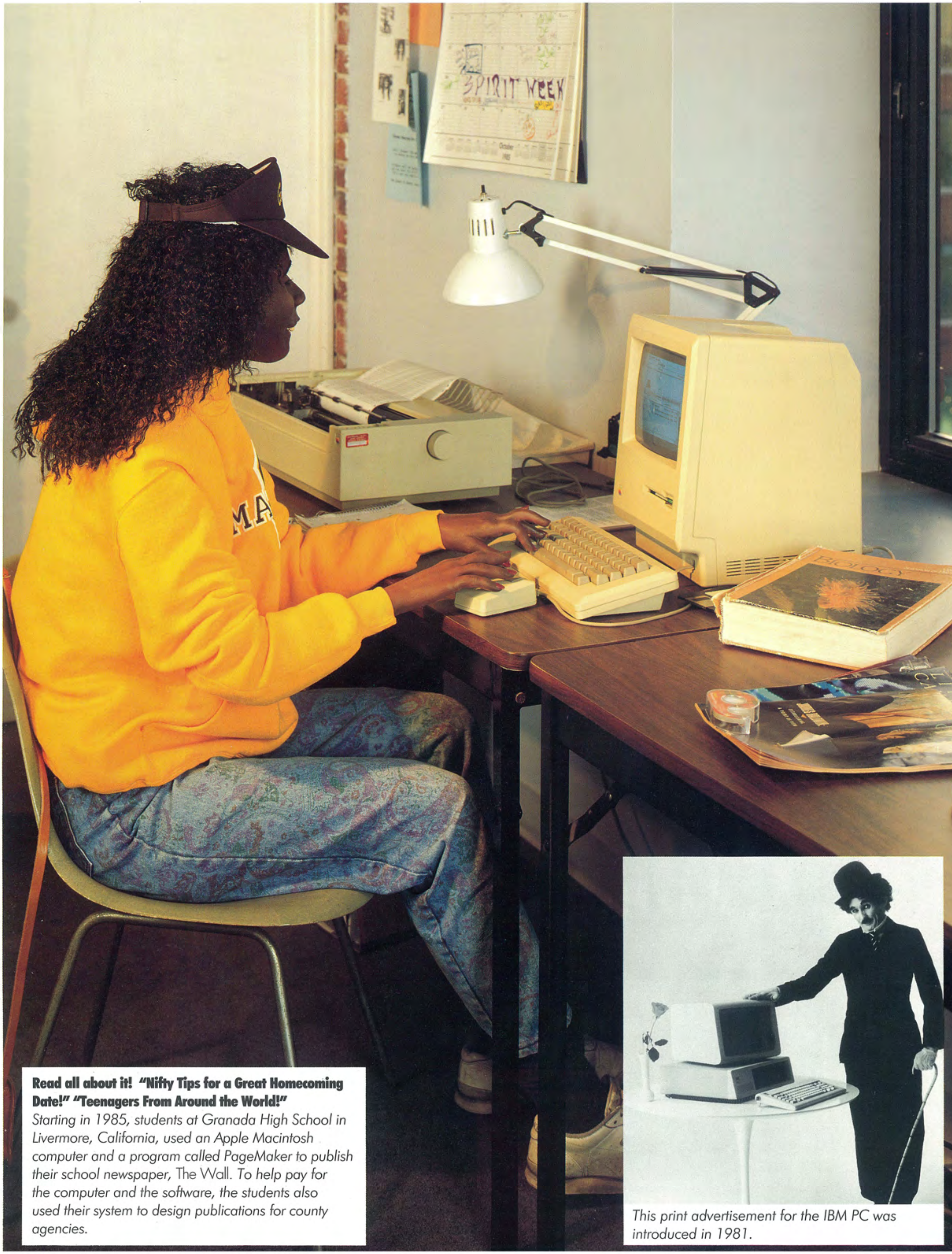
The Macintosh, with its own non-DOS operating system, offered an alternative form of computing more focused on graphics. Users could easily make text LARGER, smaller, *italicized*, or **bold** and see the result right on the screen. They could also easily create pictures, charts, and other graphics. Rather than taking their print jobs to a printer or typesetter, Macintosh users—from individuals and advertisers to schools and corporations—could produce fancy documents themselves on their own computers. Using these machines to design newsletters, catalogs, magazines, and brochures became known as *desktop publishing*.

One of the Macintosh's most appealing features was that it was easy to use. Rather than having to memorize and type out commands, as with most PCs, Macintosh users simply pointed to an icon, or small representative picture, of the command they wanted and clicked the computer's *mouse*. This meant new users and young children could quickly get down to useful work and play, without spending a long time learning the ropes. In this way, the Macintosh helped popularize styles of computing known as a "GUI" (Graphic User Interface) and "WYSIWYG" (What You See Is What You Get).

Photograph: David Boll

The horses are on the track. . . they're at the gate. . . And they're off!

At over 5,000 ticket windows across Hong Kong, fans scramble to bet on their favorite horses before the race begins at Happy Valley Racetrack. The ticket windows report their sales to central offices where personal computers, running Lotus 1-2-3 *spreadsheet software, create reports for the managers. The computers rapidly compile statistics showing how the volume of bets placed compares to the previous year, how many betting tickets are sold per ticket window, and the size of the average bet. Such information is critical to keeping tabs on the operation of Happy Valley and planning for the future.*



Read all about it! "Nifty Tips for a Great Homecoming Date!" "Teenagers From Around the World!"
Starting in 1985, students at Granada High School in Livermore, California, used an Apple Macintosh computer and a program called PageMaker to publish their school newspaper, The Wall. *To help pay for the computer and the software, the students also used their system to design publications for county agencies.*

This print advertisement for the IBM PC was introduced in 1981.

Milestone 9

We Are All Programmers

By the late 1980s, computer processors and memories were found in many, many devices—for example, CD players, telephones, thermostats, microwave ovens, cameras, and answering machines. People who programmed their VCRs were actually programming microcomputers embedded inside the VCRs. The computer itself was becoming smaller—lap-top and palm-top computers had more capability than the 20 pound IBM PC of ten years before. All these machines depended on ever more powerful, less expensive microprocessors. In 1990, world production of microprocessors totaled 1.5 *billion* (10 times the number of people born that year).

Today, many consumers in the developed world own and use several computers—in their cars, VCRs, telephones, calculators, watches, and electronic games—not to mention their personal computers. While this proliferation of computers has yet to occur in the developing world, the inexpensive, easily programmed, and durable microprocessor has greater potential for use by people around the globe than any of its predecessors.

Today, computers surround us, easing some age-old human problems and making others worse. They have begun to affect every person on earth in ways we can only begin to understand. Still greater changes lie ahead. Today's youth will be the first to grow up with computers. What will this mean for them and their world?

Courtesy of the Associated Press

Crowds celebrate the destruction of the Berlin Wall in 1989.

Computers surround us. Many of today's consumer electronics products rely on embedded microprocessors.


· CASIO · SONY · EPSON ·
PRISM
Panasonic
EASA-PHONE
KX-T2634 Silver
Integrated Telephone System
with Answering System
Panasonic
EASA-PHONE
AUTO-LOGIC
KX-T2634 Silver
Voice Menu/Time Day Stamp
Auto-Answer Speakerphone
PRISM

You are the Future

Inexpensive microprocessors have made computers more widely available and the opportunities for their use more diverse than ever. It is up to us to decide what we do with these ever-evolving tools. Are they:

- Games to while away boredom or to foster learning?
- Tools to maintain the status quo or to encourage new outbursts of creativity and entrepreneurship?
- Devices to invade people's privacy or to aid democratic change and the flow of information?
- Machines to replace people's jobs or to create new opportunities?

These are a few of the choices and challenges of the continuing Computer Revolution.

Exhibition Project Team

Development
Gregory W. Welch
Oliver Strimpel
Gwen Bell
Rachel Hellenga
Mary Beth Dorus
Natalie Rusk

Interactive Video
Brad Larson

Design
Theodore R. Groves
Richard Fowler
Åsa Chibas

Interactive Programming
David Greschler
Daniel T. Griscom

Technician
Stephen Snow

Construction
Don Greene
Peter Somers
Tyrone Peterson
Wayne Cookson
David Smith

Artifacts
Brian Wallace

Advisors
Charles W. Bachman
C. Gordon Bell
Daniel Bell
I. Bernard Cohen
Ruth Schwartz Cowan
John Diebold
Gardner C. Hendrie
Jane A. Manzelli
David Marc
Christopher Morgan
Douglas Ross
Jonathan Rotenberg
Jean E. Sammet
Howard P. Segal
Merritt Roe Smith

Special thanks to *The Machine That Changed the World,* WGBH Boston.

300 Congress Street
Boston, Massachusetts 02210
Tel 617. 426. 2800
Fax 617. 426. 2943

A one-of-a-kind fundraising event to benefit the Museum's educational programs, The Computer Bowl® plays out the legendary East/West Coast high tech rivalry. Since 1988, the Bowl has raised more than $1.75 million in cash, products and services. It attracts the support of hundreds of sponsors and enthusiastic volunteers, as well as media coverage from around the world. The Third Computer Bowl would not have been possible without the support of those listed below.

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The Association for Computing Machinery

Founders
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Virtual Reality Weekend

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High-Tech Halloween

The Computer Bowl

From The Executive Director

THE COMPUTER MUSEUM, INC. BALANCE SHEET / June 30, 1992

	Operating Fund	Capital Fund	Endowment Fund	Plant Fund	Total 1992
ASSETS					
Current Assets					
* Cash & Equivalents	$197,025				$197,025
* Receivables &other assets	41,864				41,864
*Store Inventory	69,374				69,374
*Interfund Receivable		169,376			169,376
Total Current Assets	$308,263	$169,376	—	—	$477,639
Other Assets					
* Restricted Cash Equivalents			250,000		250,000
Total Other Assets			250,000		250,000
Net Property and Equipment	—	3,346	—	2,787,296	2,790,642
TOTAL ASSETS	$308,263	$172,722	$250,000	$2,787,296	$3,518,281
LIABILITIES & FUND BALANCES					
Current Liabilities					
* Accounts Payable & other Current Liabilities	201,493	91,657			293,150
* Interfund Payable	169,376	—			169,376
Total Current Liabilities	370,869	91,657			462,526
FUND BALANCES					
* Unrestricted	(62,606)	13,516		2,787,296	2,738,206
* Restricted	—	67,549	250,000	—	317,549
Total Fund Balances	(62,606)	81,065	250,000	2,787,296	3,055,755
TOTAL LIABILITIES & FUND BALANCES	$308,263	$172,722	$250,000	$2,787,296	$3,518,281

STATEMENT OF ACTIVITY for the year ended June 30, 1992

	Operating Fund	Capital Fund	Endowment Fund	Plant Fund	Total
SUPPORT & REVENUE					
* Unrestricted Gifts	$493,031	$452,342			$945,373
* Restricted Gifts	185,246	1,143,680	250,000		1,578,926
* Memberships	244,070				244,070
* Admission	469,772				469,772
* Store/Functions	558,148				558,148
* Investment gain (loss)		(2,331)			(2,331)
* Other	—	1,633	—	—	1,633
TOTAL	$1,950,267	$1,595,324	$250,000	—	$3,795,591
EXPENSES					
* Exhibits & Education	$492,215	$31,167			$523,382
* Marketing & Membership	378,957				378,957
* Depreciation				618,802	618,802
Supporting Services					
* Management & General	232,216	118,651			350,867
* Fund Raising	182,458	196,454			378,912
* Building Operations & mortgage debt	278,769	136,396			415,165
* Store /Functions	450,695	—	—	—	450,695
TOTAL	$2,015,310	$482,668	—	$618,802	$3,116,780
Excess/(deficiency) of support and revenue over expenses	(65,043)	1,112,656	250,000	(618,802)	678,811
Fund Balance, beginning of year	2,437	97,347		2,277,160	2,376,944
Add/(deduct) transfers *Plant	—	(1,128,938)	—	1,128,938	—
Fund Balance, End of year	$(62,606)	$81,065	$250,000	$2,787,296	$3,055,755

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Mission Statement

To educate and inspire people of all ages and backgrounds from around the world through dynamic exhibitions and programs on the technology, application, and impact of computers.

To preserve and celebrate the history and promote the understanding of computers worldwide.

To be an international resource for research into the history of computing.

Facts

Founded: 1982 501(c)3

Facilities: 53,000 square feet; 7 exhibition galleries; 275-person auditorium (3,200 square feet); Museum Store.

Audience: 150,000 visitors/year (40% students); millions served through Exhibit Kits Program, educational videos and other materials.

Members: 1200 individuals from 45 states and 13 countries; 150 Corporate Members worldwide.

Museum Hours: Winter: Tuesday-Sunday, 10am-5pm; Summer: daily, 10am-6pm.

Admission: $7.00 for adults; $5.00 for students and seniors; free for Museum Members. Half price Sundays 3-5pm. Group rates by arrangement.

From The Executive Director

This was an exciting year for the Museum. History— of a sort— was made at the Museum in November when a computer fooled judges into thinking it was human in the first limited Turing Test. The year culminated in June with the opening of *TOOLS & TOYS: The Amazing Personal Computer* and a symposium presented by personal computer visionaries. These and other widely publicized Museum events generated almost 300 million media impressions worldwide.

For the third year running, the Museum funded, developed, and opened a major new exhibition. Joining forces with The Boston Computer Society, we built *TOOLS & TOYS*, an entertaining and thought-provoking introduction to the many uses of the personal computer. It was designed to appeal to people of all backgrounds, even those with absolutely no computer experience. Visitor surveys have shown an overwhelmingly positive public reaction to the exhibit— especially to its cutting edge, hands-on experiences and lively design.

With the growing disparity in technological literacy between well-served and under-served communities, the Museum's accessible approach to education is in increasing demand.

Complementing the dramatic changes inside the Museum, plans are now underway to transform its exterior. In February, the Museum's Board decided to join The Children's Museum in creating an external landmark. Together, we retained Frank Gehry Associates to carry out the design. The result is a spectacular plan for a 4-story-high "wave," a copper, steel and glass structure that arches towards the waterfront. The "wave" will serve as a dramatic new entry to both institutions, while increasing both museums' visitor throughput capacity.

Three special events generated extraordinary attention. In addition to the Loebner Prize Competition/Turing Test, the Museum held a Virtual Reality Weekend in April that broke all previous attendance records! And on May 1, first-rate contestants engaged in a keenly-fought Fourth Computer Bowl®. Energetic volunteers made it and the West-Coast satellite-linked party the most successful ever in terms of contributed support. *NEWSWEEK* recorded it all in a story that ran three days later. The Fifth Bowl— a tie-breaker— will take place in San Jose, California, May 14, 1993.

With the growing disparity in technological literacy between well-served and under-served communities, the Museum's accessible approach to education is in increasing demand. (Our group visits are up 20% this year.)

How can we leverage our unique resources to respond to this crisis?

In May, I appointed Natalie Rusk Director of Education. Her training (an EdM in Interactive Technology from Harvard Graduate School of Education), experience at MIT as consultant to the Media lab, and enthusiastic commitment to our educational goals and to reaching under-served and minority audiences make her perfect for the job. Our first major initiative under her leadership is "The Computer Clubhouse," an informal education center for youth aged 10-15. Designed to meet the needs of local underserved audiences, it will also serve as a national model for educators.

In June 1991, the Museum launched a $7.5 million Capital Campaign to secure full ownership of our building and to create an endowment to buttress the Museum's educational programs. I am delighted to report that in its first, "internal" phase, members of our Boards of Directors and Trustees, and several other individual and corporate supporters, have pledged $1.5 million. Also, a major institutional donor has pledged $2.5 million as a challenge grant toward the building. The Campaign has been a major focus of the Board and staff this year, and promises to be an even greater one, as we move toward the public phase ahead.

Other projects for the future include the enhancement of the *Smart Machines* gallery (reopening February 13) and the culmination of our 1988 exhibit development plan, *The Networked Society*. Addressing the large-scale strategic uses of computers that knit society together, this exhibit is slated to open in 1994.

The Museum's continued success depends on its supporters— corporate, foundation, and individual. On behalf of the millions of people who benefit from and enjoy the Museum and its outreach, sincere thanks to all our supporters from our entire staff.

Oliver Strimpel

Dr. Oliver Strimpel
Executive Director

Collections

Computers

Digital Equipment Corporation PCS (Personal Computer System), prototype personal computer, 1977, X1103.92; Smaky (Smart Keyboard), experimental personal computer/ portable terminal, 1978, X1104.92; DEC2, experimental personal computer, 1980, X1105.92
Gifts of Richard M. Merrill

Digital Equipment Corporation VAX-11/780, first implementation of the VAX-11 minicomputer virtual address extension, 1977, X1111.92
Gift of David Cutler

Intel Corporation Model 310 iRMX System, software development environment for the Intel 8086 microprocessor, 1983, X1100.92
Gift of David Alan Feustel

International Business Machines Corporation IBM PC jr., IBM's early family-oriented computer, 1983, X1098.92
Gift of Jeffry A. Borror

NEC Corporation NEC PC8401A, pre-production model of early NEC laptop computer, 1984, X1101.92
Gift of Hans Fantel

Seattle Computer Products, Inc. personal computer, proprietary Q-DOS operating system purchased by Microsoft and extensively modified to create MS-DOS, 1980, X1110.92
Gift of Dr. Donald Grossman

Sony Corporation SMC 70, first computer to utilize Sony's 3.5" floppy disk and drive, 1982, X1108.92
Gift of John F. and Nancy S. Doyle

VectorGraphics Corporation Vector 3, Model 5030, personal computer with graphics display and print capacity, 1979, X1092.92
Gift of Dr. John Lief

Components

Cornell University Professor T. Bloch's patch panels from experimental threshold logic (neural net) computer, ca. 1962, X1106.92
Gift of Dr. Lester Ludwig

International Business Machines Corporation IBM 3850 Mass Storage System, magnetic tape-based cartridge system, 1987, X1102.92
Gift of Dave Jones

Unisys Corporation Micro A SCAMP microprocessor, first mainframe on a chip, 1988, X1091.92
Gift of David Faultersack

Transducers

Digi-Log Systems, Inc. TeleComputer, early "lightweight" acoustic-coupled portable terminal, 1969, X1113.92
Gift of Edward A. Feigenbaum

Hollerith Tabulating Machine Company Hollerith card punch, manual punch for dollar-size cards, ca.1900, X1099.92
Gift of Mrs. Henry C. Clark

Logitech, Inc. ClearCase Mouse, input device commemorating Logitech's 2,000,000th mouse, 1988, X1112.92
Gift of Serge Timichef

VR 92 vacuum tubes used in experimental RCAF memory device, ca. 1940, X1094.92; Captured German direction finder antenna components analyzed by the Royal Canadian Air Force, ca. 1942, X1095.92; Standard neon bulbs used in experimental RCAF memory device, ca. 1944, X1096.92
Gifts of R. D. Carter, RCAF Wing Commander Ret'd.

Xerox Corporation 860 Information System keyboard, first commercial on-keyboard "CAT" touch-sensitive cursor controller, 1980, X1109.92
Gift of Kevin Deame

Slide Rule

Elizur Wright's Arithmeter, spiral slide rule designed to aid state regulation of the Massachusetts insurance industry, patented 1860, X1097.92
Gift of The New England

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This new permanent exhibition explores eight application areas on some 40 computer stations. The first area, Making Pictures, features a Virtual Reality Chair (patent pending) among other interactives focusing on graphics. Other areas address Writing, Making Sound, Adding It Up, Playing Games, Exploring Information, and Sharing Ideas. This last area features a Networking Game that lets up to four people work together to solve a puzzle. In a final area, visitors can use digital video to record their views of the personal computer, and then browse a database of computing resources. TOOLS & TOYS *would not have been possible without the generous support of those listed below.*

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From the Chairman

As computing plays an ever more central role in our lives, the social and economic importance of sound technology education grows. Yet many, including, surprisingly, many young people, feel alienated from and left behind by the rapid developments and the ever widening possibilities opened up by computers and information technology.

This year, more than ever, The Computer Museum's educational exhibits and programs have been guided by the pressing need to reach out to those who have not yet experienced the potential of the computer.

On behalf of the Board of Directors, I extend our profound thanks to all the Museum's supporters–individual, corporate, and foundation–for your generous support last year. And as the impact of our educational mission continues to grow, I exhort you all to continue to spur on the critical work of the Museum with your support.

Gardner C. Hendrie
Chairman of the Board of Directors

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The Computer Museum

Annual Report 1993

It is deeply satisfying to me to chair the Board of Trustees of such a visionary, innovative institution as The Computer Museum.

I would like to commend and thank outgoing Chairman Gardner Hendrie for his leadership during the Museum's tremendous growth from 1988-1993. The budget and exhibit space grew by 50%, and the number of interactive computer exhibits tripled!

Now these exhibits can be leveraged to meet educational needs at other museums and centers of informal education. Under Gardner's tenure, the Computer Clubhouse was planned. It becomes fully operational in the fall of 1993. It will be my pleasure to see it not only in action in Boston, but also replicated in other cities.

On behalf of the Board, I extend our profound thanks to the Museum's supporters—individuals, corporations, and foundations—for your generous support last year. To take the Museum to the next stage of its evolution as an international institution, I urge all of you to join us in making that next stage come true.

Charles Zraket

Charles A. Zraket
Chairman of the Board of Trustees

From the Executive Director

THE COMPUTER MUSEUM, INC. BALANCE SHEET / June 30, 1993

	Operating Fund	Capital Fund	Endowment Fund	Plant Fund	Total 1993
ASSETS					
Current Assets					
Cash & Equivalents	$259,590				$259,590
Receivables and other assets	60,085				60,085
Store inventory	49,137				49,137
Interfund receivable		$123,310			123,310
Total current assets	368,812	123,310			492,122
Other assets					
Restricted Cash Equivalents			$250,000		250,000
Total other assets			250,000		250,000
Net property and equipment		52,908		2,334,052	2,386,960
TOTAL ASSETS	$368,812	$176,218	$250,000	$2,334,052	$3,129,082
LIABILITIES AND FUND BALANCES					
Current liabilities					
Accounts payable and other liabilities	354,068	13,414			367,482
Interfund payable	123,310				123,310
Total current liabilities	477,378	13,414			123,310
FUND BALANCES					
Unrestricted	(108,566)			2,334,052	2,225,486
Restricted		162,804	250,000	412,804	
Total fund balances	$(108,566)	$162,804	$250,000	$2,334,052	$2,638,290
TOTAL LIABILITIES AND FUND BALANCES	$368,812	$176,218	$250,000	2,334,052	3,129,082

STATEMENT OF ACTIVITY for the year ended June 30, 1993

	Operating Fund	Capital Fund	Endowment Fund	Plant Fund	Total 1993
SUPPORT AND REVENUE					
Unrestricted gifts	$360,505	$375,561			$736,066
Restricted gifts	136,766	208,740			345,506
Memberships	287,771				287,771
Admissions	486,728				486,728
Auxiliary activities	463,560				463,560
Realized investment gain (loss)					
Miscellaneous	35,026		$6,463		41,489
TOTAL	1,770,356	584,301	6,463		2,361,120
EXPENSES					
Exhibits and education	471,630	14,982			486,612
Marketing and membership	287,123				287,123
Depreciation				$699,099	699,099
Supporting services					
Management and general	278,247	5,759			284,006
Fund-raising	156,908	102,189			259,097
Building operations and mortgage debt	294,698	133,777			428,475
Auxilliary activities	334,173				334,173
TOTAL	1,822,779	256,707		699,099	2,778,585
Excess (deficiency) of support and revenue over expenses	(52,423)	327,594	6,463	(699,099)	(417,465)
Fund balance, beginning of year	(62,606)	81,065	250,000	2,787,296	3,055,755
Add (deduct) transfers					
Plant		(245,855)		245,855	
Unrestricted	6,463		(6,463)		
Fund balance, end of year	$(108,566)	$162,804	$250,000	$2,334,052	$2,638,290

Mission Statement

To educate and inspire people of all ages and backgrounds from around the world through dynamic exhibitions and programs on the technology, application, and impact of computers.

To preserve and celebrate the history and promote the understanding of computers worldwide.

To be an international resource for research into the history of computing.

Facts

Founded: November 14, 1982
501(c)3

Facilities:
53,000 square feet; 7 exhibition galleries; 275-person auditorium (3,200 square feet); Museum Store.

Audience:
135,000 visitors/year (45% students); millions served via Exhibit Kits Program, educational videos, and other materials.

Members:
1,200 individuals from 45 states, 13 countries; 150 Corporate Members worldwide.

Museum Hours:
Winter: Tuesday-Sunday, 10am-5pm; Summer: daily, 10am-6pm.

Admission:
$7.00 adults; $5.00 students, children 5-up, and seniors; free for Museum Members and children 4-under. Half price Sundays 3-5pm. Group rates by arrangement.

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From the Executive Director

This *Annual Report* has a special prospectus on the Museum's informal learning programs. As our interactive computer-based exhibits grew to more than 120 this year—with the oldest dating from 1987—the Museum's creative energies took new and exciting turns.

We created a brand-new kind of learning center, the Computer Clubhouse. We shared our expertise at the annual Association of Science-Technology Centers (ASTC) conference in Toronto, Ontario. And the Museum wrote and obtained its first research grant!

One of the key principles is the importance of letting visitors experience the topics being presented, because informal learning is a three-dimensional experience involving all the senses.

The Clubhouse, completed at the end of the fiscal year, offers an opportunity for young people to develop their own computer-based projects. With mentors to guide them, participants learn about the use of computers rapidly in a way that could affect the course of their lives.

Like our Exhibit Kits sent around the world, the Clubhouse is designed to have a far-reaching impact. The project ideas and software that we develop will be suitable for dissemination to community centers, after-school clubs, museum computer labs, and a range of other settings across the country.

The increasing availability of computer hardware in many schools and communities has not been matched by ideas for putting the technology to good use. Well-conceived and appropriate uses of the technology will be the key contribution of the Clubhouse. Tested projects, software to launch participants, and plenty of printed support materials will enable educators, mentors, parents, and community workers to transform sterile computer centers into lively places of discovery. The project is described in detail in the prospectus.

At this year's ASTC conference, Museum staff presented papers on our work in exhibits and education. One of the key principles is the importance of letting visitors experience the topics being presented, because informal learning is a three-dimensional experience involving all the senses. We have discovered that the best way for visitors to learn new technologies is to be engaged in interesting activity. It is also important to balance what visitors want to know with what the so-called "experts" might think they should know.

But there is no way to assure an exhibit's success without trying it out on visitors! The Museum has developed a "formative evaluation process" to test all its interactive software to make sure it really achieves its educational goals.

Adding another dimension to our own learning process, a recent grant from the National Science Foundation will enable us to explore the use of virtual reality as a tool for informal science education. Much has been written about how this new technology might be used as an educational tool, but little research has actually tested its effectiveness.

We will study whether visitors' comprehension of a human cell is improved by "walking into" this basic biological building block and studying it in an interactive, three-dimensional environment, as compared to using a two-dimensional graphic display. What we learn will also help us to build even more innovative and exciting interactive exhibits.

Meanwhile, we also completely re-designed and enhanced *Robots & Other Smart Machines* to include R2-D2™, the original robot costume from "Star Wars," as well as new hands-on interactives on real-time expert systems, emotional synthetic speech, artificial life, and much more.

And we also extended the reach of our exhibits this year with copies of our software installed in the Smithsonian Institution National Museum of American History, the National Aquarium, and the North Carolina Museum of Life and Science. These institutions have a combined visitorship of over seven million people a year.

The Museum's continued success stems from your generous support. On behalf of all the people who benefit from and enjoy the Museum and its outreach, I would like to thank all of you—our corporate, foundation, and individual supporters.

As always, we also welcome your suggestions and involvement. Please give me a call or send email (Internet: Strimpel@tcm.org), if you have ideas or would like to volunteer. We look forward to hearing from you.

Oliver Strimpel

Oliver Strimpel
Executive Director

The Fifth Computer Bowl 1993

A one-of-a-kind fundraising event to benefit the Museum's educational programs, The Computer Bowl® plays out the legendary East/West Coast high-tech rivalry in a contest of computer knowledge. Since 1988, the Bowl has raised more than $3.4 million in donations and in-kind support. It attracts the support of hundreds of sponsors and enthusiastic volunteers, as well as media coverage from around the world. The Fifth Computer Bowl would not have been possible without the support of those listed below.

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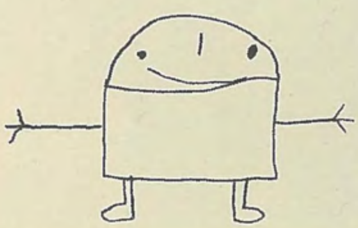
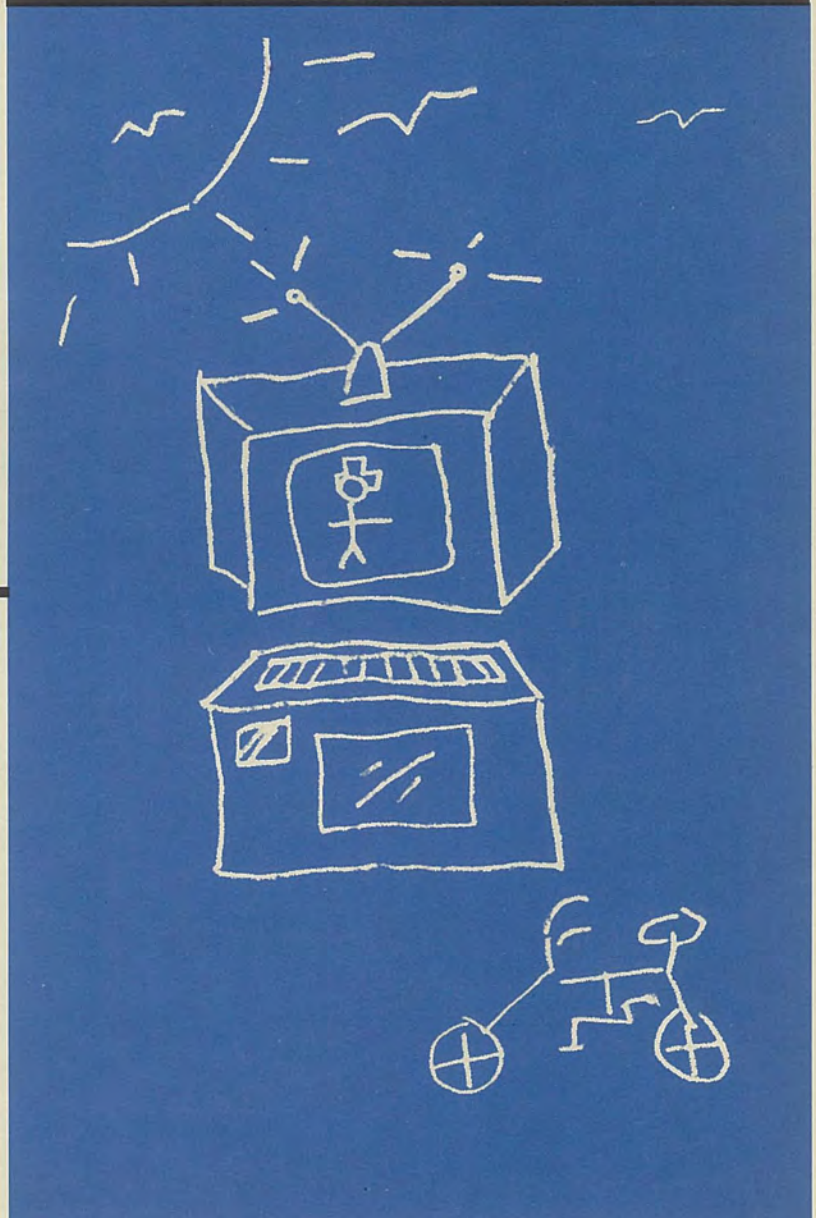
informal Learning at The Computer Museum





The above illustrations of smart machines of the future are by young Computer Museum visitors.

Our interactive exhibits answer these questions:

Can

How do computers work?

How have computers evolved?

Photo: David Bohl

Photo: FayFoto

How do computers work?

This question is answered by *The Walk-Through Computer*™, an authentic, two-story working model of a desktop computer. To operate the 50-times-larger-than-life computer, visitors use a giant "mouse" and the function keys of an enormous keyboard. After two cities have been selected, a gigantic monitor displays the shortest route between them, along with a slide show of sights along the way.

Inside the computer, people see how instructions are processed. Walking across the printed circuit board, visitors trace the flow of information from one part of the computer to another; data is stored and retrieved from shoulder-high memory banks. A Software Theater completes the experience, summarizing the critical points of how a computer program works.

How have computers evolved?

Through nine dramatic vignettes, *People and Computers: Milestones of a Revolution* traces the evolution of the computer from a handful of costly electronic giants in the 1940s to the millions of desktop computers and microprocessors in use today. The exhibition explores both the positive and negative impact of the computer on society and people's lives.

Starting with the punch-card machinery of the 1930s, the centerpiece of each milestone is a life-size re-creation of an important computing era. The Whirlwind computer, UNIVAC I, IBM System/360, PDP-8, Cray-1, IBM PC, and Macintosh are featured. The displays draw upon the Museum's collection of artifacts, amplified by interactive stations, films, and videotapes. Each milestone typifies a new way of using and thinking about computers. The forces that led to major advances, as well as the false starts, are explored.

machines behave and think like people?

What can computers do?

Photo: Neal Hamberg

Photo: Marjorie Nichols

What can computers do?

This question is addressed in two different exhibits. *Tools & Toys: The Amazing Personal Computer* focuses on the versatility of the personal computer for people's work, play, learning, and communication. *Robots & Other Smart Machines* investigates the world of artificial intelligence (AI) and robotics.

Tools & Toys explores eight application areas on some 35 computer stations. The first area, Making Pictures, features a Virtual Reality Chair (patent pending) among other interactives focusing on graphics. Other application areas address Writing, Making Sound, Adding It Up, Playing Games, Exploring Information, and Sharing Ideas. This last area includes a Networking Game that lets up to four people work together to solve a puzzle using live video and an audio network. In a final area, visitors can use digital video to record their views of the personal computer, and then browse a database of computing resources.

Can machines behave and think like people?

Robots & Other Smart Machines also addresses the intriguing question: Can machines behave and think like people? Shakey, the first mobile robot to "sense" its environment, NASA's Mars Land Rover, and 25 other notable robots in the Robot Theater illustrate how "smart" machines are and are not. People can also learn how robots "see," "touch," "hear," and move by communicating with contemporary robots that spell their names with alphabet blocks, recognize the sound of voices, and convert printed materials to synthesized speech.

Some 30 interactive stations explore the areas of creativity, games, problem-solving, communication, and "artificial life." At one station, people can breed exotic three-dimensional fish in an "electronic aquarium." Another station asks people to distinguish between music composed by Mozart and a computer program. Others probe how expert systems coordinate a large-scale bakery, and draw original works of art.

Photo: Noah Southall

The Computer Clubhouse is latest computer technology

Computer Clubhouse participants design their own multimedia presentations, incorporating images, music, voice, and text.

During school vacation in December 1989, five neighborhood kids made their way into the Museum to participate in a robot-building workshop. Speaking to one another in a combination of English and Spanish, they excitedly built models of cars, cranes, and merry-go-rounds—and then learned how to use a computer to program their machines to move. After seeing a drawing in David Macaulay's book, *The Way Things Work*, one boy got an idea for a new gear mechanism for his crane. "Míra, míra, look at this," he said, as the machine lifted his car into the air.

These young people returned every day—even after the workshop was over—looking for more opportunities to use computers in open-ended ways. But most museum exhibits are designed for short interactions. So, The Computer Museum decided to create the Computer Clubhouse, a new learning space where underserved youth use the latest computer technology to develop their own projects.

Local Program, National Model

In the 1993-1994 school year, the Clubhouse will serve more than 600 young people, ages 10 to 15, from low-income neighborhoods. Through after-school group programs, drop-in hours, and school group participation, the Clubhouse helps address inequities between those young people who have access to state-of-the-art computers at home and those who do not. Young people from low-income neighborhoods participate free of charge, and make up more than 75% of the total participation.

Between 1990 and 1993, more than 50 educators, community leaders, and young people have helped plan and implement the Clubhouse program. The Computer Clubhouse model moves away from the sterile computer lab and toward an interdisciplinary approach to learning real-world applications of powerful, but underutilized computer tools. The Education Committee and advisors continue to evolve concepts for similar learning environments across the country. Museum staff are developing Software Starter Packages to help other organizations and centers that are introducing computers as a resource. A video and printed materials are also planned.

Using Computers As Creative Tools

The vibrant Clubhouse environment gives young people the opportunity to create their own projects in six cutting-edge computer application areas: electronic music, computer-controlled devices, "virtual reality," multimedia, computer game design, and scientific simulations.

One of the most accessible areas is the electronic publishing station. Here, participants use color scanners, video capture cards, multimedia authoring software, and other tools to create pictures, newsletters, and interactive presentations. Many participants begin by scanning a picture of a family member into a computer and then adding special effects. During the Clubhouse's pilot session, six teen-age workers from the Children's Museum (located next door) came to the Clubhouse to develop a presentation on their summer job experience. With the help of Clubhouse staff, they integrated music, images, and text to create a "living" legacy to be kept at both museums.

The music studio is already notorious! Word has spread quickly among Boston youth about this computerized recording room, and many participants come to the Clubhouse already having chosen a name for their group and having rehearsed a song to record. As many as six young people at a time work together in the studio, using computers to record, edit, and mix their own music.

a new learning space where underserved youth use the to develop their own projects.

Clubhouse mentor Michael Lee, 18, created this illustration using digital image editing software.

At the computer-aided design station, young people design their own three-dimensional objects and environments. A 13-year-old from an all-girls group became engrossed in designing the layout for a public garden. Her group leader reports that since that key experience, she has decided to pursue a career as a landscape architect. Another youth who had lost interest in school is using the Clubhouse's high-powered computer equipment to build a portfolio for applying to art school.

Instead of learning to play yet another game, interested young people use the Clubhouse's many resources to design and program their own computer games. For many, this learning opportunity is something they never dreamed was possible. For others, the Clubhouse challenges them in ways that the classroom has not.

The Clubhouse also features a build-it-yourself station where young people construct their own robots and other computer-controlled machines, and a science simulation station where participants program computers to model both natural and artificial systems.

Learning from Peer and Adult Mentors

Professionals and graduate students in engineering, music, art, and environmental science serve as adult mentors, sharing their experience and enthusiasm, and serving as role models. Unlike other programs, the Clubhouse encourages mentors to work on their own projects alongside young people. By engaging themselves in the activities, adult mentors provide inspiration and examples for youth participants to follow, and opportunities for youth to broaden their interests. Youth mentors, skilled with computers, offer peer support and gain job experience for themselves within the Clubhouse program.

Sponsors

Start-up of the Computer Clubhouse project has been made possible with the support of Intel Foundation, Lotus Development Corporation, Digital Equipment Corporation, Hayden Foundation, Hewlett-Packard Company, International Business Machines Corporation, State Street Foundation, Raytheon Company, Arthur D. Little Foundation, Ellis L. Phillips Foundation, Boston Edison Company, and Fleet Bank of Massachusetts.

Who We Reach

On-Site

People come from all over the world to The Computer Museum, the only one of its kind. Its exhibits and programs are designed to be accessible to ages six and up, to computer novices and experts alike. Since the Museum was established as a non-profit institution in 1982, annual visitorship has grown from 20,000 to 135,000 a year. Half of our visitors are students and half, adults. Sixteen-and-a-half percent of visitors come from outside the USA, and 58% from beyond Massachusetts. Over 3,000 educators a year visit the Museum at no charge, helping further the Museum's educational mission.

Underserved Audiences

The Museum is committed to meeting the needs of underserved audiences and is fully accessible to disabled individuals. In one year alone, with grants and support from corporations, foundations, and the Massachusetts Cultural Council, the Museum's Ticket Subsidy Program provided reduced or free admissions to more than 11,000 students, including groups from low-income neighborhoods, groups serving people with disabilities, and other underserved audiences. In addition, the Computer Clubhouse provides an in-depth learning opportunity for more than 600 young people from low-income neighborhoods from inner-city Boston each year. The Museum has a particular commitment to young women from underserved communities. Initiatives include a collaboration with Operation SMART™ at Girls Incorporated of Lynn, MA, where young women design and build their own robots and learn to take apart and explore the inside of a computer.


Photo: Neal Hamberg

Volunteer and Mentor Programs

Hundreds of volunteers provide assistance to the Museum on an ongoing basis. Their involvement spans a wide range of activities from software programming and fund-raising to assisting with special events and educational programs. The Computer Clubhouse Mentor Program recruits six young people a season to serve as youth mentors. Aged 12 to 18, they offer peer support and gain job experience for themselves. In addition, 20 professionals and graduate students in engineering, music, art, and environmental science share their experience and enthusiasm as adult mentors, while also serving as role models.

Beyond The Museum

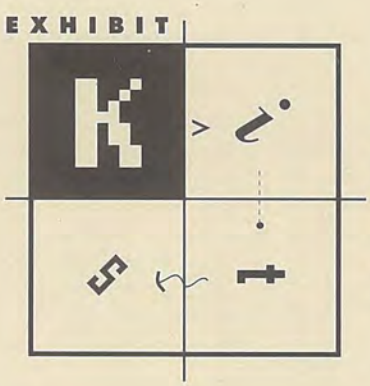


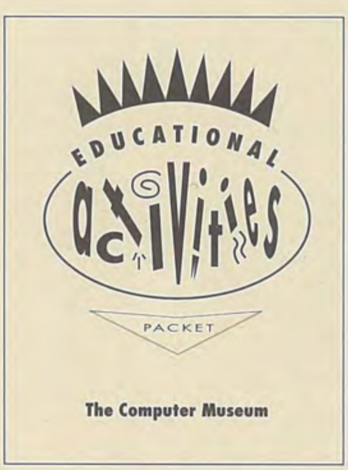
Exhibit Kits

For every visitor to The Computer Museum, there are over 20 more who see and try our exhibits at other museums around the world. The Computer Museum has turned its most sought-after interactive computer exhibits into "kits" that are easily installed by other museums.

Sponsored in part by the National Science Foundation, American Association for Artificial Intelligence, and the Hearst Foundation, the Exhibit Kits Program includes exhibits on topics such as artificial intelligence, programming, and how computers play games. Kits are on display at the Smithsonian Institution National Museum of American History, the Franklin Institute, and the St. Louis (MO) Science Center, as well as in other museums in the USA, Japan, Mexico, and the UK.

Educational Video

The Museum's educational video, *How Computers Work: Journey Into The Walk-Through Computer*™, brings the excitement of this giant computer exhibit to thousands of classrooms and homes across the country. The video has sold more than 10,000 copies and is seen by an estimated 50,000 people a year.



Educational Activities Packet

The Computer Museum developed the Educational Activities Packet in response to requests from educators for new materials and approaches to foster students' interest in computers. The packet is designed for use in classrooms with or without access to computers, and may be used by itself or to supplement Museum visits.

The packet offers information and hands-on activities to help teachers and students understand the workings, evolution, applications, and impact of computers. Made possible with support by NYNEX Corporation, the packet is available in both English and Spanish. It reaches approximately 13,000 students and 4,000 educators a year, and has been used across the United States, in Canada, Jamaica, Japan, and Nepal.

The Museum's Educational Vision

The Museum's mission is to educate and inspire people of all ages and backgrounds on the evolution, technology, applications, and impact of computing through dynamic interactive exhibitions and programs.

Inequities in access to computer technology are widening the opportunity gap between young people from underserved communities and youth of privilege. The Computer Museum is particularly committed to addressing this issue by providing young people from underserved backgrounds the resources they need to help them develop their talents, contribute to their communities, and to pursue fulfilling careers that benefit society.

To reach the widest audience and achieve the greatest impact, the Museum will:

- **develop model educational programs involving the use of computers;**
- **create innovative educational materials about computing that can be integrated into a wide variety of educational settings;**
- **build inspiring and engaging interactive computer exhibits.**

These approaches leverage the Museum's expertise in informal, museum-style education, emphasizing the importance of play and exploration in learning, and the potential of the computer as an empowering, creative, and productive tool.

The Computer Museum's educational mission works in concert with the national education reform movement. This includes teacher education, as well as collaboration with schools, after-school centers, and other local and national organizations to improve the lives of young people into the 21st century.

The Museum seeks support for the following projects:

Exhibits

The Networked Society

With partial funding in place, the world's first exhibit focusing solely on global computer networks is being developed. This 5,000-square-foot, $1.5-million exhibit will offer first-hand experiences with networks and a broad and balanced view of how network technology impacts daily life. The goal is to make the invisible "information infrastructure" not only visible, but also understandable.

Hands-on experiences will illuminate how networking technology works. Specific applications in transportation, health care, government, education, finance, and retail will clarify how computer networks affect our lives. Moral and ethical issues, such as privacy, and some of the cultural dimensions—life, love, and legality "on the Net"—will also be explored. A rich hands-on environment representing a "networked society" in microcosm and actual computer networks in compelling real-world and fantasy settings will be featured.

Virtual Reality

With support from the National Science Foundation, the Museum is researching the educational effectiveness of virtual reality as a tool for informal learning. The Museum will explore whether visitors' comprehension of a cell is improved by "walking into" this basic biological building block and studying it in an interactive, three-dimensional environment versus an explanation using two-dimensional graphics. The results—including the final virtual cell world—will become an exhibition, with other examples of virtual reality. Visitors will be able to experience this technology for themselves and also discover its impact on science, business and the arts.

Programs

Teacher Workshops

With a grant from the Ford Foundation, Cambridge College and the Museum have developed workshops to empower educators to use computers. The Computer Clubhouse will offer workshops to help teachers learn about and feel more comfortable with innovative uses of computers for teaching science, mathematics, and technology. Educators will be encouraged to create their own computer-based projects and plan how to incorporate such activities into their classrooms.

Materials

"Living Book"

The Museum continues to develop materials that take the fun and educational spirit of its interactive exhibits beyond its walls. A combination book and interactive CD-ROM on *The Walk-Through Computer*™ is currently under development. It will invite the reader inside this dramatic two-story working model of a computer to get to the heart of how a computer works.

Starter Software Packages

Based on evaluation of what works best in the Computer Clubhouse, easy-to-use software packages will be developed to enable novices to use powerful computer tools. These packages will help young people to design their own diverse products, including scientific simulations, computer-controlled devices, and three-dimensional "worlds." This software will be made available to other museums, after-school centers, and schools.

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Collections

Computers

Albert Computer, Inc.
Albert personal computer, Apple II clone, 1983
Donated by Mitchell Kapor, X1127.93-X1131.93

Apple Computer, Inc. PowerBook 170 laptop computer, 1992
Donated by John Sculley, X1137.93

Computer Devices, Inc. 1206 Miniterm Pro portable computer/terminal
Donated by Jeffrey B. Buckley, X1139.93

Epson, Inc. QX-10 personal computer with integrated word processing, database, and math applications, 1980
Donated by Craig McCoy, X1125.93

GO Corporation, Inc. G400 developers' release pen/tablet computer, 1990
Donated by Mitchell Kapor, X1127.93

Philips (Netherlands) P2000T personal computer, 1981
Donated by Dr. J. L. Verbeek, X1141.93

Poqet Computer Corporation Poqet PQ064 palmtop computer, 1988
Donated by Mitchell Kapor, X1130.93

Texas Instruments Corporation TI Silent 7000 portable computer and terminal, 1983
Donated by Howard L. Funk, X1118.93

Thinking Machines Corporation Connection Machine CM-1 massively parallel computer, 1985
Donated by Thinking Machines Corporation, X1124.93

Toshiba, Inc. T1000 laptop computer, 1987
Donated by Mitchell Kapor, X1128.93

Toshiba, Inc. T1100 laptop computer, 1987
Donated by Mitchell Kapor, X1129.93

Microprocessor-based devices

Seiko, Inc. RC-4400 digital watch with personal computer interface, 1985
Donated by William Etra, X1119.93

Sub-assemblies and components

Apple Computer, Inc. Apple II networking board, 1982
Donated by Mitchell Kapor, X1132.93

Dresden University (East Germany) D42/Cellatron 8205 computer power supply boards, 1964
Donated by Prof. Dr. Egon Hörbst, X1122.93

International Business Machines Corporation IBM 3081 multilayer, multichip carrier, 1981
Donated by Evan E. Davidson, X1120.93

Zuse (West Germany) Z 23 transistor logic board, 1961
Donated by Prof. Dr. Egon Hörbst, X1123.93

Unknown manufacturer (East Germany) reverse-engineered workstation board, ca. 1984
Donated by Prof. Dr. Egon Hörbst, X1121.93

Memories

Integral Peripherals, Inc. Mustang 1820 20 megabyte 1.8" hard drive, 1992
Donated by Integral Peripherals, Inc., X1115.93

Transducers

Apraphulian binary computer model, 1988
Donated by Rachel Freedman, X1117.93

International Business Machines Corporation 5 1/4" DemiDiskette Module product test version
Donated by Jeffrey Young, X1140.93

Koala Technologies, Inc. KoalaPad, touch tablet for the Apple II, 1983
Donated by Mitchell Kapor, X1126.93

Ephemera

Integral Peripherals, Inc. model of subminiature hard drive, 1992
Donated by Integral Peripherals, Inc., X1116.93

RCA Corporation Spectra 70 tie clip, ca. 1973
Donated by David W. R. Brown, X1138.93

Software

Lotus, Inc. 1-2-3 DOS release 1.0, 1982
Lotus, Inc. Symphony, 1984
Lotus, Inc. Jazz release 1.01, 1983
Microsoft Corporation Softcard release 1.0, 1980
Donated by Mitchell Kapor, X1133.93-X1136.93

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The Computer Museum

Photo: Keith Quenzel/FAYFOTO

Ken Olsen celebrates Digital Equipment Corporation's gift of the building to the Museum with Trustees, Overseers and friends.

It gives me great pleasure to look back at the last twelve months as I complete my first year as Chairman of the Board of Trustees. This year we implemented a new governance structure with the establishment of a Board of Trustees and a Board of Overseers, each of which is working diligently and enthusiastically for the Museum.

Photo: David Bohl

Chairman of the Board Charles A. Zraket explores The Walk-Through Computer™ with young visitors.

The financial statements on page 6 record a large increase in operating activity, reflecting expanded educational programs. It is gratifying to note that we kept revenues ahead of expenses to realize a small operating surplus this year.

This banner year also capped our first decade in Boston. The pages that follow tell the remarkable story of the Museum's development, first with a report on the decade by Oliver Strimpel, our Executive Director, and then with a pictorial timeline from 1984 to 1994.

On behalf of the entire Board, I extend thanks to all the individuals, corporations, and foundations who committed hard work and funds to build and nurture this special institution. I hope you will all be with us as we enter our second decade.

Charles A. Zraket
Chairman of the Board of Trustees

Ten years ago,

the Museum took the plunge, and moved from a secure corporate nest within a Digital Equipment Corporation building in Marlboro to Museum Wharf on Boston's waterfront. The Museum's 10-strong staff led by Gwen Bell took less than a year to complete the move and open five new exhibit galleries. This initial set of galleries pointed the way for the Museum's development; the SAGE, Univac, IBM 1401 and Seymour Cray exhibits were primarily historical. *The Computer and the Image*™, on the other hand, explored a key application of computing—computer graphics and image processing—exploiting hands-on interactive stations, film, video, and artifacts.

From the Executive Director
1984-94

Today's exhibits reflect the increasing impact of computing on many aspects of life. The exhibits have become more interactive—more than 125 interactive stations today compared to 25 a decade ago. But the most significant change took place in 1990 when *The Walk-Through Computer*™ became the symbol for the Museum in the minds of children around the country. Appearing on the "Today" show and on "Sesame Street," the Museum's friendly giant continues to attract young visitors from around the world.

Five years ago, the Museum's Board laid out a strategic plan for the exhibits in which three themes would be addressed in the permanent exhibits: the evolution of computing; computer technology and how it works; and the applications and impact of computing. *The Walk-Through Computer's* extraordinary size invites visitors to discover the elements of computer technology; *PEOPLE AND COMPUTERS: Milestones of a Revolution*™ reveals the effect of computers on employment and recreation with vignettes supplemented by period film footage. *ROBOTS & OTHER SMART MACHINES*™ and *TOOLS & TOYS*™ indulge visitors' desire to engage with a wide range of computer uses, from robotics and expert systems to music and games. The 1994 *NETWORKED PLANET*™ exhibit gives visitors a chance to try out the much touted "information highway" for themselves with the help of computer-based "network guides." Over the past decade, the Museum has enriched the permanent exhibit experience with a panoply of special exhibits. Topics have ranged from computer art to digital views of Earth from satellites. Taken together, the Museum's 30,000 square feet of exhibitions offer a uniquely accessible introduction to a technology that is fast becoming ubiquitous.

Since 1984, the Museum has expanded the impact of its exhibits in several dimensions. On-site, the number of visitors has tripled. Beyond our walls, copies of our exhibit interactive software reach over a million people a year in other museums. The video "How Computers Work," based on *The Walk-Through Computer*, serves tens of thousands of students. And the Museum's travelling exhibits on pocket computing and satellite digital imagery of Earth have been on display in over 20 other museums.

An important milestone

was the opening of *The Computer Clubhouse*™, an innovative learning environment in which children engage in open-ended computer-based projects. The *Clubhouse* has forged a connection for the Museum with several underserved communities of Boston. Kids from housing projects are in the *Clubhouse* almost every day experimenting with multimedia tools and building interfaces for robots—acquiring skills that could affect the course of their lives.

In 1984, the Museum's historical collections of computing were already one of the world's finest. In the past decade many important acquisitions have been added. The Univac 1, IBM 360, Cray 1 and Xerox Alto are examples. In 1986, the Museum held an international early model personal computer contest which yielded nearly a hundred significant additions including the Micral, Apple 1, and TV Typewriter. The Museum's collections have continued to perform valuable rescue missions, saving important items from destruction. A good example is the JOHNNIAC named after John Von Neumann. This 1953 one-of-a-kind computer was rotting in a parking lot in Los Angeles until we flew it to Boston. The machine is now beautifully restored, with the help of the original project engineer, Ray Clewett.

Artifacts represent only one facet of the historical record; the past decade has seen a strengthening of our document, video, photograph and book collections. Video of computers in use and pioneers telling their own stories serves as an especially useful aid to interpretation owing to the relative inscrutability of the Museum's collections. Our video collection was greatly enriched with the acquisition of the collections assembled by WGBH-TV, the PBS station in Boston, during their research for "The Machine that Changed the World" television series. In 1994, the collections include nearly 1,200 artifacts, 570 film and video titles, and 4,000 photographs.

A very significant achievement of the decade has been the tripling of the Museum's operating budget *(see Chart 1)* and the diversification of the Museum's support. The Museum owes its existence to the far-sighted and generous support of Digital Equipment Corporation, which provided well over half the Museum's funding in 1984. In 1994, over 50 different sources each provided more than $10,000 of annual support, with no single source accounting for more than 2% of operating revenues *(see Chart 2)*.

An increasing proportion of the Museum's backing comes from beyond Massachusetts, showing an appreciation for our mission nationwide. This geographical reach is reflected in the Museum's visitors, of whom over half come from beyond Massachusetts.

chart 1

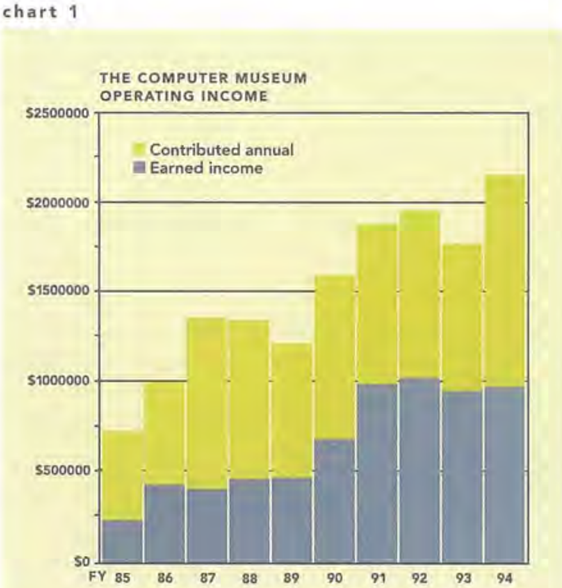
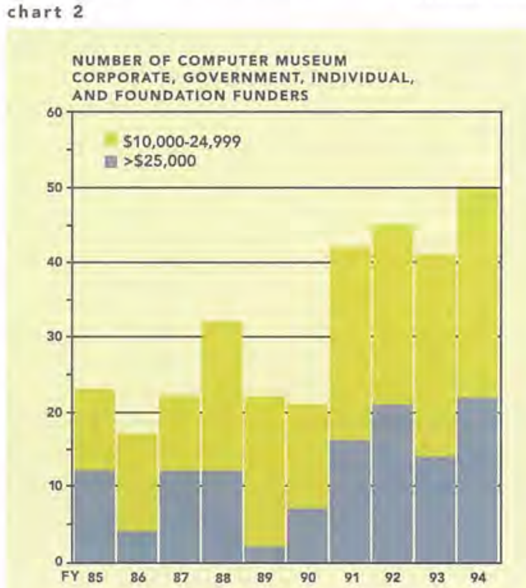


chart 2



THE COMPUTER MUSEUM, INC. BALANCE SHEET/JUNE 30, 1994

	Operating Fund	Capital Fund	Endowment Fund	Plant Fund	Total 1994
ASSETS					
Current Assets					
Cash and cash equivalents	$351,494				$351,494
Receivables and other assets	236,536			18,000	254,536
Store inventory	52,403				52,403
Interfund receivable		417,222			417,222
Total Current Assets	640,433	417,222		18,000	1,075,655
Other Assets					
Restricted cash equivalents			250,000		250,000
Property and Equipment					
Equipment and furniture				344,471	344,471
Capital improvements				960,401	960,401
Land and building				1,603,221	1,603,221
Exhibits		352,279		4,078,754	4,431,033
		352,279		6,986,847	7,339,126
Less - accumulated depreciation				(3,735,002)	(3,735,002)
Net Property and Equipment		352,279		3,251,845	3,604,124
TOTAL ASSETS	640,433	769,501	250,000	3,269,845	4,929,779
LIABILITIES AND FUND BALANCES					
Current Liabilities					
Accounts payable and other current liabilities	146,281	68,870			215,151
Deferred revenue	126,654	388,206			514,860
Interfund payable	417,222				417,222
Total Current Liabilities	690,157	457,076			1,147,233
Bond Payable				509,333	509,333
Fund Balances					
Unrestricted	(49,724)				(49,724)
Restricted		312,425	250,000		562,425
Net investment in plant				2,760,512	2,760,512
Total Fund Balances	(49,724)	312,425	250,000	2,760,512	3,273,213
TOTAL LIABILITIES AND FUND BALANCES	$640,433	$769,501	$250,000	$3,269,845	$4,929,779

STATEMENT OF ACTIVITY AND CHANGES IN FUND BALANCES for the year ended June 30, 1994

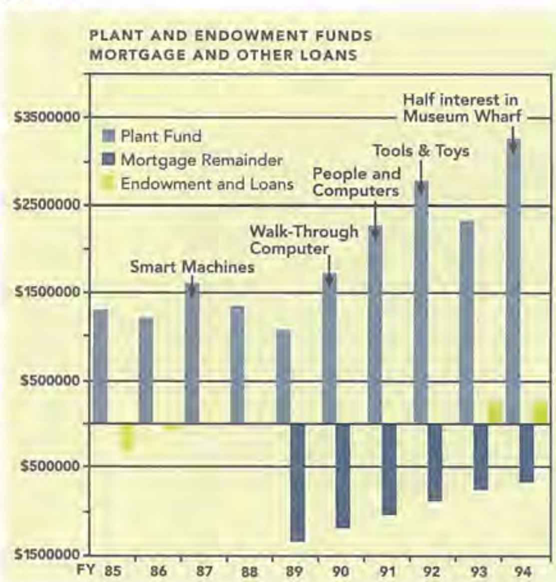
	Operating Fund	Capital Fund	Endowment Fund	Plant Fund	Total 1994
SUPPORT AND REVENUE					
Unrestricted gifts	$714,876			$1,013,888	$1,728,764
Restricted gifts	341,903	534,545			876,448
Memberships	187,903				187,903
Admissions	504,541				504,541
Auxiliary activities	482,418				482,418
Miscellaneous	7,752		6,382		14,134
TOTAL	2,239,393	534,545	6,382	1,013,888	3,794,208
EXPENSES					
Exhibits and programs	512,366	18,761			531,127
Marketing and membership	390,867				390,867
Depreciation				772,731	772,731
Supporting services:					
Management and general	267,465				267,465
Fund raising	201,901	133,883			335,784
Occupancy	307,101	46,977			354,078
Auxiliary activities	507,233				507,233
TOTAL	2,186,933	199,621		772,731	3,159,285
EXCESS (DEFICIENCY) OF SUPPORT AND REVENUE OVER EXPENSES	52,460	334,924	6,382	241,157	634,923
FUND BALANCES, BEGINNING OF YEAR	(108,566)	162,804	250,000	2,334,052	2,638,290
ADD (DEDUCT) TRANSFERS					
Equipment purchase		(105,303)		105,303	
Bond repayments		(80,000)		80,000	
Investment income	6,382		(6,382)		
FUND BALANCES, END OF YEAR	$(49,724)	$ 312,425	$250,000	$2,760,512	$3,273,213

Corporate support has grown

beyond the computer industry to corporations and businesses that rely critically on computers, such as telecommunications companies, banks, insurance companies, accounting firms, and law firms. Federal foundations, including the National Science Foundation and the National Endowment for the Humanities, and national private foundations, such as the Alfred P. Sloan and Hearst Foundations, have added their support to our exhibit, outreach, and educational programs.

The culmination of the decade of growth and consolidation came in 1993 with Digital Equipment Corporation's gift of the building. The Computer Museum now owns a half interest in Museum Wharf, the building and land we share with the Children's Museum. Chart 3 shows the impact of the gift on the Museum's assets, as well as gradual reduction in the Museum's mortgage liability and the establishment of an endowment fund.

chart 3



Starting in 1988, The Computer Bowl® event and PBS television program, airing on 288 stations in the USA and in 200 countries around the world, has become the bi-coastal event for the computing community to have fun, socialize, and raise money for the Museum. Its success owes a great deal to dedicated Silicon Valley volunteers. "Grass roots" support has been mirrored by an increase in the number of West Coast Board members. Last year we opened a Museum office in Menlo Park, CA to further build our Silicon Valley relationships.

The maturing of the Museum has led to an evolution in governance. As the decade advanced, the number of Board members swelled from 24 to 46. Active committees grew from the core Executive, Nominating, Collections, and Finance committees to include Exhibits, Education, Marketing, Development, Computer Bowl, Publishing, Licensing, and Audit, as well as committees for special development or exhibit initiatives. As the Board approached fifty members, it became apparent that the Museum would benefit from a twin Board structure. A 25-person Board of Trustees was therefore created to maintain the fiduciary responsibility for the Museum's governance, and a diverse Board of Overseers was established as a formal body of high-level volunteers with connections to various communities, industries, regions, or other special groups. A record number of senior volunteers now actively help the Museum in all of its endeavors.

Complementing our growing volunteer community is a team of staff who have become more professional and experienced each year. The Museum now has 45 employees, many of whom are seasoned experts in their fields. Through regular presentations at national museum and education conferences, the Museum is recognized as a leader in interactive exhibitry and informal education about computing.

The Museum's second decade promises to be even more exciting as the Museum continues to exploit and explain the new technologies which are both its medium and its message. Perhaps my retrospective on our second decade will reach you through a wireless network that connects to a universal communications device in your pocket. And perhaps you will respond with your reactions and ideas for our future just as easily. For the present, I invite you to respond by e-mail, and to explore our Gopher and World-Wide Web servers on the Internet. I hope you will join with us in making our second decade an even bigger success than the first.

Oliver Strimpel

Oliver Strimpel
Executive Director
strimpel@tcm.org

FY85

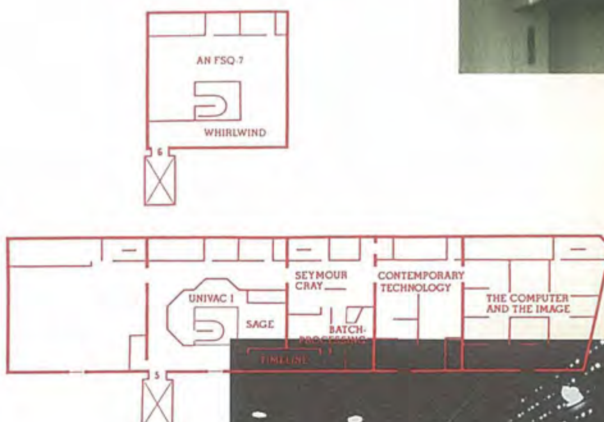
Chairman of the Board John William Poduska, Sr., helped the Museum make the transition from its first home at Digital Equipment Corporation in Marlboro, Massachusetts, to Museum Wharf in Boston.


Photo: Bachrach

Moving into Museum Wharf: all able bodies were used to heft the SAGE Air Defense System console carefully into the elevator for display.


Photo: Meredith Stelling

The exhibitions included Whirlwind, and two floors of the SAGE, AN/FSQ 7; a timeline for the 1950s through the 1970s; an IBM 1401 installation; Seymour Cray's machines; chips and manufacturing; and *The Computer and the Image*, better known as the "graphics gallery." By 1993, none of the original exhibits was left.



Installed, the SAGE console's lights were programmed to simulate the machine in operation.


Photo: Bill Gallery

A visitor punches cards at the IBM 1401 exhibit. This interactive was popular but hard to maintain. Over the span of six years, about ten card punch machines were demolished by use.


Photo: Lou Goodman

The graphics gallery featured seven interactives on different platforms. Andy Kristoffy, research assistant for graphics, is using a Masscomp minicomputer to recolor his face according to the reflectivity of light. This technique was used in medical imaging to show bone fractures.


Photo: Lou Goodman

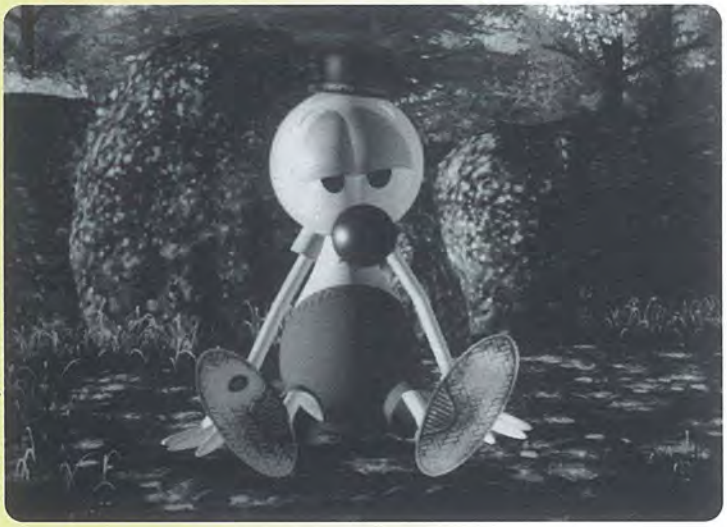


Photo: courtesy of Lucasfilm Ltd.

FY86

The Animation Theater in the graphics gallery started the Museum on a series of programs featuring computer-generated films. These have continued to fascinate visitors to the present day. Here André, one of the first fully three-dimensional models, is waking up. He was created in the 1984 film "André & Wally B." by the team that was to form Pixar.

Photo: Lilian Kemp

On COBOL's 25th anniversary, its premature tombstone was given to the Museum. Left to right: Oliver Smoot, CODASYL Committee Secretary Thomas Rice, current COBOL Committee Chairman Donald Nelson, Commodore Grace M. Hopper, Michael O'Connell and Howard Bromberg. Bromberg was the originator of the tombstone in a fit of frustration with the committee work on the original COBOL specifications. The COBOL Tombstone is on view in the gallery, *PEOPLE AND COMPUTERS: Milestones of a Revolution*.

Bill Gates' Teletype tape to input the BASIC interpreter for the Altair was added to the collection. This BASIC interpreter became a *de facto* standard for microcomputers.

Photo: Jerry Rabinowitz

For a Mouseathon at the Museum, teams built microprocessor-based robots to find their way through a maze to the cheese. The competition was between a set of Japanese mice and three mice brought by Dr. John Billingsley of England.

J. Presper Eckert and Kay Mauchly cut the birthday cake for the ENIAC's 40th, February 13, 1986.

FY87

Smart Machines™, the first new gallery since 1984, opens. Donors Gordon Bell and Russell Noftsker cut the ribbon at the June 18th opening.

Photo: FAYFOTO

Twenty-five historic robots were assembled for the *Smart Machines Theater* including Shakey, the first mobile sensing robot, and NASA's Mars Land Rover.

Photo: Duane Winfield

Oliver Strimpel, Director of Exhibits, hangs a drawing by Harold Cohen in the exhibit.

Photo: Dan McCoy/Rainbow

On One Hand™, an exhibition on the history of pocket calculating, was the Museum's first traveling exhibit. For better understanding, the pocket-sized Napier's Bones were built giant-size. The Smithsonian Institution Traveling Exhibition Service traveled this show to a dozen sites around the USA.

Colors of Chaos: A Special Exhibit of images generated by Heinz-Otto Peitgen and Peter Richter, University of Bremen, and Robert L. Devaney, Boston University.

The Mandelbrot Set, courtesy of Benoit Mandelbrot/IBM

The winners of the Personal Computer Competition and their machines. From the left: Robert L. Blankenbaker built the earliest personal computer available for resale, the 1971 Kenbak-1. Robert Pond, an Altair 8800 hobbyist, maxed out this machine. Lee Felsenstein built the first implementation of a memory-mapped alphanumeric video display for personal computers. Thi Truong of France created the Micral, the earliest commercial non-kit computer based on a microprocessor.

Photo: Jerry Rabinowitz

FY88

Photo: Linda Holekamp

Gardner Hendrie becomes the third Chairman of The Computer Museum's Board of Directors.


Photo: Arthur Riehl

A UNIVAC 1, located in the garage of Mrs. Sarah Lawson in Goodlettsville, Tennessee, was donated to the Museum. Students of Professor Arthur Riehl of the University of Louisville and Dr. John McGregor, Murray State University, refurbished the computer for display.

The UNIVAC was the first commercial computer; only 50 were made. Its fame came from correctly predicting Eisenhower's landslide election victory in 1952. In fact, at that time "univac" was synonymous with "computer"and people referred to "IBM univacs."

Photo: Linda Holekamp

Education Coordinator Michael Chertok takes a robot workshop on the road to classrooms throughout New England.


Photo: Jerry Rabinowitz

At the Museum's celebration of 25 Years of Computer Games, Peter Reynolds and Tom Snyder coax a young voyager into "The Halley Project."


Photo: Jerry Rabinowitz

Alan Kotok, Shag Graetz, and Steve "Slug" Russell at the PDP-1 playing "SpaceWar!," the game they wrote 25 years before, at the Museum's games celebration.

FY89

At the First Computer Bowl, the East Coast team of Richard Shaffer, Esther Dyson, David Hathaway, Mitch Kapor and Bill Poduska beat the West Coast team of David Bunnell, Adele Goldberg, Bill Joy, Allen Michels and Casey Powell. From the left: Michels, Powell, Bunnell, Goldberg, Poduska, Hathaway, Shaffer, Kapor, Dyson.

Photo: Martha Everson

Computer Art in Context: SIGGRAPH '89 Art Show opened June 30th for a six-month stay. A full-color catalog published by *Leonardo* featured 14 articles and all the works in the show.

Thoughts of the Moon. ©1988 Barbara Nessim

Flower Power. ©1988 Hiroshi Kamoi

Terra Firma in Focus, an exhibit on the art and science of digital satellite imagery, opened in the Museum and then went on to travel the country under the auspices of the Association of Science and Technology Centers.

Photo: SPOT Image Corporation

Nobel laureate Arno Penzias (on the ladder) installs *Capricious Constellation*, the mobile sculpture he did jointly with Lillian Schwartz (standing on the far right) and Alan Kaplan (not shown). Greg Welch, Dan Griscom, and Oliver Strimpel of the Museum watch in awe.

Photo: Linda Helekamp

Robot building workshops brought parents and children together for project-based learning.

Photo: Michael Chertok

FY90


Photo: ©1990 Jack McWilliams Photography


Photo: ©1990 Seth Resnick

Oliver Strimpel becomes Executive Director and realizes his dream exhibit, *The Walk-Through Computer*. The biggest project of the Museum to date involved a devoted team. Richard Fowler from Great Britain's National Museum of Photography, Film, and Television signed on as designer. David Macauley, famous for his books on the way things work, did the illustrations.

Jon Palfreman and Nancy Linde from WGBH-TV and Dean Winkler from Post Perfect Productions combined talents on the Software Theater. Drew Huffman from Paracomp animated many of the segments inside the chips and disk drive. A multi-talented staff and plethora of advisors and volunteers kept the project on schedule to open June 23.


Photo: Richard Fowler


Photo: Richard Fowler

The keyboard is swung into position.

The giant power plug outlet is delivered.

The Walk-Through Computer monitor is installed.


Photo: FAYFOTO

Photo: FAYFOTO

Mitchell Kapor is one of the first to use the trackball.

Oliver Strimpel shows the CPU to Intel's Clif Purkiser, Ann Lewnes, and Jim Jarrett.


Photo: Ed MacKinnon

The West Coast Team won the Second Annual Computer Bowl, April 27, 1990. From the left: PC Letter Editor Stewart Alsop II, Microsoft Corporation Chairman Bill Gates, venture capitalist John Doerr, Chuck House of Hewlett-Packard, and Larry Tesler of Apple.

FY91

PEOPLE AND COMPUTERS: Milestones of a Revolution was a realization of the Museum's history exhibition. Joe Thompson returned to Boston from California to relive his experiences as an original operator of MIT's Whirlwind computer. Joe is immortalized as a manikin in the exhibit.

Photo: Gregg Silverio/FAYFOTO

J. Presper Eckert with the console of the UNIVAC 1 computer, based on his design for the ENIAC and EDVAC. The UNIVAC 1 was the first commercial computer available in the USA.

Photo: Gregg Silverio/FAYFOTO

Programming languages specialist Jean Sammet and the Tower of Babel in the milestone that highlights the evolution of high-level languages, such as COBOL and FORTRAN.

Photo: Gregg Silverio/FAYFOTO

Three of the members of the IBM System/360 team, Gene Amdahl, Dick Case, and Bob Evans, hide the console of the computer that brought computing into the mainstream of the business world.

Photo: Gregg Silverio/FAYFOTO

PDP-8 engineer Gordon Bell (on right) with neurophysiologist Dr. Truett Allison (on left) who modified the system for use in the operating room at Yale Medical School and West Haven VA Medical Center, Connecticut.

Photo: Gregg Silverio/FAYFOTO

The Third Annual Computer Bowl was played on the West Coast in the San Jose Convention Center, but the East Coast team recaptured this prize. Captained by author Pamela McCorduck, the team included John Armstrong of IBM, Sam Fuller of DEC, James Clark of NCR, and John Markoff of The New York Times.

Photo: Joe Czop

FY92


Photo: FAYFOTO


Photo: Neal Hamberg

Boston Computer Society Chairman Jonathan Rotenberg (second from right), who initiated plans for *TOOLS & TOYS: The Amazing Personal Computer*, helps exhibit sponsor Mitch Kapor, chairman, Electronic Frontier Foundation (far left), cut the ribbon during the June opening. Oliver Strimpel and Gardner Hendrie, chairman of the Museum's Board (far right), look on.

TOOLS & TOYS' colorful design and engaging applications immediately drew young people and groups.


THE WALL STREET JOURNAL MONDAY, NOVEMBER 11, 1991

Some Computers Manage to Fool People At Game of Imitating Human Beings

Restricted Topics

Key Words Bring Canned Replies

The Computer Museum's Loebner Prize Competition based on a limited version of the Turing Test was one of the Museum's most widely covered events.


Photo: Ed MacKinnon

Bill Gates, chairman of Microsoft Corporation, asks the questions at the Fourth Annual Computer Bowl, played on the East Coast. ("Computer Chronicles" Host Stewart Cheifet is on the right.)


Photo: Ed MacKinnon

Captain John F. "Future" Shoch of the West (holding the trophy) noted, "It's no surprise the West Coast team, so clearly superior in bytes, brains and brawn, has captured The Computer Bowl." Team members included (from the left) Vern "The Ace" Raburn, Jeffrey "The Killer" Kalb, Ruthann "The Mighty" Quindlen, and John E. "Knock Knock" Warnock.


Photo: Courtesy of Intel Corporation and Sense8

A weekend of "virtual reality" in April featured networked VR on a personal computer. People lined up outside the doors, breaking previous attendance records.

Photo: Linda Holekamp

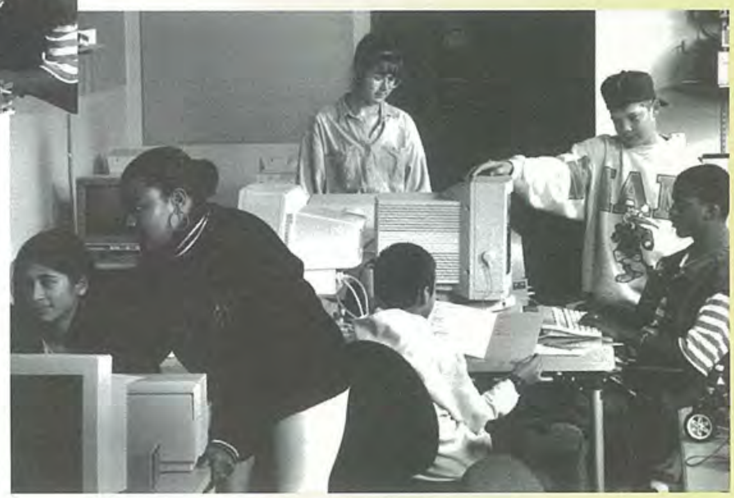
Former Celtics' star Dave Cowens (on the right) joins Museum Exhibit Engineer Dan Griscom at the *How Tall Are You?*™ exhibit, one of 14 licensed exhibits that have been distributed to 18 museums and centers in the United States, Mexico, the United Kingdom, and Japan.

FY93

The enhancement of *Smart Machines* featured new installations and interactive exhibits and upgraded the best existing interactives. Before the opening,150 students in a project involving The Wang Center and the Museum shared their robotic creations with J. F. Engelberger, the "father of modern robotics." From the left: Engelberger, Ullanda Dennis, Marna McNulty, Melissa Almeida.

The Computer Clubhouse is launched for underserved youth, aged 10-16. Some young people from Dorchester, Mass., create computer-controlled LEGO devices.

Guided by Clubhouse mentors, these young people use powerful computer tools with real-world applications to work on their own projects.



Part of transforming *Smart Machines* into *ROBOTS & OTHER SMART MACHINES* was the arrival from the Smithsonian of "R2-D2"™, the original robot costume of the "Star Wars" character.

The Overnights Program enables kids to participate in games and educational activities, while camping out in the galleries (as some Futurekids did in The Walk-Through Computer).

Photo: Eileen Knight

In the Fifth Annual Computer Bowl in San Jose, West Coast Captain Harry Saal (hoisting the trophy) led his team to victory. He explains, "It's final proof that Westerners 'Excel' over the 'Lotus'-eaters from the East." He is joined by Lisa Thorell, Michael McConnell, Jerry Kaplan and Jean-Louis Gassée.

Photo: Joe Czop

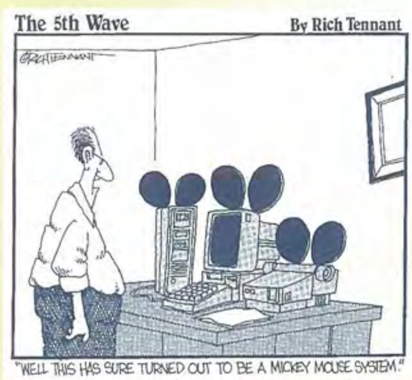
FY94

Photo: ©1993 David Bohl

Charles A. Zraket becomes the Museum's fourth Chairman of the Board. Here he introduces students from Montclair Elementary School, Quincy, to The Walk-Through Computer. From the left, they are: Brian Stock, Loan Vu, Cindy Chou, Joseph Cronin, Sarah White, Jessica Pierre.

Photo: Krystyna Wiekiewiczz

Grandmaster Joel Benjamin captures the title for the 4th Harvard Cup: Human vs. Computer Chess Challenge. Although application speed and performance improved, the computer team won only 25 percent of the total points.



The Museum provides a light-hearted look at our lives with computers in an exhibit of 50 irreverent drawings by cartoonist Rich Tennant.

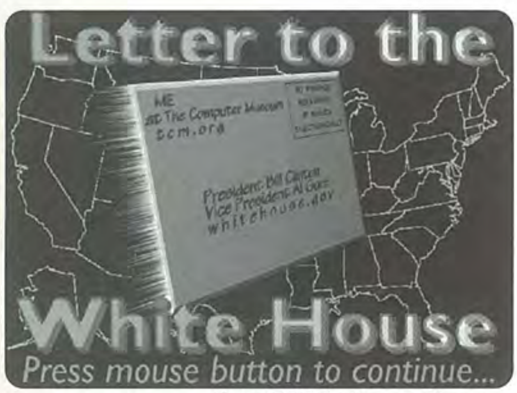


Photo: ©1993 The Computer Museum

Letter to the White House™ enables visitors to send an electronic message to President Clinton and Vice President Gore, then see how it is routed through the web of machines that are part of the Internet. The exhibit was a prototype for *THE NETWORKED PLANET,* opening November 1994.

Photo: Keith Quenzel/FAYFOTO

Ten years after moving to Museum Wharf, Ken Olsen and Oliver Strimpel celebrate the transfer of Digital Equipment Corporation's leasehold ownership of the building to The Computer Museum.

Photo: Vera Kark

Thumbs up for the East Coast who defeated the West 190-150 in The Computer Bowl All-Star Game. This contest pitted the Most Valuable Players of past Bowls against each other. Captain Mitch Kapor is flanked by Neil Colvin, Bob Frankston, Pamela McCorduck and David Nelson. They faced Captain Bill Joy, Bill Gates, David Liddle, Jeff Kalb, and Harry Saal from the West.

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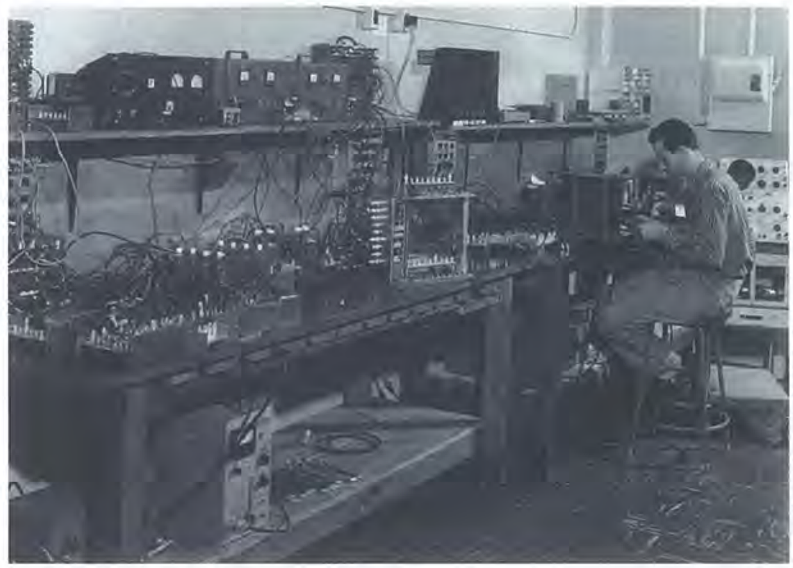
Photo: from the Historical Collection

This photo from the Museum's collection shows Sylvian Ray testing core planes in 1959.


Photo: from the Historical Collection

This 1952 photograph from The Computer Museum's collection shows the first General Purpose machine designed and built by Computer Research Corporation. It was developed under contract from the Air Force Cambridge Research Labs as part of their plan to investigate digital computers to help solve the United States' air defense problem. The man on the left is Dick Dabney, the first President of CRC. On the right is Don Eckdahl, also of CRC.

THE SIXTH COMPUTER BOWL 1994

A one-of-a-kind fundraising event to benefit the Museum's educational programs, The Computer Bowl plays out the legendary East/West Coast high-tech rivalry in a contest of computer knowledge. Since 1988, the Bowl has raised more than $4.4 million in donations and in-kind support. It attracts the support of hundreds of sponsors and enthusiastic volunteers, as well as media coverage from around the world. The Sixth Computer Bowl would not have been possible without the support of those listed below.

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Photo: Keith Quenzel/FAYFOTO

In the *Computer Clubhouse*, young people use powerful computers to create their own computer animation.

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Photo: David Bohl

• To **educate** and inspire people of all ages and backgrounds from around the world through *dynamic* exhibitions and programs on the technology, application, and impact of *COMPUTERS*.

• To preserve and celebrate the history and promote the understanding of computers worldwide.

• To be an international resource for research into the history of computing.

MUSEUM HOURS
Winter: Tuesday-Sunday, 10am-5pm
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$7.00 adults; $5.00 students, children 5-up, and seniors
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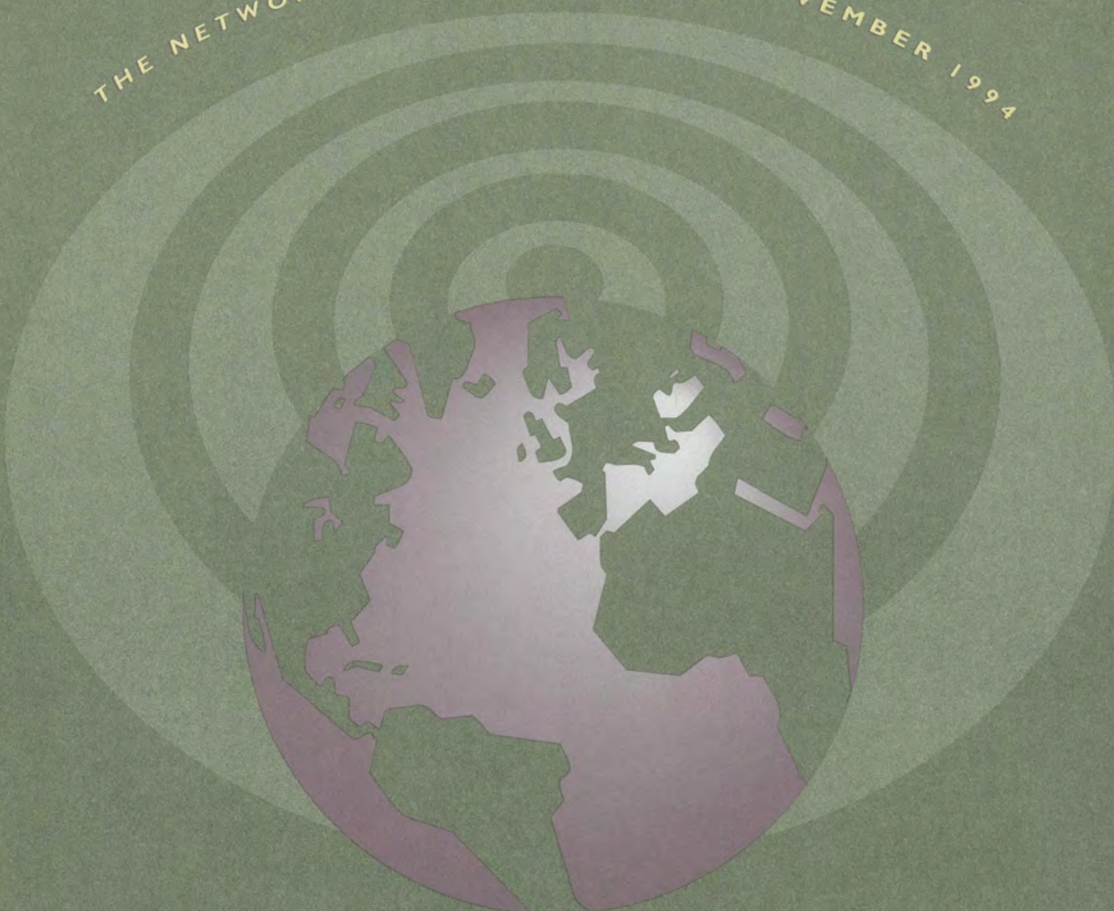
THE COMPUTER MUSEUM

THE NETWORKED PLANET OPENED NOVEMBER 1994



Annual Report FY'95

EXPANDING OUR HORIZONS

Looking back on a year rich with accomplishment, one theme in particular strikes me—that of the Museum expanding its reach, in distinct but interconnected ways.

First, the Museum extended itself beyond its usual domain of superbly crafted interactive exhibits by surprising—and delighting—visitors with two exhibits on computers and art. Witness our highly successful *Robotic Artist: AARON in Living Color* exhibit, as well as our collaboration with the DeCordova Museum in Lincoln, Mass., on *The Computer in the Studio* art show.

Second, with the launch of *The Networked Planet*™ exhibit, we welcomed telecommunications corporations to our family of supporters. The exhibit, which reflects the close relationship of computing and communications, continues to attract a steady stream of visitors eager to learn about networks.

Similarly, *The Networked Planet* drew on support and conceptual development from the international corporate community. While physically in Boston, the Museum is now truly without global boundaries in its friendships. (And we shall work hard to make these borders vanish even further in the coming year, as we leave an ever-larger Museum imprint in cyberspace!)

None of this could happen without the most generous help of the Museum's many supporters. On behalf of our entire Board, I offer heartfelt thanks to you all.

Charles A. Zraket

Charles A. Zraket
Chairman of the Board of Trustees

Photograph: David Bohl

The Year of the Internet

The Computer Museum launched itself into "cyberspace" this year, chronicling and exploiting the surge of global networking that is taking the world by storm. In November, we opened *The Networked Planet,*™ a major permanent exhibition on global networks that takes the mystique out of "The Information Highway" by revealing the technology and social effects of telephone, financial, transportation, weather, retail, and medical networks, as well as the Internet. In an extraordinary collaboration with our sponsors, the Museum was able to offer visitors high-bandwidth connections to the Internet, providing one of the first public-access sites to the World Wide Web. This issue's cover story describes the project in detail.

The Museum's T1 link to the Internet not only enabled visitors at the Museum to "surf" the Web, but also, for the first time, opened up the Museum to remote visitors from around the world. Our Web site, <http://www.tcm.org/>, went live in January, offering the Internet Sampler, the first example of an interactive exhibit to become available to remote users. The site also features over 100 pages of information about the Museum, including this issue of The Computer Museum *Annual.*

This screen capture shows the home page of the Museum's current Web site.

The Computer Clubhouse, the Museum's open-ended exploration space for inner-city 10- to 15-year-olds, is also an online leader. Demonstrations of the kids' skill can be seen in the ever-changing online art show, <http://www.tcm.org/clubhouse/projects/gallery/>, also featured at SIGGRAPH 95.

A two-year grant from the National Science Foundation is enabling the Museum to explore the wider possibilities of an Online Computer Museum (OLCM) to make exhibition and collections resources available to anyone with Internet access. At a March workshop, experts from industry, academia, and the media developed guidelines for the OLCM. Three primary uses were foreseen. First, the OLCM can provide a surrogate visit, especially for people unable to get to the Museum in person. But it was recognized that in order to be effective, exhibition materials will require "re-curating" for the online medium. Second, the OLCM can help prospective visitors plan a visit to the onsite museum, serving as a customized "electronic brochure." Third, the OLCM can offer an in-depth view of collections and exhibitions that goes beyond the material available in the onsite gallery. Students and researchers will likely value this.

The Museum's ever-popular benefit, The Computer Bowl,® also ventured into cyberspace last year with each coast's team remaining on their home turf, responding in real time to questions from the questioner in "Virtual Kansas." (See page 18.) And, in partnership with ONSALE Interactive Marketplace, the Museum conducted one of the first-ever charity auctions on the Web. The sale of 134 items garnered world-wide exposure for the donors and offered bidders from around the world a unique and entertaining experience. The excitement of the auction room was recreated online, with the server taking over 10,000 hits per hour as the close of bidding approached.

Artifacts, consisting as they do of atoms rather than bits, cannot be placed online. But, increasingly, the Museum's collections will feature bits: images, documentation, film and video, and software, all of which can be stored and disseminated online. The first item to be placed online in this way is the archive of the MsgGroup, one of the first ARPAnet mailing lists, which, between 1978 and 1986, addressed almost every issue regarding the design and use of electronic mail. The Museum also started an occasional e-mail letter for the international community interested in the collections.

This year the Museum took advantage of the Net to augment informal and frequent communication with its community of members and supporters and to perform administrative tasks such as renewing memberships and booking functions. The Museum's volunteer boards and committees that span the world are now connected instantaneously via electronic mail. And job candidates have competed successfully for staff positions that were posted online.

While these forays into cyberspace were taking place, the Museum had its best-ever onsite year with a record number of visitors in the flesh. The big draws were *The Networked Planet* and, in April, a quintessentially onsite exhibition of Harold Cohen's color painting machine. This one-of-a-kind installation was a tour de force of art, artificial intelligence, and robotics. Featured live on both the *Today Show* and *CBS This Morning, AARON* captured the imagination of kids and adults alike. (See article on page 10.)

This year the Museum maintained its fast-paced exhibit development program, raising nearly $1 million for the all-new *Walk-Through Computer™ 2000.* During the year, we completed the exhibit's planning, posting concept sketches on the Web site (see <http://www.tcm.org/tcm/uc/>). The strong support of industry leaders in Silicon Valley, especially principal sponsors Cirrus Logic and Intel, has been critical to the success of this unique educational project.

It is very gratifying to report that the ranks of Museum supporters grew last year: Thirty-seven corporations joined the Museum as new members, and the Friends, the group of the Museum's $1000/year-and-above supporters, grew to 74 individuals. Your generous contributions, both intellectually and financially, combined with good earned revenue results, enabled the Museum to conduct its fullest range of programs ever while maintaining an operating surplus.

Exhibits, education, collections management and preservation—each area will offer a rich program in both real- and cyberspace in the coming year. I hope you will participate with your enthusiasm, ideas, and support so that we can forge ahead and turn ambitious plans into reality.

Oliver Strimpel
Executive Director
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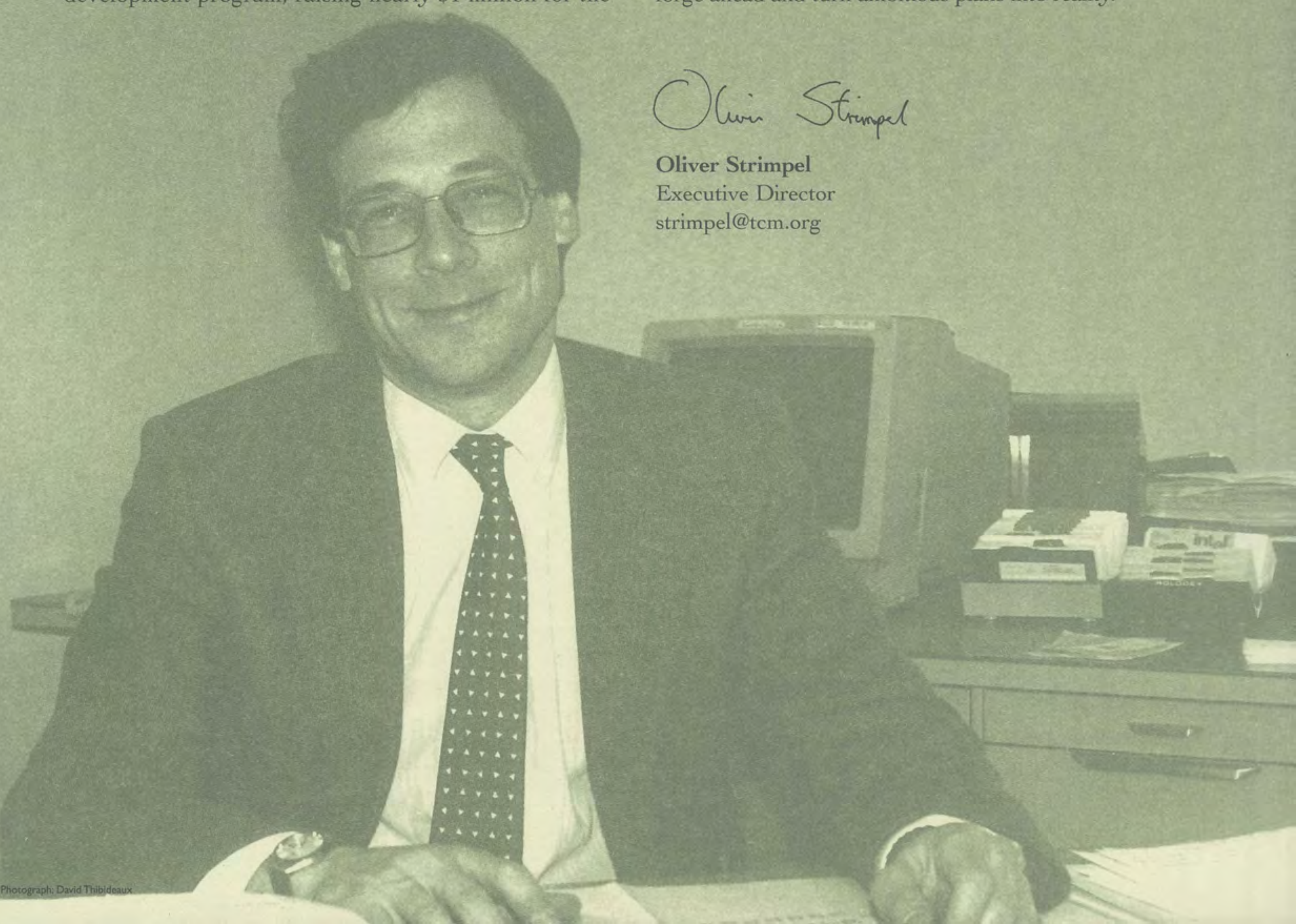


Photograph: David Thibideaux

THE COMPUTER MUSEUM, INC. BALANCE SHEET / JUNE 30, 1995

	Operating Fund	Capital Fund	Endowment Fund	Plant Fund	Total 1995
ASSETS					
Current Assets					
Cash and cash equivalents	$271,682				$271,682
Receivables and other assets	171,532			18,000	189,532
Store inventory	50,191				50,191
Interfund receivable		305,390			305,390
Total Current Assets	493,405	305,390		18,000	816,795
Other Assets					
Restricted cash equivalents			250,000		250,000
Property and Equipment:					
Equipment and furniture				358,271	358,271
Capital improvements				964,245	964,245
Land and building				1,603,221	1,603,221
Exhibits		94,376		5,780,794	5,875,170
		94,376		8,706,531	8,800,907
Less - accumulated depreciation				(4,592,239)	(4,592,239)
Net Property and Equipment		94,376		4,114,292	4,208,668
TOTAL ASSETS	**493,405**	**399,766**	**250,000**	**4,132,292**	**5,275,463**
LIABILITIES AND FUND BALANCES					
Current Liabilities					
Accounts payable and other current liabilities	143,745	13,271			157,016
Deferred revenue	68,879	461,423			530,302
Interfund payable	305,390				305,390
Total Current Liabilities	518,014	474,694			992,708
Bond Payable				429,333	429,333
Fund Balances					
Unrestricted	(24,609)				(24,609)
Restricted		(74,928)	250,000		175,072
Net investment in plant and exhibits				3,702,959	3,702,959
Total Fund Balances	(24,609)	(74,928)	250,000	3,702,959	3,853,422
TOTAL LIABILITIES AND FUND BALANCES	**$493,405**	**$399,766**	**$250,000**	**$4,132,292**	**$5,275,463**

STATEMENT OF ACTIVITY AND CHANGES IN FUND BALANCES FOR THE YEAR ENDED JUNE 30, 1995

	Operating Fund	Capital Fund	Endowment Fund	Plant Fund	Total 1995
SUPPORT AND REVENUE					
Unrestricted gifts	$869,698				$869,698
Restricted gifts	779,899	1,871,253			2,651,152
Memberships	204,390				204,390
Admissions	556,802				556,802
Auxiliary activities	494,842				494,842
Miscellaneous	12,565		10,106		22,671
TOTAL	2,918,196	1,871,253	10,106		4,799,555
EXPENSES					
Exhibits and programs	623,041	430,580			1,053,621
Marketing and membership	341,151				341,151
Depreciation				857,237	857,237
Supporting services:					
Management and general	365,688				365,688
Fundraising	707,268	5,814			713,082
Occupancy	316,842	40,172			357,014
Auxiliary activities	531,553				531,553
TOTAL	2,885,543	476,566		857,237	4,219,346
EXCESS (DEFICIENCY) OF SUPPORT AND REVENUE OVER EXPENSES	32,653	1,394,687	10,106	(857,237)	580,209
FUND BALANCES, BEGINNING OF YEAR	(49,724)	312,425	250,000	2,760,512	3,273,213
ADD (DEDUCT) TRANSFERS					
Exhibits placed in service and equipment purchases	(17,644)	(1,702,040)		1,719,684	
Bond repayments		(80,000)		80,000	
Investment income	10,106		(10,106)		
FUND BALANCES, END OF YEAR	**$(24,609)**	**$(74,928)**	**$250,000**	**$3,702,959**	**$3,853,422**

On November 12, 1994

— our tenth anniversary in downtown Boston — The Computer Museum opened *The Networked Planet,*™ a major 4000-square-foot exhibit on the applications, technology, history and impact of the growing computer network infrastructure that is increasingly becoming part of everyday life.

The exhibit shows how computers, and the networks that connect them, are almost as essential as electricity. Using a variety of hands-on, interactive experiences, visitors learn about all kinds of computer networks, from the telephone system to financial networks to the largest network of all, the Internet.

To achieve this, the Museum turned to leaders in the field of networking, bringing together a veritable "United Nations" of computer and networking technology: a high-speed T1 connection to the Internet provided by Sprint, over 30 Mac AV computers provided by Apple Computer, Novell's Netware 4 networking software to connect all the computers together, a Chipcom hub, routers from both Wellfleet and Cisco, high-end graphic workstations from Sun Microsystems and Hewlett-Packard, and a fault-tolerant Internet server from Stratus. Most of this cutting-edge technology resides in the Network Control Center, where visitors can see how networking technology works in real time and is juxtaposed to an additional piece of hardware, no longer in operation: an original Interface Message Processor (IMP) that served to connect computers on ARPAnet, the precursor to the Internet.

The technology, of course, helped to put into action the many hours of planning, design and programming provided by staff and an army of dedicated volunteers. Our two advisory boards ensured that the content of the exhibit was correct and well-balanced. Experts from NYNEX, S.W.I.F.T. and the Harvard Community Health Plan helped collect and interpret the information that became part of the interactive exhibits.

The result is an exhibit with over 60 computers, high-speed access to the Internet, off-site representation in the form of a World Wide Web site, <http://www.tcm.org.>, and, based on summative evaluations, positive visitor response. Catching the wave of the public's fascination with the "Information Highway," *The Networked Planet* exhibit helped to break The Computer Museum's attendance record for FY '95.

A Trip along the Information Highway

The Networked Planet exhibit is designed as a trip along an information highway, with areas dedicated to applications and the impact of computer networks. But with an exhibition space of just under 4,000 square feet, the exhibit staff and advisors had to make tough decisions about which stops to feature along the highway.

Examples were chosen to illustrate the use of live feeds of information, social and technical issues, the global character of the network, local applications, and subjects that would be of interest to family visitors. Major off-ramps take visitors to a telephone network, a financial network, airline and weather networks, telemedicine, and the Internet. Minor excursions via video kiosks look at other applications, such as retailing, transportation, telecommuting, employee monitoring, and computerized fingerprinting.

To provide perspective, an historical timeline lets visitors zoom from the era when the first telegraph message announced, "What has God wrought?" in 1844 to maps showing the evolution of the ARPAnet into the Internet in the 1980s.

The Visit

After a brief introductory film, visitors are issued key cards, which they use to join the exhibit's local area network. Visitors log on with their name, sex, age, and zip code, and are asked to choose whether they want to keep their information private or public. If they select the "public" setting, the system allows for a "Who's out there?" option, by which they can "spy" — that is, see the location of everyone in the exhibit who is logged on. If they choose "private," no one has access to their information, but they also have no access to other visitors' information.

When visitors log on, they also get to pick one of four "Network Guides," electronic tour guides who provide commentary on the exhibit. The guides, chosen to represent diverse perspectives, tell stories that illuminate technical and social questions. Each gives clues to his or her unique perspective and background so that a visitor can make a choice of the approach of his guide, as well as the option to have subtitles in Spanish. A capsule view of each guide follows.

ERICA, a wife and mother who runs her own business consulting firm from home:

"Computer networks let me run my business from my house, which is great because I'm here when my kids come home from school. But it's not always easy keeping my family life and business separate."

JESSIE, a teenager who by day is a computer programmer, by night a creator of computer games:

"Come fly with me through the computer networks. You can't make reservations, you don't need a passport, and there are no boundaries."

BEATRICE, a book editor in her fifties:

"At the publishing house where I'm an editor, we use computer networks throughout the publishing process. Computer networks have changed the way we make books, but I can't say they've made the books themselves any better."

MAX, a social worker working with the homeless:

"A lot of people don't have access to technology. What I do is I use the technology — like computer networks — to help these people out, get them more connected."

A Computer-Animated Ride Down a Phone Line

Analog lines leave an out-going call.

Lines switch at a switching station.

Digital lines are used for the long haul.

Lines switch again.

Analog lines go to a final destination.

Animations by Ed Hill

The Telephone Network

From the time of the Carterfone decision in 1968, when the FCC said that digital bits could be sent over phone lines, telephone lines have been used for digital network connections. But most people have no idea what happens after the wire leaves the wall. The exhibit fills this gap of knowledge by providing a computer animation, created by animator Ed Hill, that slows down the action and illustrates the various transformations that occur in any phone call.

While the exhibit reveals the almost miraculous technology of a telephone network, the commentary of the guides brings out some of the social issues. Max, for example, queries the visitor: "What about people without phones? The homeless people I work with don't have a number where a social service agency, a potential employer, or landlord can reach them. In this society, if you can't be reached by phone, you are invisible."

International Financing and Banks

The exhibit needed to show that while the old saying, "money makes the world go 'round," may be true, computer networks are what make money go around the world. No longer does someone need to be on the floor of the stock exchange to see the latest transaction. A variety of services brings these transactions right to the desktops of people around the world. Our live ILX feed, provided by Thomson Financial Services, allows visitors to view stock exchange transactions as they happen. Visitors can stand and watch as a stock symbol changes from green (while it is going up) to red on a down-turn, and they can also track the monthly progress of any stock they choose.

To enforce the extremely fast pace of making financial transactions, a simulated situation was created where each visitor gets a million "cyber-bucks" to invest in four constantly changing global markets, with visitors competing against each other to see who can make the most profitable investments. The closing times of foreign markets emphasize the global quality of the financial networks, as do other simulated purchasing opportunities, from African kenta cloth to New Zealand kiwi fruit.

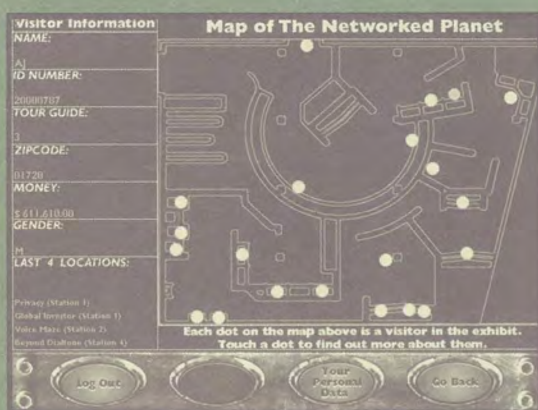
Since the 1970s when Marshall McLuhan said that "cash is a poor man's credit card," money has become an increasing abstraction. Network Guide Erica expresses a common kind of problem: "The other day when I was out shopping with my son, he asked me to buy him an overpriced stuffed animal. I told him it cost too much. He said, 'Momma, just get some money out of the machine.' He thinks cash machines give you money any time you want it. It's hard teaching my son about the value of money when he thinks you can get all the money you want, anytime you want, out of a machine."

Probing the Privacy Issue

When Congressman Ed Markey visited *The Networked Planet* and was faced with the choice of keeping his information private or public, he aptly noted that in the real world you have no choice about who has access to your information. The exhibit tries not merely to present the technology involved in global networks, but also to increase visitors' awareness about attendant social implications. Here, for example, two Network Guides discuss both sides of the privacy issue:

Jessie

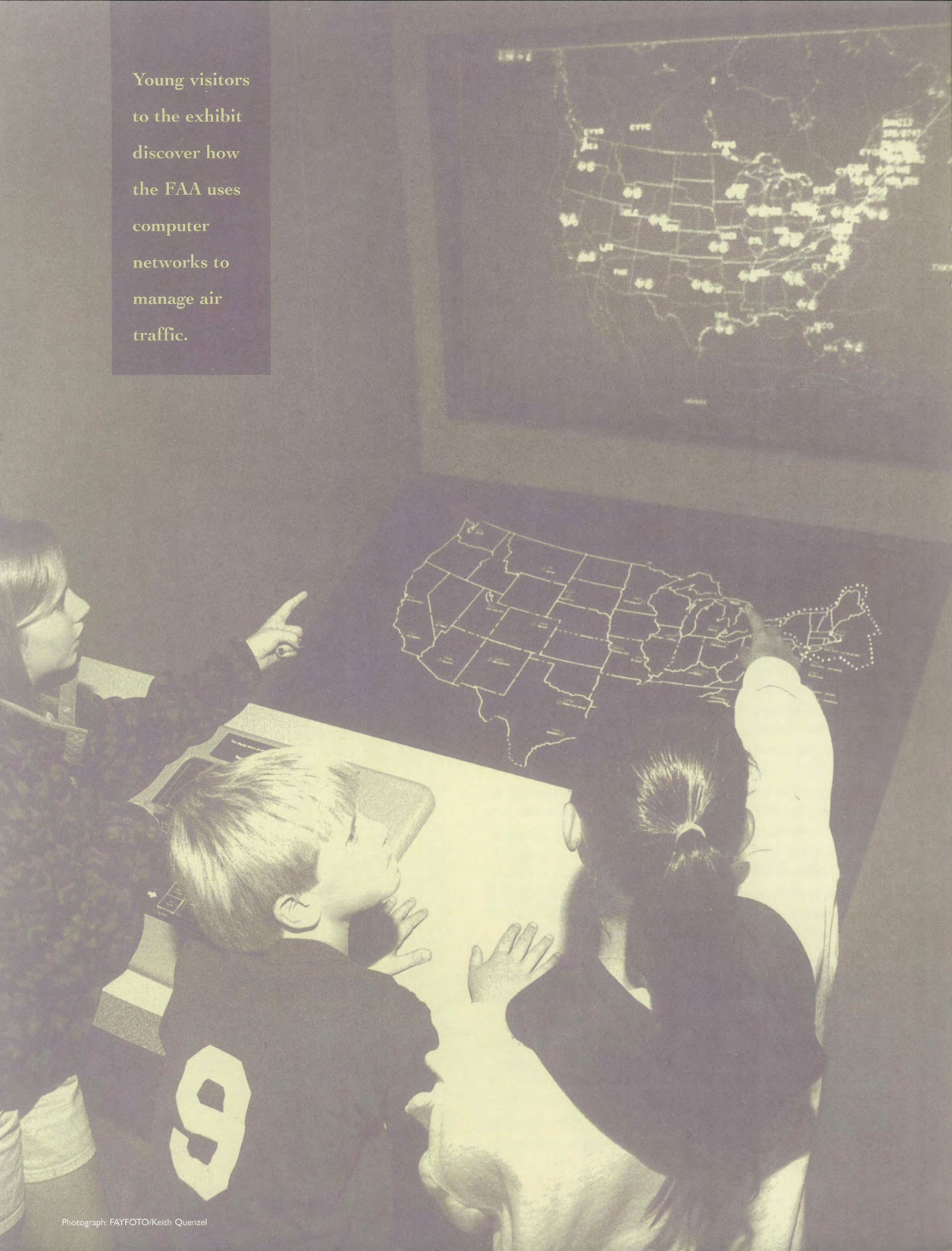
"On the networked planet there's a lot of information about you, spread out over many different networks. Where you shop, what you buy, your birth date, your shoe size, and even how many parking tickets you haven't paid. I never give anyone my social security number. There's a lot of information tied to that number — your driving record, school and medical records. People who get your social security number and understand networks can find out almost anything they want to know about you."



This screen image shows the location of the visitors logged on at various stations in *The Networked Planet* exhibit.

Beatrice

"I know a lot of people think computer networks intrude on their privacy — that too many people know too much about them. But sometimes I want to share information about myself. When I applied for a mortgage to buy a house, it was approved partly because my credit rating is very good. The bank knew that I am a low risk. Now, I don't know those people at the bank, and they don't know me. Without a credit report how could they have known I'm someone they can safely lend money to?"



Young visitors to the exhibit discover how the FAA uses computer networks to manage air traffic.

Photograph: FAYFOTO/Keith Quenzel

Air Traffic Control

A direct link to the Air Traffic Control program used by the FAA provides a highly dramatic view of all the commercial planes in the air in the United States at any given minute. The networks let the air traffic controllers see the big picture by collecting information from multiple locations and sending it to one central source.

The system was designed to allow regional air traffic control managers to monitor the flow of aircraft across the country. It helps them to anticipate potential delays before they happen and to orchestrate a more manageable traffic flow for air traffic controllers.

Here's how it works:

❶ Flight location information is collected. Twenty air traffic control centers across the United States track air traffic in their area using radar. Every three minutes, each center sends its latest radar information by phone or satellite to the John A. Volpe Transportation Center in Cambridge, Mass.

❷ Flight location information is processed. Computers at the Volpe Center collect the air traffic control centers' radar information and organize it into a "big picture" of all the airplanes' locations.

❸ A "big picture" of airplanes' locations is sent to over 50 centers. The data of all the airplanes' locations is sent via a network to computers in over 50 FAA installations (and *The Networked Planet* exhibit). This includes the 20 air traffic control centers and major airports, where flight control managers use the information to manage air traffic controllers. Standing at the exhibit, a visitor can see the locations of all the planes in the air change every three minutes and can select any city and get a close-up of their incoming flights.

The Internet Sampler

The idea of the Internet can be difficult to understand without experiencing it firsthand. For many visitors, the exhibit's Internet Samplers provide their first ride on this most publicly hyped segment of the "Information Highway." The Samplers offer an easy on-ramp to the Internet, either by using Gopher or via the World Wide Web. Visitors can choose Internet sites to visit from the "hot lists" compiled by Museum staff and arranged in subject categories, or enter their own favorite Uniform Resource Locator (URL), or search the Net for their own interests using search engines and Net indexes.

This highlight of *The Networked Planet* exhibit is enhanced by the incredibly fast T1 connection service provided by the exhibit's principal sponsor, Sprint. The T1 line allows visitors to view graphic images and download audio and video clips relatively quickly. Here visitors can see for themselves the global nature of the Internet as they "surf" Web sites that include an online art museum in France, Sarajevo Alive On Line, a listing of events for Jerusalem's 3000th anniversary, the Australian Triathlon page, and the site of the African National Congress.

The Sampler's Main Menu also offers information on how the Internet works, the history and culture of the Internet, and how to join the Internet.

Since July, visitors have learned more about the Internet from hands-on demonstrations that are included with the price of admission. These are the first of many programs planned for *The Networked Planet*, as the Museum continues to educate the community about the Internet and other cutting-edge applications of network technology. Future programs include more advanced fee-based Internet training classes designed for the general public, for businesses, and for educators, and a video-conferencing system that will send The Computer Museum to remote sites and bring remote programs to the Museum.

The most far-reaching network project is The Online Computer Museum, which will be launched in March 1996. More than just an online version of The Computer Museum, this Web site will offer a unique online destination with online exhibits, forums, and research opportunities. Visitors can preview our ideas for The Online Computer Museum and read learn about our existing exhibits and facilities at our Web site, located at: <http://www.tcm.org/>.

EXHIBIT ADVISORS

The following individuals from industry and academia offered their valuable insights throughout the planning and implementation of *The Networked Planet*:

National Endowment for the Humanities Advisory Committee

Robert Baum
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From April 1-May 29, The Computer Museum hosted the world premiere of AARON, an expert system with its own painting machine built by artist Harold Cohen. Each day, the computer-driven robot controlled by AARON created an original color painting. From its first creation — recorded live on *Today* March 31 — *AARON* captured the imagination of thousands of Museum visitors and media worldwide. (An earlier, simpler version of AARON, which made black and white line drawings, engaged Museum visitors from 1987-1994.)

What follows are highlights from a conversation between Cohen and photographer Becky Cohen in March. Both art and text are excerpted from the exhibition catalog that she created.

"Nancy with potted plant," painting 60" x 84", oil on canvas, computer-generated drawing, 1991; collection Robert and Deborah Hendel.

BC: AARON has been making drawings autonomously for more than two decades, and now you are celebrating its new ability to color its drawings with dyes and special brushes. How did you get it to paint?

HC: Putting dye on paper is easy: You just build a machine! This one consists of a small robot arm carried around over a large flat table on what we call an "xy device." The arm has a "hand" that's able to pick up the cups and brushes ... located at the edges of the table, it manipulates the taps on bottles of dyes, and so on.

Of course, I'm joking about it being easy to build a painting machine. The truth is that it was a relatively straightforward task compared with writing the code that would give AARON the ability to think about color. That has been my major pre-occupation the past two or three years, and there would have been no point in building a machine if I hadn't been able to do it.

BC: What people see in the Museum is the machine painting. What they can't see is how AARON is thinking about color.... Why was color a difficult problem?

HC: Human beings can see the results of putting two colors next to each other and can proceed on the basis of this feedback. The program is able to keep a ... complete record of what it's doing, but it can't see in the same sense that you or I can. I had to come up with rules about color juxtaposition that would serve in place of the visual feedback that humans use. As a painter, with a lifetime of experience of color, I must obviously have known what some of those rules were, yet I found it frustratingly difficult to say what they were.

BC: Were you able to map the rules you had built for the screen-based coloring program onto the coloring program for the painting machine?

HC: Well, actually not. I spent some time trying to translate the red-green-blue mixtures that AARON specified into combinations of the dyes I was using, but it never worked to my satisfaction.... Finally, I abandoned that approach and started to build up a new version based directly upon the dyes.... I'd have much preferred to use oil paint, which I've always found to be the most versatile and ... beautiful of media. It wouldn't have been at all practical for the painting machine, unfortunately. Oil paint is a more or less transparent material, and you have to control the thickness of the paint film rather precisely to get the most from it. My machine is much too crude a device to do that; in fact, I'm not sure that any current robot could exercise that level of control.

Drawing generated by AARON, 1994.

BC: What kind of dyes have you chosen? And why dyes? Do they suffer from impermanence?

HC: Oh no, not at all. That was true in the nineteenth century, with some of the earliest industrial dyes, but no longer. I have a shirt that's been in the California sun for almost two decades and in and out of the washing machine I don't know how many times; it still has most of its original color.

I've been using these Procion fabric dyes for several years for working on paper; they're very beautiful in color and they all rate six or seven on a permanence scale from one to seven....

BC: What programming languages do you use?

HC: AARON is written in LISP and runs on a Silicon Graphics computer, while the painting machine is controlled by a PC — a generic 486 — and the program is written in C++.

When AARON generates a painting, it stores it in a file as a set of instructions. Most of these instructions will control the movement of the brush on the paper, both in making the initial drawing and in filling in the color. Some of them specify the mixing of dyes for individual areas of the painting, and

"Clarissa," painting 42" x 54", oil on canvas, computer-generated drawing, 1992.

BC: Yes, I could see the brush following the internal contours of shapes as it was coloring; but it seems that AARON must also have a sense of portraiture: that it has some idea of what sorts of color might be good for clothing, or plants.

HC: AARON has a very clear idea of what it is doing.

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BC: How does AARON assign color?

HC: In AARON's understanding of the drawings, different elements are characterised by their different attributes. It knows, for example, that a face has two eyes, and it will never draw a face with three. To the degree that color is also an attribute of a face, there are a limited number of colors it can use. It would never decide to paint a face green because it doesn't believe that faces can be green. However, there is no such limitation on the assignment of colors to things like sweaters or backgrounds. Color assignment here reflects the program's concern for the color "signature" of the whole painting. If AARON decides to do a red sweater, for example, it will probably not decide to do a red background....

some of them specify the size of brush to be used. The file is read over a network connection by the 486, which then interprets those instructions and scales the dimensions of the Silicon Graphics screen to whatever size drawing is being made. It also scales the volume of the dye to be mixed for any color and the size of the brush, and then it generates the lowest-level commands that drive the painting machine.

To do everything it is supposed to do, the 486 program has to control the movement of the arm across the table, the horizontal rotation of the shoulder, the vertical rotation of the elbow, two rotations of the wrist, the opening and closing of the hand, and the reach — how far the hand can extend from the elbow. The program also has to know where the cups and brushes are kept, where the tap handles are and how much to move them up and down, and so on.

BC: So, the order of events is: AARON first generates the drawing, then the coloring for the drawing, and finally sends orders to the 486. AARON never thinks about coloring before drawing, does it?

HC: No, the drawing is done first, and then AARON decides about color. But the coloring part doesn't only involve the color choice. It must also map out the path the brush must take filling in the various shapes in the drawing.

When I started work on the painting version of AARON, I was struck by the fact that we have a very poor vocabulary for talking about color relationships, and that almost all of what's been written as color theory has been either theory about color perception or theory about color measurement. There is almost nothing about color use.... Whenever I find myself faced with a problem about how the program should proceed, I've asked myself how I would proceed. I was deeply frustrated to find that I couldn't describe what was happening in my own head when I was manipulating color as a painter.

•

BC: Your pictures tend to be sort of two-and-a-half dimensional: not 2D, not 3D, but somewhere in between — sort of like Pompeiian frescoes.

HC: All representation is two-and-a-half dimensional, isn't it? The viewer is always confronted with a flat surface that evokes something in the physical — 3-dimensional — world.... It seems to me that the last 500 years of Western culture have been quite aberrant with respect to world history. At no other time in human history will you find our own characteristic obsession with appearances, nor its consequence, which led to the underlying technology both for photography and for computer graphics — the reflection of light off the surfaces of things in the world. That's a mystery to me. Do we really believe that we can find out the truth by the way things look?...

BC: You seem to have created a sort of magical space where AARON's "organisms," figures, and plants have a special interrelationship with each other. Even in the room-like environments, it is as if the figures have a truly imaginative relationship with each other.

HC: I ... hesitate on the word "imaginative" because that implies capabilities to the program that I know perfectly well [it] doesn't have. AARON's domain of expertise is the building of representations, not knowledge of the outside world. Hmm ... Well, it has some knowledge of the outside world.

BC: Like what?

HC: For example, it knows how people are put together. It knows how they are capable of moving. It knows how plants grow. It knows that rooms have walls at the back. It knows all of those things, though that isn't to say that it knows them in the same way that you or I know them. I suspect that whatever success the program has had has rested upon devising a representational mode perfectly fitted to the structure of its knowledge.

Untitled, painting 54" x 42", oil on canvas, computer-generated drawing, 1991.

BC: It seems that you reinvented drawing as a means of reinventing color.

HC: I was becoming increasingly disturbed and antipathetic towards the whole modernist movement in painting, in art. We had turned painting into a very specialized game that only a very few people could understand and respond to. I have always felt that the health of any art depends upon its relationship to the culture it serves, and I wasn't happy with where I stood.... I suppose that in turning away from color to spend several years investigating drawing, I was beginning to look for a way of getting back to a kind of imagery that would be available to more people.... Over time, I began to think that there was something slightly unsatisfactory about having AARON do all these drawings that I was then required to color.

BC: From the beginning of your dialogue with your creation, you have always wanted its work to qualify according to your own high standards of interest, use, and beauty.

HC: Of course, why would I demand less of it? One of the bargains I made with myself from the earliest days was that I would never accept the position of having to apologize because this was done by a computer. I have always insisted that the work the program did would have to stand on equal terms with art made by hand.

BC: Still, you want what you've modeled in AARON and AARON's drawings to be truly within the domain of art. Presumably that is why you've spent so much time running the other way from so-called "computer art."

HC: Yes. But ... my goals have changed subtly over the years. For a very long time, I thought AARON's work should be indistinguishable from the work made by human artists. That isn't quite the case any more. I want the work to look as if it has been made by an intelligence, but it doesn't have to be a human intelligence. I am much happier now when I see the program produce an image that looks as if it had been made by somebody who is seeing the world for the first time: seeing the world from a different point of view from someone who grew up human.

BC: You give AARON a rather innocent quality, placing it just at the boundary of discovery all the time. I am wondering if you are ever surprised by any of the actions AARON takes....

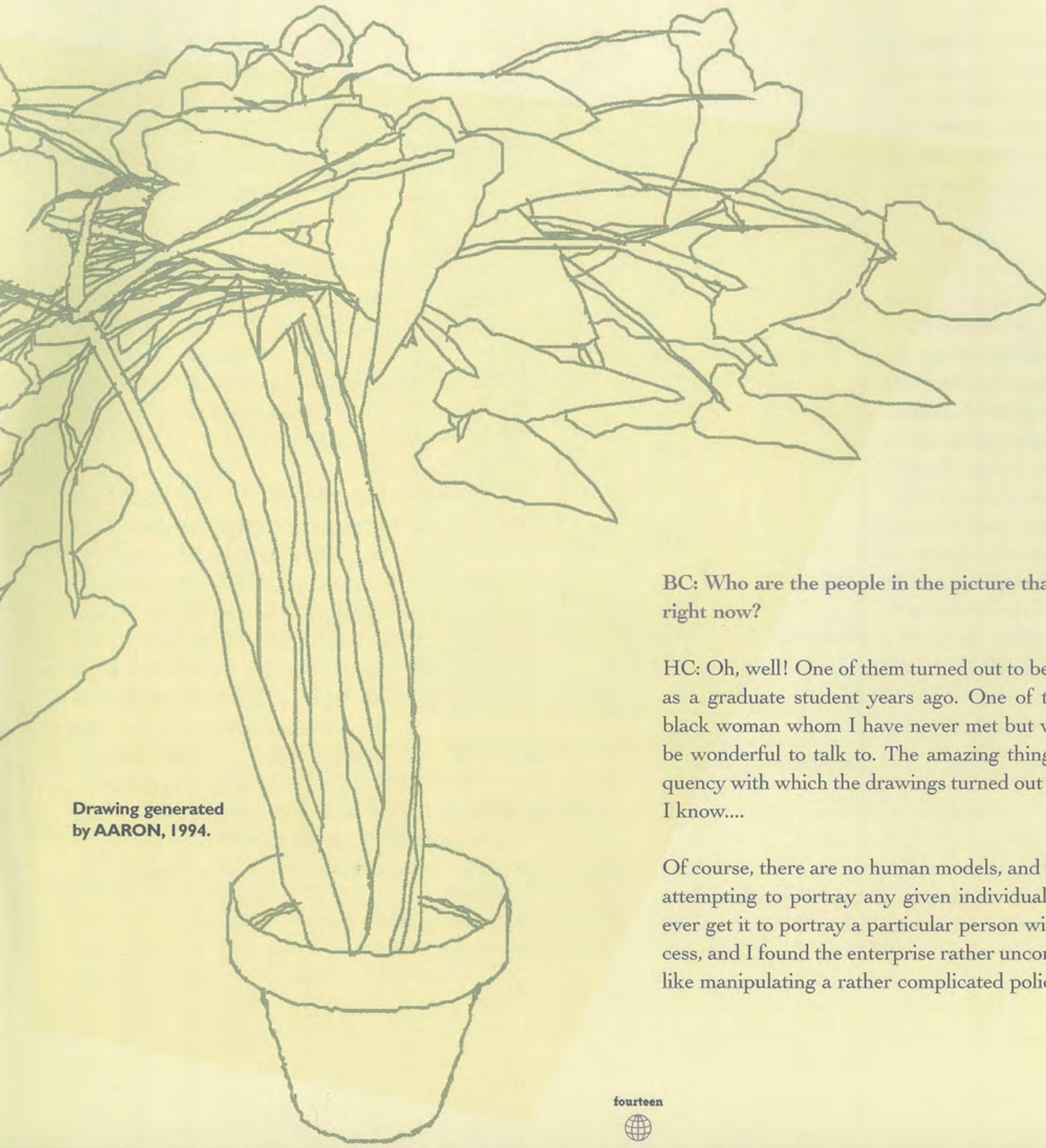
HC: I know exactly what AARON knows, but I can still be surprised. When you work on a program as I've worked on AARON, you make the program the heir to some subset of your own knowledge. When it plays that knowledge back to you, you can find yourself saying, "Hey, where did that come from? I didn't realize that that is what I believe." In that sense the whole endeavor is quite a shocking and remarkable experience....

BC: Yet AARON has taught you something.

HC: AARON is teaching me things all the way down the line. From the beginning, it has always been very much a two-way interaction. I have learned things about what I want from AARON that I could never have learned without AARON.

BC: So, this decades-long conversation with AARON has enabled you to build on your own understanding of your own knowledge. AARON is probably the oldest, continuously-developed artificial intelligence program in computing history at this point. It has also allowed you to create a new medium for yourself as an artist, even to redefine what we mean by art.

HC: Interestingly enough, I think the very age of the program contributes a great deal to the quality of what it does. Whatever else happens after 20 years of continuous development, AARON has a kind of complexity ... that you won't get when you sit down and knock off a program in three months or three years.

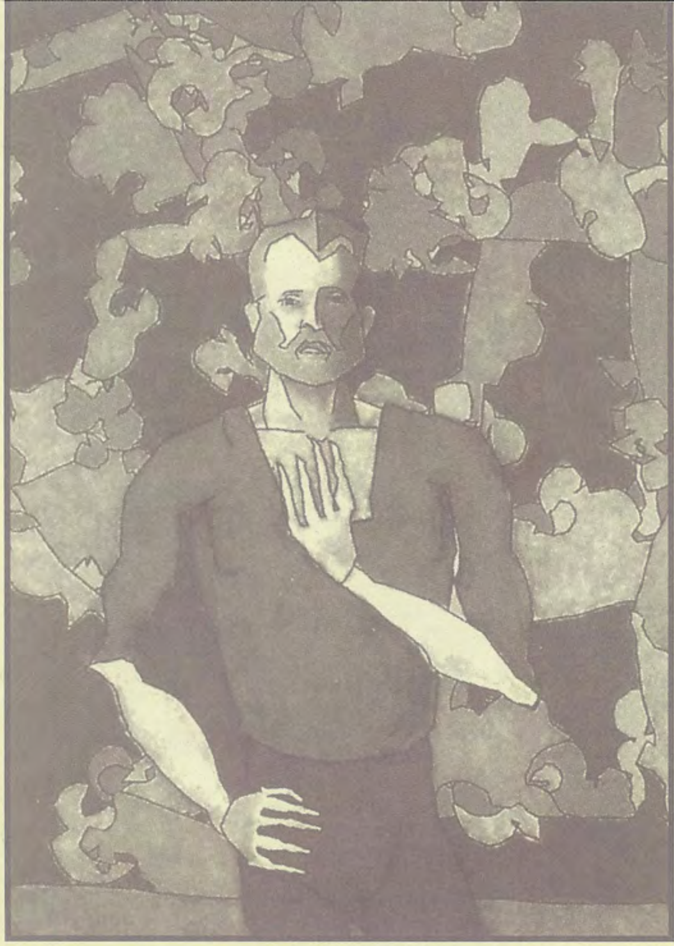


Drawing generated by AARON, 1994.

BC: Who are the people in the picture that AARON draws right now?

HC: Oh, well! One of them turned out to be someone I taught as a graduate student years ago. One of them is a graceful black woman whom I have never met but who I think would be wonderful to talk to. The amazing thing to me is the frequency with which the drawings turned out to look like people I know....

Of course, there are no human models, and the program is not attempting to portray any given individual. Only once did I ever get it to portray a particular person with reasonable success, and I found the enterprise rather uncomfortable ... It was like manipulating a rather complicated police identikit.



"AARON with decorative panel," painting 72" x 54", oil on canvas, computer-generated drawing, 1992.

BC: What artistic future are you indicating with your work?

HC: Public attitudes towards computers are by no means neutral. In a market-driven society, the manufacturer shoots for the biggest possible, not the most sophisticated, market.... The vast majority of users today identify the computer as a box on which to run ready-made packages.... There is no package for what I do, and there couldn't possibly be ... using one would be absolutely antithetical to the artist's position.... I am in the fortunate position of having been in this game from the time when there weren't any packages to be bought ... if you wanted a program, you wrote one.

EDITOR'S NOTE: To purchase the color catalog of AARON paintings, contact the Museum Store (617-426-2800 x 307). Harold Cohen or Becky Cohen can be reached through the information given below:

Harold Cohen
Center for Research in Computing and the Arts
University of California, San Diego
9500 Gilman Drive
La Jolla, CA 92093-0037
(619) 534-4383/0188

Becky Cohen
Phone: (619) 942-7386
Fax: (619) 942-9602

BC: What traditional artistic goals have you been escaping for the last quarter century by casting your lot with artificial intelligence?

HC: I am not sure I am escaping any goals, or even trying to. Oh, of course it isn't exactly traditional to have a machine generate one's artworks. But—in the twentieth century, certainly—art-making is a highly self-reflective activity, and what is central is the degree to which the making of art contributes to an ongoing dialogue about the nature of art. In that sense I think my work is absolutely orthodox.

I have never subscribed to what I once called the telecommunication model of art: the artist has something in mind which is encoded in a message and sent across the art medium, or the Internet, or whatever, and is then received and decoded, with the result that the audience understands just what the artist had in mind....The artist is concerned with the design of meaning generators, not meaning communicators. The power of the program still is that it is capable of generating some personality on a piece of paper; it will initiate some response on the part of the viewer in terms of what the viewer knows about human personality and human experience.

"Meryl," painting 24" x 34", oil on canvas, computer-generated drawing, 1993; collection Robert and Deborah Hendel.

COMPUTERS

ACT (Computers) Ltd.
Apricot computer, 1984
Donated by Janet Baker. X1212.95

AT&T EO 440
portable computer, 1993

AT&T EO 880
portable computer, 1993
Donated by Dawn Bunting and Jon Rubinstein. X1197.95-X1198.95

Compaq Inc., portable
IBM PC-compatible, 1983
Donated by Barbara Lee Chertok. X1216.95

Convex
C1 Computer
Donated by Convex Computer Inc. X1192.95

Epson HX-20
laptop computer, 1984
Donated by Roger J. Hennessey. X1213.95

German National Research Center for Computer Science Reduction Machine, 1990

"The inception of this machine goes back to the early seventies. At this time, the idea of 'Higher-Level Language Architectures' was investigated by many researchers. The GMD Reduction Machine was, however, strictly based on the lambda calculus and the principle of reduction or meaning preserving transformation and not on a particular programming language. Its architecture is based on a multi-stack automaton set up to traverse tree structures and is very different from a conventional von Neumann architecture.

"By 1975, Mr. Hommes had the machine completely simulated. Great care was deployed to implement the lambda calculus completely and correctly. All the problems with naming were overcome by using 'protectors,' which protect variable occurrences from wrong bindings. Later they turned out to be a special version of deBruijn indices.

"Measurements showed potential of providing reasonably fast symbol-processing power of the machine, which could be used to emulate Backus' FP system, list-processing, recursive functions, and much of conventional programming language constructs without compiling. Backus' idea of program transformations towards more efficient, but equivalent, forms could be demonstrated. In 1976 Dr. Kluge, now Professor in Kiel, Germany, joined the GMD and got interested in the machine. Our combined efforts and support by the management finally made it possible to design and construct an actual hardware model in TTL technology. It became operational early in 1978. Factorial 500 takes about 10 seconds and fills the screen with digits. This was impressive at that time. Although the machine raised some interest worldwide, the enormous progress in making faster and faster von Neumann processors turned the focus of development towards software solutions. The machine should still be operational." Klaus Berkling

Donated by the German National Research Center for Computer Science. X1193.95

Microdata Computer Corporation, Inc.
32/s computer, 1976

The 32/S was microprogrammed, in firmware, on the 3200 processor. Designed in conjunction with the PL/1-based Microdata Programming Language (MPL), the 32/S system enabled all programming to be done in a high-level language.

Donated as part of the University of Southeastern Louisiana microprogramming collection. X1220.95

Tandy Radio Shack
TRS-100, 1980
Anonymous. X1210.95

VTC, Inc.,
Laser Apple II clone, 1987
Donated by John and Noeleen Ostapkovich. X1215.95

Zenith Data Systems
Model 171 prototype
laptop computer, 1983
Donated by Rich Carl. X1211.95

SUB-ASSEMBLIES AND COMPONENTS

ETA Systems, Inc.
ETA10 printed circuit board and CMOS chip, CMOS chip interconnection layer mask; CMOS chip wafer
Donated by Carl Ledbetter. X1223.95-X1225.95

Remington Rand
Univac File II Buffer
Processor II, 1962
Donated by Jim Payne X1202.95

Telefunken TR-4
computer microprogram unit
Donated as part of the University of Southeastern Louisiana microprogramming collection. X1221.95

University of Illinois
CSX-1 logic module, 1962
Donated by Jim Payne. X1206.95

Zuse Computer Company
Zuse Z22 plug in module, 1956
Donated as part of the University of Southeastern Louisiana microprogramming collection. X1222.95

MEMORIES

Harvard University Computation Laboratory, Harvard Mark IV memory drum read/write head chassis, 1952
Donated by Walt Williams. X1217.95

International Business Machines, System/360 Capacitor Read-Only Store, 1965; System/360 Transformer Read-Only Store, 1965

Capacitor Read-Only Store (CROS) — one of three control store microcode systems developed at IBM in the early 1960s — and dedicated software allowed IBM to efficiently make System/360 machines function like older products such as the 7070, the 1401 and 1410, easing customer acceptance of the new products and giving rise to the now-common term *emulation*. Donated as part of the University of Southeastern Louisiana microprogramming collection.

Donated by the University of Southeastern Louisiana. X1218.95-X1219.95

The *Microprogramming Handbook* came with the 1976 Microdata Computer Corporation 32/s computer, donated as part of the University of Southeastern Louisiana microprogramming collection.

Remington Rand
Univac File II drum storage, 1958; drum controller, 1958; core storage, 1959
Donated by Jim Payne. X1199.95-X1201.95

Sanders Associates core
memory subsystem, c. 1968
Donated by Jim Payne. X1205.95

TRANSDUCERS

**Atari, Inc.,
Pong face plate, 1975**

Donated by Russell Nelson. X1214.95

Hayes Micro Coupler modem, 1979

The modem Steve Wozniak used with his Apple II, this 1200-baud modem was one of several Hayes products that dominated the burgeoning personal computer market in the early 1980s.

Donated by Steve Wozniak. X1194.95

**IXO Inc.
Telecomputing system, 1982**

Back to the future: In a 1982 *Byte Magazine*, Chris Morgan, then editor-in-chief, waxed enthusiastic about the IXO Telecomputer: "Imagine a terminal that costs $500 and can: access the Source, CompuServe, Dow Jones, or other remote database or computer services; automatically handle the protocols to access these services; have a full ASCII character set; have a built-in modem with autodialer; emulate other terminals; fit in your pocket; and operate from a battery." Bob and Holly Doyle, the original, Cambridge, Mass.-based IXO developers, donated a complete set of hardware, peripherals, software, documentation, and dealer materials to the Museum.

Donated by Bob and Holly Doyle. X1209.95

SynOptics Communications collection, 1981-95

Donated by SynOptics Communications. X1173.95-X1190.95

Stratus Computer "phone home" remote service board, 1984

Donated by Stratus Computer. X1191.95

Tektronix, Inc., oscilloscope camera C-27

Donated by Ed Hill. X1208.95

SOFTWARE

**NSnipes,
first networked computer game, 1982**

Donated by Drew Major and Novell/SuperSet Software, Inc. X1195.95

MIT Whirlwind computer program library, 1948-63

The original Whirlwind program library, donated with the assistance of William Wolf, consists of thousands of paper and magnetic tapes with quick hacks, subroutines, I/O and other protocols, scientific, military, and academic applications, and other program elements. This donation also includes a number of Whirlwind components such as logic and memory modules, magnetic tape drives, and AC/DC converters.

Donated by Susan Cooper. X1196.95

ELECTRONIC ARCHIVES

**Electronic Mail
re E-mail, 1978-1986**

This archive of electronic mail on the subject of e-mail is from the MsgGroup, one of the first ARPAnet mailing lists to be established and then automated. It was administered and moderated by Einar Stefferud, with funding support from Steve Walker of ARPA IPTO, from May 10, 1978, to June 11, 1986. MsgGroup addressed "virtually every relevant issue related to e-mail use or system design," said Stefferud, founder of First Virtual Holdings Inc. "You will find much of the history of Internet e-mail there, including the first really huge flamefest, and the underpinnings of the current e-mail architectural model." The archive, which is 5389 kilobytes in length, includes more than 2600 messages from 100-200 individuals.

Stefferud collected and preserved the archive on ECL.USC.EDU at Network Management Associates, Inc.'s expense. Frank Wancho at White Sands Proving Ground copied and preserved it on SIMTEL-20, and Edward Vielmetti obtained a copy in 1990 to make it available through MSEN to the Internet community.

When Stefferud was president of Network Managment Associates, Inc., he decided to donate the archive to The Computer Museum for preservation and for the Museum to make it available to the Internet community. He explained, "The MsgGroup archives really belong collectively to all the contributors, and not to anyone in particular. I determined that The Computer Museum is the proper holder and preserver of the archives, in the interests of the MsgGroup contributors." Using software donated from First Virtual, the Museum plans to make the archive available for a nominal fee.

Donated by Einar Stefferud, as president of Network Managment Associates, Inc., representing the MsgGroup contributors. E1.95

CARD PUNCH EQUIPMENT

Remington Rand Univac Model 3 card punch, 1955; card verifier (British version), c. 1948

Donated by Jim Payne. X1203.95 - X1204.95

CALCULATORS

National Semiconductor NS 900 calculator, 1983

Donated by Sam Christy. X1207.95

MICROPROGRAMMING COLLECTION

Bruce Shriver assembled the microprogramming collection at the University of Southwestern Louisiana. A large number of people contributed to this collection from around the world. The list of original contributors is kept with the document component of the collection. Every item that is part of the original collection is identified as such in the catalog. The Museum continues to add items and identifies other components appropriate to this collection. The artifacts from the collection are included in the list above.

DOCUMENT, FILM, VIDEOTAPE, AND PHOTOGRAPH DONORS

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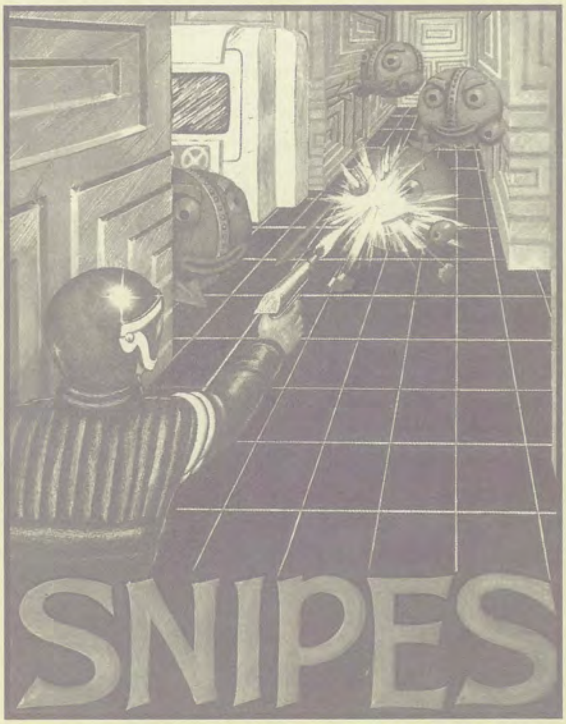

This manual accompanied the floppy diskette for the original *Snipes* game.

THE 1995 COMPUTER BOWL

A one-of-a-kind fundraising event to benefit the Museum's educational programs, The Computer Bowl® plays out the legendary East/West Coast high-tech rivalry in a contest of computer knowledge. Played for the first time in cyberspace, the 1995 Bowl was conducted simultaneously and interactively on both coasts using state-of-the-art satellite technology. The score was the West 230 to 190 for the East.

Since 1988, the Bowl has raised more than $2 million in donations and in-kind support. It attracts the support of hundreds of sponsors and enthusiastic volunteers, as well as media coverage from around the world. The Seventh Computer Bowl would not have been possible without the support of those listed below.


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THE WINNING WEST COAST TEAM: (from the left) Roel Pieper, Andy Hertzfeld, Steve Blank, Captain Cheryl Vedoe, and Eric Benhamou

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Andy Hertzfeld
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Roel Pieper
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THE EAST COAST TEAM: (from the left) Carl Ledbetter, Joe Alsop, Captain Katherine Clark, John Landry, and Paul Gillin

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Scott Ford of Novell, Inc., explains how *The Networked Planet*'s own network enables the Network Guides to track visitors.

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From the left: Computer Museum Director Oliver Strimpel, *Robotic Artist* exhibit sponsors Gwen and Gordon Bell, and artist Harold Cohen watch AARON put the finishing touches on a painting.

Photograph: Roger Farrington

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***Networked Planet* advisor and sponsor Paul Severino of Bay Networks (center) discusses the Internet Sampler with Vinton Cerf (right) and Simon Rakov (far left).**

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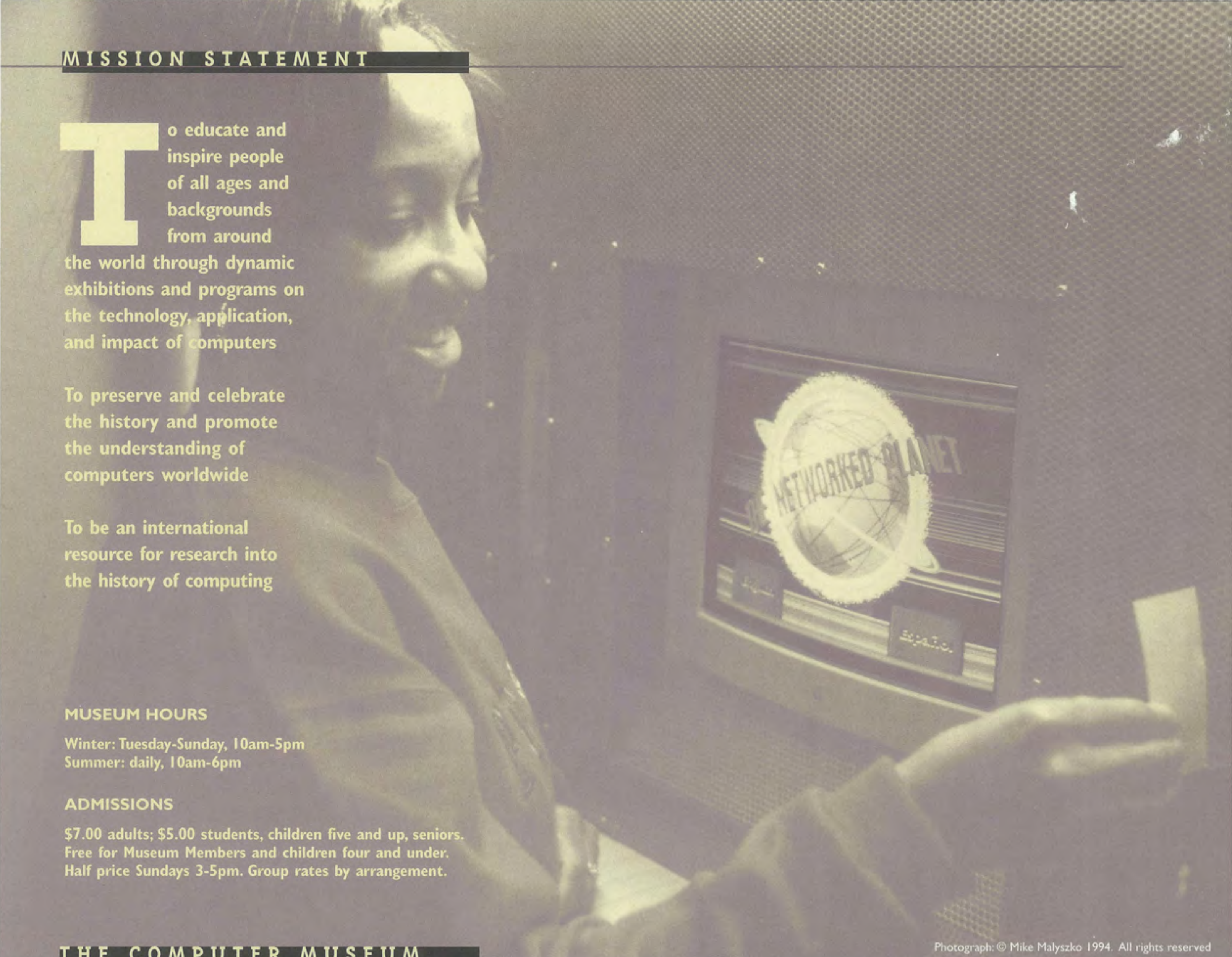

To educate and inspire people of all ages and backgrounds from around the world through dynamic exhibitions and programs on the technology, application, and impact of computers

To preserve and celebrate the history and promote the understanding of computers worldwide

To be an international resource for research into the history of computing

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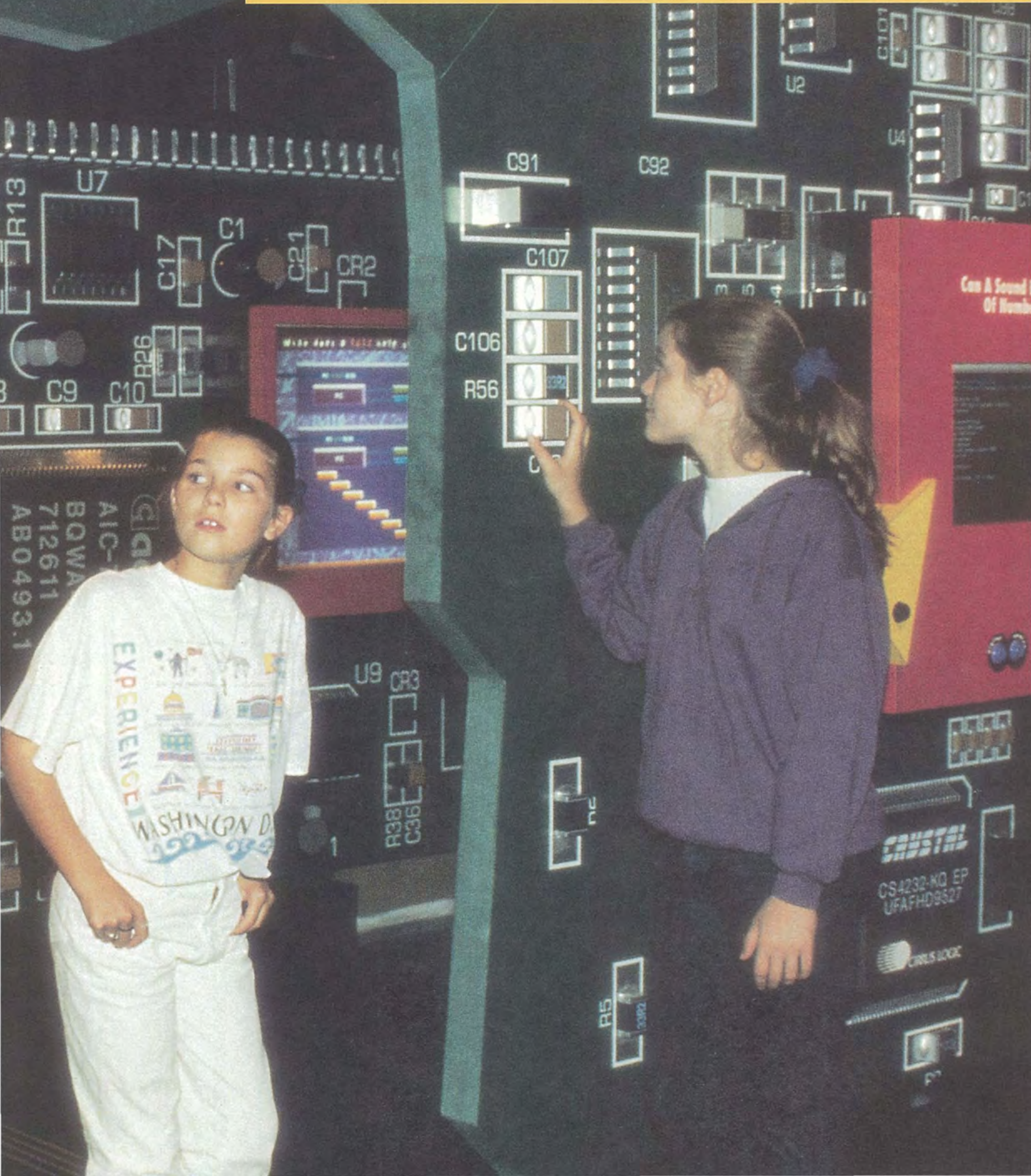

THE MUSEUM CELEBRATES CHILDREN

It's been a banner year for kids at the Museum. They have been at the heart of several initiatives that exemplify the Museum's educational philosophy: to inspire people about technology without intimidation.

This year, the Museum published its first book, *The Computer Museum Guide to the Best Software for Kids*, to resounding reviews. Following this came the launching of the *Guide*'s companion exhibit, *The Best Software for Kids Gallery*. Like the book, the gallery has garnered enormous attention, its space packed with delighted visitors of all ages. Both *Guide* and *Gallery* offer beleaguered parents solid, highly digestible information about choosing children's software. The Museum was honored to receive a Best of Boston™ 1996 award from *Boston* Magazine, citing both the exhibit and the book's author-experts, Cathy Miranker and Alison Elliot.

The Museum also unveiled the upgrade to its flagship exhibit, *The Walk-Through Computer™ 2000*. In addition to the latest technological bells and whistles, the new exhibit radiates a whimsical, kid-friendly practicality. The monster keyboard, for example, is now sturdy enough to withstand the rigors of a multitude of tiny but energetic jumping feet.

I am gratified to have been involved in the promotion of *The Guide to the Best Software for Kids*. And as a parent of three small children, I am delighted that the Museum continues to dispel the notion of stodgy computing by offering a place where the entire family can learn while having fun together.

These achievements could never happen without the support of our many generous members, sponsors, and volunteers. On behalf of my fellow Board members, I thank everyone who has played a part in the Museum's progress this past year. And I invite new friends to join us and share in the excitement to come.

Larry Weber
Chairman, Board of Trustees

FAYFOTO/John Rich

THE NON-CYBER MUSEUM

This year I was fortunate to be able to take a six-month sabbatical. During my absence, Marilyn Gardner did an excellent job as acting director, and, together with our dedicated staff, successfully maintained the Museum's strong momentum. I returned in May to a Museum that looked better than ever. A few weeks later, *The Best Software for Kids Gallery*™ opened, and the exhibit has been packed ever since. A tremendous energy exists throughout the Museum as our visitor assistants conduct a wide array of gallery tours and theatrical performances.

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Last year, I wrote about "The Year of the Internet." Since then, the Internet, with its ethereal "cyberspace," has grown by leaps and bounds. Yet the Museum kicked off the fiscal year with an extremely real-space, physical exhibit. *The Walk-Through Computer*™ *2000* exists in only one place and uses literally tons of atoms to convey its bits of information and knowledge.

As I left on sabbatical, the tension between the physical-space and cyberspace manifestations of the Museum was on my mind. People kept asking me if I feared the demise of the physical museum under the onslaught of an ever-more-capable global computer network. The sabbatical gave me a golden opportunity to tackle this issue.

The book *City of Bits*, by William J. Mitchell (MIT Press 1995), and subsequent conversations with the author helped my ideas to gel. Mitchell sees the Internet as one of a family of technologies that include storage and telecommunications. Storage technologies, from ink on paper to CD-ROMs, enable us to write information into a medium and retrieve it at a later time. This frees us from the need to convey information in real time. Telecommunications technologies let us share information without being in the same place. Telegraph, telephone, or video conferencing all allow real-time communication between people separated in space.

Storage and communications technologies can be combined so that people can communicate across both time and space. Traditionally, this has been accomplished with books and paper mail. The advent of the Internet makes this "ungluing" of space and time more practical, as the bits can be stored and transmitted with fewer, or even no atoms tagging along for the ride. More and more, the technology gives us a choice. Do we want to do things in the same space and time (face-to-face), or do we prefer to decouple space and/or time from our transactions?

Plenty of examples from every-day life show the trend towards the decoupling of life from the here and now. These include ATM banking, mail-order catalog shopping, and telephone airline reservations. Will the same thing happen to museums? Will people simply click onto our website, explore virtual galleries, exchange messages online with other visitors and staff, and check our online gift shop before they jump to another site?

I began to see the answer when Bill Mitchell and I discussed his analysis of the Economy of Presence. He pointed out that being in the same place and time as another person or object is a scarce resource. There are only a few cubic meters of real space around a person where one can be said to be in the same place and have a face-to-face meeting. In contrast, an infinite amount of space is available outside that small sphere. Similarly with time: The present is fleetingly scarce compared to time past or future. The relative scarcity of high levels of presence in which time and/or space is shared creates value. So a high level of presence is appropriate for an interaction only if it can add value to the experience. Otherwise, lower levels of presence are preferred because they are more cost-effective.

THE QUESTION FOR MUSEUMS NOW BECOMES: DO MUSEUMS BRING VALUE TO HIGH LEVELS OF PHYSICAL PRESENCE?

Looked at this way, certain activities seem to shift into the lowest possible levels of presence. Banking, mail-order shopping, and travel reservations are activities for which the added cost of high presence (travel time and cost, parking, etc.) do not add sufficient value to justify the cost. But when interactions are not routine, but more subtle or sensitive, higher levels of presence become necessary. For example, we can conduct a great deal of business on the phone, but prefer a face-to-face meeting for delicate negotiations.

The question for museums now becomes: Do museums bring value to high levels of physical presence? If this question can be answered affirmatively, museums as physical entities will endure, just as live performance has prospered in an age of TV, radio, and hi-fi, and face-to-face meetings have not been rendered obsolete by the telephone.

I believe at least four aspects of museums thrive in real space, adding value that justifies the cost of the real museum visit. First, the artifacts. An unmistakable thrill comes from being close to an important artifact. At The Computer Museum, our visitors love seeing the actual "R2-D2"™ costume used to make *The Return of the Jedi*. Standing in front of part of the pioneering 1951 computer Whirlwind conjures up an awe and appreciation of the engineering imagination and effort that launched computing. It is simply a different experience from seeing a photograph, or even exploring a high-resolution virtual world of the object. Museums with collections will continue to attract visitors.

Second, physical museums can effectively convey physical scale—large or small. The giant *Walk-Through Computer* is exciting because it is larger than you; scale is harder to gauge in a virtual exhibit. The major draw to natural history museums are dinosaurs. Can there be a better way of appreciating the *Tyrannosaurus rex*'s bulk than by being dwarfed by its towering skeletal fossil?

Third, architectural spaces can convey an ambiance that heightens cultural experiences. Appropriate exhibit design enhances the content of a physical space, harnessing all the senses in concert to create a powerful impact on the museum-goer. Physical environments can evoke a feeling of having arrived at a destination, which adds a special sense of occasion to the visit.

Fourth, the social interactions of a museum visit are vital determinants of the experience. The simultaneous sharing of experience within a family or school group becomes part of the fun. Conversation stimulated by the exhibits helps build relationships and understanding of the museum's content.

So when people ask me if physical museums will disappear, I answer that they will not if they play to the strengths that physical space uniquely endows upon them. The Internet should be used to build complementary experiences that stem from the special assets of the physical museum.

As we enter the new fiscal year, we are moving ahead vigorously with programs that will further strengthen the physical presence of our exhibition galleries. We are also launching a major, complementary presence in cyberspace, called *The Computer Museum Network*. I look forward to reporting on exciting developments in both "spaces" next year.

Oliver Strimpel
Executive Director

THE COMPUTER MUSEUM, INC. STATEMENT OF FINANCIAL POSITION / JUNE 30, 1996

ASSETS

CURRENT ASSETS	
Cash and cash equivalents	$208,969
Accounts receivable	211,627
Pledges receivable	131,442
Inventory and prepaid expenses	65,227
TOTAL CURRENT ASSETS	617,265
PLEDGES RECEIVABLE, non-current	331,270
INVESTMENTS	724,763
LAND, BUILDING, EQUIPMENT, AND EXHIBITS - net of accumulated depreciation of $5,494,922	3,943,995
TOTAL ASSETS	**5,617,293**

LIABILITIES AND NET ASSETS

CURRENT LIABILITIES	
Accounts payable	230,411
Deferred revenue	24,035
Current portion of bond payable	80,000
TOTAL CURRENT LIABILITIES	334,446
BOND PAYABLE, net of current portion	269,333
NET ASSETS	
Unrestricted	3,414,118
Temporarily restricted	1,349,396
Permanently restricted	250,000
TOTAL NET ASSETS	5,013,514
TOTAL LIABILITIES AND NET ASSETS	**$5,617,293**

THE COMPUTER MUSEUM, INC. STATEMENT OF ACTIVITY FOR THE YEAR ENDED JUNE 30, 1996

	UNRESTRICTED	TEMPORARILY RESTRICTED	PERMANENTLY RESTRICTED	GRAND TOTAL
REVENUES, GAINS AND OTHER SUPPORT				
Contributions	$2,201,642	$1,079,396	$ -	$3,281,038
Membership	368,505	-	-	368,505
Admissions	560,555	-	-	560,555
Investment income	11,824	-	-	11,824
Auxiliary income	495,938	-	-	495,938
Total	3,638,464	1,079,396	-	4,717,860
NET ASSETS RELEASED FROM RESTRICTIONS satisfaction of program restrictions	497,658	(497,658)	-	-
TOTAL REVENUES, GAINS, AND OTHER SUPPORT	4,136,122	581,738	-	4,717,860
EXPENSES				
Exhibits	1,434,878	-	-	1,434,878
Marketing and membership	516,079	-	-	516,079
Auxiliary	518,954	-	-	518,954
General administration	227,873	-	-	227,873
Fundraising	724,959	-	-	724,959
Depreciation	902,683	-	-	902,683
Total	4,325,426	-	-	4,325,426
CHANGE IN NET ASSETS	(189,304)	581,738	-	392,434
NET ASSETS AT BEGINNING OF YEAR	3,603,422	767,658	250,000	4,621,080
NET ASSETS AT END OF YEAR	**$3,414,118**	**$1,349,396**	**$250,000**	**$5,013,514**

GETTING TRIVIAL WITH

THE OFFICIAL COMPUTER BOWL TRIVIA BOOK

By Christopher Morgan

When readers tell me my new book is trivial, I thank them for the compliment! That's because it's a trivia book—*The Official Computer Bowl Trivia Book*, to be exact—and it proves that computer "nerds" (and nerd wannabes) can have fun, too! The book (Crown paperbacks, $10.00) is available from The Computer Museum Bookstore (617-426-2800 x307).

The Official Computer Bowl Trivia Book was born when fans of The Computer Bowl™ began asking for copies of the questions. So we assembled the questions used in the first six Computer Bowls and the pre-game shows in book form, along with hundreds of additional questions. Half of the questions in the book are new.

With a foreword by Microsoft Corporation's Bill Gates, the book features chapters on computers in the arts; the PC revolution; fun and games; people in computing; the Information Highway; companies, business and money; tough questions for hackers only; minis, mainframes and supercomputers; software; and pioneering computing.

WHAT IS THE COMPUTER BOWL?

The Computer Bowl was born in 1988 when the Museum's founding president, Gwen Bell, saw a set of computer trivia questions compiled by Steve Coit. They inspired the idea for a good-natured battle of wits between colorful high-tech personalities on West and East Coast teams. The object: to answer tough computer trivia questions and win the title "Computer Trivia Champs of the Universe." Over its nearly decade-long existence, The Computer Bowl has entertained thousands of people in the studio audience and millions more on PBS's *Computer Chronicles* show. Though strictly for fun, the competition is fierce, transforming the Bowl into something of an institution, and raising millions of dollars for the Museum, thanks to generous corporate and individual contributors.

RADIO DAYS

I've spent a lot of time on radio shows this year promoting the book, including NPR's *Science Friday* with Ira Flatow, where I challenged callers from around the country with tricky questions. The listeners did especially well, but here's one that stumped them: "Who invented the mouse, and how many buttons did it have?" (Answer: Doug Engelbart; three buttons.)

WHERE DO THE QUESTIONS COME FROM?

I contributed many of the questions to the book, but the majority have come from Museum members and staff, ACM members, the media, and trivia mavens Gwen Bell and Steve Golson. The questions range from the light-hearted ("Is the divorce rate higher in Silicon Valley or in Boston's Route 128 area?") to the "tough-techie" ("The ancient Mayan numbering system was not a base 10 system. Was it base 5, base 12, or base 20?") (Answers: Route 128; base 20.)

My job was to collate and fact-check the questions, combing Internet byways and libraries for arcane bits of computer trivia, such as the identity of the computer pioneer who hated street musicians so much that he sued them. (Answer: Charles Babbage.) And what did computer pioneer Alan Turing bury in his backyard during World War II, and why? (Answer: silver ingots to guard against inflation.)

1988: THE FIRST BOWL

The first Computer Bowl was held at Boston's World Trade Center in 1988. I co-hosted with William Randolph Hearst III. We got off to a somewhat shaky start when we learned that the satellite upload was not established to beam the Bowl to a waiting West Coast audience. Fortunately, I had an extra set of questions with me and spent an unscripted half hour asking the audience to answer them.

The audience was more than up to the challenge, rivaling our Bowl contestants from the East Coast (Esther Dyson, Mitch Kapor, David Hathaway, Bill Poduska, and Dick Shaffer) and the West Coast (Adele Goldberg, Bill Joy, Casey Powell, Allen Michels, and David Bunnell). The link was eventually established, and the show went on without a hitch. (The East Coast won, by the way).

Look for reruns of past Bowls on PBS and the Jones Computer Network.

SOME TEASERS FROM THE 1996 BOWL

Are you up to a challenge? Try answering these 1996 Bowl questions:

1. *Toy Story* was the first full-length feature film to be completely generated by computer. Its director, John Lasseter, won an academy award for a previous computer-generated short film. What was it called?

2. One trendy term on the Internet these days is actually a Sanskrit word that means "the visible form that the gods take on earth." Is that word *agent*, *avatar* or *java*?

3. What was the internal code name for the Netscape 1.2 Internet browser? Was it Cheddar, Brie or Provolone?

4. Which of the following is not the name of a real website: The House of Sacred Squirrels, The Bureau of Missing Socks, or Wombats Who Speak Esperanto?

5. One of the earliest forms of mechanical information storage was an ancient Peruvian device consisting of a cord with knotted strings of various colors attached, used for recording events, keeping accounts, etc. What was the device called? A quipu, an atahualpa or a picchu?

SOME ALL-TIME FAVORITE BOWL QUESTIONS

Here are some of my all-time favorite Bowl questions, taken from past Bowl scripts. My choices are mostly whimsical or slightly wacky because I am mostly whimsical and slightly wacky. Enjoy!

1. According to *The New York Times*, what U.S. government figure once sent the following e-mail message: "Oh Lord, I lost the slip and broke one of the high heels. Forgive please. Will return the wig on Monday." Was it Oliver North, J. Edgar Hoover or George Bush?

2. What was the first rock group to go online on the Internet? The Rolling Stones, Severe Tire Damage, or Aerosmith?

3. In the movie *Star Trek IV, The Voyage Home*, Scotty makes a mistake in attempting to communicate with a 20th century computer by speaking into the wrong peripheral device. What was the device?

4. What leading man was attacked by robot spiders in the movie *Runaway*? Was it Tom Selleck, Tom Hanks or Tom Cruise?

5. What Looney Toons cartoon character once used a UNIVAC computer to solve a mystery? Bugs Bunny, Porky Pig or Sylvester?

6. In the comic strip *Doonesbury*, what computer did Mark learn to program? The PDP-11/70, the Macintosh or the IBM PC?

7. Sega is the name of a popular line of computer video games including *Sonic, The Hedgehog*, but it's also an acronym. What do the letters "SEGA" stand for?

8. Texas Instruments developed the first popular microcomputer-based toy. What was it called?

9. What famous economic advisor appeared in an ad for Apple Computer in 1985?

10. In *Star Wars* was "R2-D2"™ an actual working robot, a hollow robot operated by a midget or a computer animation image?

Photograph: Vera Zark

1994 Computer Bowl All-Star Game winners from the East Coast (from left): Neil J. Colvin, Foundation Technologies Ltd.; Bob Frankston, Microsoft; Team Captain Mitchell Kapor, Electronic Frontier Foundation; Pamela McCorduck; and David L. Nelson, Novell MultiMedia.

Photo, page 5: 1990 East Coast Captain Pat McGovern (left), of International Data Group, dukes it out with West Coast Captain John Doerr of Kleiner Perkins Caufield and Byers.

1996 BOWL ANSWERS

1. *Tin Toy* • 2. Avatar • 3. Cheddar • 4. Wombats Who Speak Esperanto [No one got this one right, by the way.] • 5. A quipu

ALL TIME FAVORITE BOWL ANSWERS

1. Oliver North • 2. Severe Tire Damage, according to *The New York Times*. The group performed November 18, 1994, on the Internet 20 minutes before the Stones began their first-ever online concert. • 3. A mouse • 4. Tom Selleck • 5. Porky Pig • 6. The PDP-11/70 • 7. SErvice GAmes • 8. Speak and Spell • 9. Alan Greenspan • 10. A hollow robot operated by a midget.

Christopher Morgan is president of Christopher Morgan Communications in Boston and a Museum Overseer.

FAYFOTO/John Rich

Chris Morgan and Bill Gates at The Computer Museum in November 1995. Gates wrote the foreward to the Bowl trivia book.

The WALK-THROUGH COMPUTER 2000

MAKING A GREAT EXHIBIT EVEN GREATER

On October 21, 1995, The Computer Museum opened *The Walk-Through Computer 2000*, the networked, multimedia upgrade of its colossal, 50-times-scale personal computer.

FAYFOTO/John Rich

The original *Walk-Through*, unveiled in 1990, had captured the public's imagination, inspiring 750,000 Museum visitors from around the world to learn how computers work by entering and operating the huge PC. But over the next five years, rapid advances in technology had made *The Walk-Through Computer*™ obsolete. By 1995, PCs everywhere featured impressive multimedia, communications, and networking applications that were not available in 1990. They also sported faster microprocessors, more powerful hard drives, and lots more memory than the older models.

The Museum decided that it was time to upgrade its flagship exhibit. With the support of Cirrus Logic, Inc., Intel Corporation, and 12 other corporate sponsors—which all supply components used by today's PCs—the 1990 *Walk-Through Computer* was replaced by a totally new exhibit, packed with state-of-the-art technology.

The new machine is driven by a high-speed Pentium® processor, surrounded by multimedia boards, connected to a CD-ROM drive, and networked—at the same 50-times-scale as its predecessor. Over 100 people—sponsors, volunteers, the Museum exhibit and design team, and outside contractors—spent 18 months fabricating the $1 million exhibit, designing it to captivate a diverse audience including seniors and small children.

IMPROVING UPON THE ORIGINAL

To bring new life to its cornerstone exhibit, the Museum had to find innovative, exciting ways to explain how a computer works to an increasingly sophisticated audience. The upgrade provided a unique opportunity to improve upon the original model.

Ongoing evaluations of visitors' experiences had revealed specific instances where the old exhibit did not work for some people. At the same time, an advisory group of educators and marketing experts began to meet regularly and recommended that the new exhibit be more interactive, immersive, and fun.

UPGRADE HIGHLIGHTS

The Walk-Through Computer is state-of-the-art inside and out:

MULTIMEDIA

- The Philips Electronics CD-ROM player stores over 600 MB of data optically on a CD-ROM—enough for an entire encyclopedia set with graphics and sound.
- The audio/video board, loaded with Cirrus Logic processing chips, lets the computer process audio, video, graphics and text.
- The Adaptec SCSI adapter card allows the CD-ROM player to connect to the computer for rapid transfer of data.

NETWORKING

- A Hayes modem allows people at computers to send electronic mail or hook onto global networks like the Internet.
- A Cirrus Logic infrared transceiver chip provides communication via infrared signals between the computer and a cellular phone or personal digital assistant.
- The 3COM Ethernet card enables people at computers on a local-area network (LAN) to share information and messages.

MORE MEMORY

- The Quantum 4.2 GB hard drive (upgraded from 400 MB) is faster at reading and writing the vast amounts of information used in movies, animation, and sound.
- The 32 MB of random access memory (RAM) from Texas Instruments (upgraded from 4MB) enables the computer to have eight times as many files open at once as did the 1990 model. This means more multimedia applications can be used in real time.

MORE SPEED AND POWER

- The Intel Pentium® Processor is three times faster than the 1990 exhibit's 486 microprocessor, and handles the vast amounts of data needed for full-motion video and rich CD-quality sound.
- The Texas Instruments digital signal processing chip (DSP) speeds up the modem so that multimedia data travel over the phone lines faster.
- The American Power Conversion Uninterruptible Power Supply provides battery-backup power, and prevents electrical surges from entering the computer via an outlet, phone line, or network cable.

FAYFOTO/John Rich

The plan that emerged from both the advisors and visitor evaluations called for these changes:

- interactive activities built inside the oversized components that would bring each part to life and help visitors learn, as they move through the exhibit, what each part does and how it relates to the whole computer;
- a fanciful, oversized desktop environment that would immerse visitors as they explore the giant machine and its new, more life-like, 3-D components. It was decided that the desktop would belong to an imaginary teenager named C.J.;
- a new, more realistic application for the big monitor that would resemble the operating environment of computers people actually use nowadays for work and play.

Visitors enter the new exhibit through a colossal simulation of a bubble-jet printer and find themselves shrunk to crayon-size next to an eight-foot-long CD-ROM. Clicking and rolling a car-sized trackball on C.J.'s vast desktop, they answer e-mail from C.J.'s friends and explore full-motion video on a 12-foot-tall color monitor.

Once inside the giant machine, visitors discover ceiling-high printed circuit boards loaded with suitcase-sized chips accurate down to the number of pins on each. Bright flashing lights in the motherboard floor lead to a powerful seven-foot-square Pentium® processor, opened to reveal a photo of the actual silicon die.

THE INTERACTIVES

The new *Walk-Through* presents and explains each of the components by its role in the operation of the computer: Input, Processing, Storage, Communication, and Output. Most of the components feature interactive activities that enable visitors to experience firsthand how the parts work.

PROCESSING

At the heart of the new PC sits the table-sized microprocessor, with a cut-away view revealing how the levels of the chip are soldered to wires connected to pins plugged into the motherboard. The interactive program embedded in the processor shows how it converts instructions from English to programming and assembly languages, and finally to ones and zeroes. By operating a control panel, visitors take charge of the computer, fetching an instruction from one of three programs—sending e-mail, playing a sound, or making a picture. Each is designed to highlight the microprocessor's interaction with the computer's components. As visitors execute each instruction, it jumps off the screen into a fantastic display of lights and sounds racing from the microprocessor through buslines in the motherboard floor to each component.

A periscope-type device reveals an actual electron-microscope view of real transistor gates switching. For a simulated view into the heart of the microprocessor, the Museum used edited IMAX footage of a microprocessor fly-through, provided by Intel. A stunning, enlarged colorized image of a Pentium processor covers the processor's surface.

The audio/video board, loaded with Cirrus Logic processing chips, enables the computer to process audio, video, graphics, and text. To tell the story of the other chips inside the PC, a customized A/V board uses larger-than-life-sized replicas of audio and video processing chips, supplied by Cirrus Logic. An exploded hole in the middle of the card allows entry. The interactive program embedded in the board's audio section lets visitors record their voice as an analog audio signal, convert it to a digital signal that the computer understands, and manipulate the numbers to hear how their voice changes. An interactive in the video section lets visitors capture a digital image of their face and discover how a computer mixes red, green, and blue to create a full-color image accurately on a screen.

STORAGE

At the hard drive, visitors use a giant read/write arm to flip magnets and write messages by setting eight bits of code. As the mammoth disk platters spin, visitors then see the bits read magnetically and decoded, with the results displayed on a monitor.

The interactive program embedded in the 8-foot-by-10-foot CD-ROM player reveals how a CD stores and retrieves vast amounts of data optically. By manipulating individual bits of information on a table-sized CD, visitors "write" a code, then see the giant mirrored disk spin past a laser that reads the code. A monitor displays the results. The CD-ROM player actually shoots a laser at pits and lands on the surface of the disk.

Creating these interactives was a challenge, since they had to work on spinning platters. The Museum worked with the New Curiosity Shop in California to develop the concepts for writing bits with magnets and laser light. Mystic Scenic Studios of Dedham, Mass., the exhibit's primary fabricator, developed the mechanics—a series of 96 bits that could be manipulated—while programmer Eban Gay created the software offering visitors feedback during the activity.

A magnified display inside the huge RAM modules lets visitors take "files" from a bin and "load" them into RAM. If visitors switch off the power, the files drop and the RAM "forgets" everything. Another display lets visitors discover how RAM stores information at the microscopic level by setting eight individual bits to form a single byte of information.

COMMUNICATIONS

In an Ethernet board, a lighthearted 3-D animation tells the story of networks. Created by computer animator Ed Hill, the interactive program reveals how messages are sent to all the computers on a local area network, but are delivered only to those with proper addresses.

Behind and outside the PC chassis, the huge modem's interactive shows how audio tones are used to send and receive digital messages over phone lines. Setting an 8-bit ASCII code (one byte) using audio tones turns into a series of corresponding high and low tones as it is sent to a receiving unit to be read, decoded, and displayed.

Photos by FAYFOTO

INPUT AND OUTPUT

A spruced-up, car-sized Kensington Turbo Mouse 4.0 controls the action of the cursor on the 108-square-foot NEC color monitor. Since the new ball sits on a cushion of air, not on ball bearings, it is much easier to manipulate.

In the first version of the *Walk-Through,* the keyboard's steep keys proved too hazardous for little feet. The new streamlined keyboard is ergonomically safe, allowing kids (of all ages) to climb on the keys to their hearts' content.

The new application being output to the big monitor is a realistic collection of work-and-play-related *faux* programs, games, and files that simulate the operating

Some members of *The Walk-Through 2000* exhibit team. From left: (back row) Don Greene, Jennifer Brackett, Owen Mysliwy, Dennis Shea, Josh Hooten; (front row) Patrick Liddy, Ann Fraioli, Sari Boren, and Christopher Grotke.

environment of a typical multimedia computer. Programmer Dan Griscom and graphics designer Patrick Liddy worked with the Museum to create the interactive activities, which include e-mail, songs, movies, letters, and games—all relating to C.J., the computer's imaginary teen-age owner, and the upcoming visit of a pen pal.

R.I.P. WALK-THROUGH 1.0

On Sunday evening, August 13, the giant computer's lights dimmed for the last time. In the following weeks, the old *Walk-Through*'s insides were razed. As the opening date approached, Mystic Scenic Studios worked round the clock, as the Museum's carpentry and design shop prepared the exhibit space and completed a mammoth replica of a bubble-jet printer. At the crack of dawn and after dusk, the PC's huge components arrived (in 10 truckloads) from Mystic Scenic. Six-man crews carefully unloaded the oversized parts in sections and placed them in the exhibit. Meanwhile, local muralists finished painting the huge books and other details on C.J.'s desk that accentuated the big computer's scale.

Finally, on Saturday, October 21, *The Walk-Through Computer 2000* opened to the public. Jim Blessing, 9, of Concord, Mass., was the first person to operate the upgrade. The last to use the old exhibit in August, Jim returned in the fall, eager to try out the new version. (He gave it a big thumbs up.) As of July 31, more than 100,000 visitors had explored the new PC.

EXHIBIT ADVISORS & SPONSORS

The upgrade would not have been possible without the support of its sponsors.

PRINCIPAL SPONSORS
- Cirrus Logic, Inc.
- Intel Corporation

MAJOR SPONSORS
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- Avid Technology, Inc.
- Bose Corporation
- Digital Equipment Corporation

EXHIBIT ADVISORS

The following individuals offered valuable insights throughout the planning and implementation of the upgrade:
- Daniel Dennett
- Clif Gerring
- Jan Liziak
- Christopher Morgan
- Mitchel Resnick
- Lee Sproull

THE PRESS AND THE CELEBRITY PC

News of the original *Walk-Through Computer* traveled quickly around the world, generating media coverage in 63 countries, including spots on the *Today* show and *Sesame Street*.

Not to be outdone, the new *Walk-Through* has already prompted interest worldwide. The exhibit turned into a mini-United Nations last summer, as film crews from Japan's NHK-TV, the BBC, and Germany's ZDF-TV arrived to shoot the giant computer for educational programs—all within the same week! A long feature in the German news magazine *Stern* prompted *The Times* of London to fly a photographer across the Atlantic to capture the giant PC for a cover.

On the home front, Bill Nye, PBS's "Science Guy," was filmed using the keyboard as a giant teaching tool. *Weekly Reader* put the exhibit on its cover to help teachers excite young children about computers. *Washington Post* writer John Schwartz was inspired to reflect on the nature of obsolescence for *Wired*. For a page-one story on Sherry Turkle, *USA Today* photographed the MIT psychologist-sociologist on the giant keyboard. In April, *The Boston Globe* followed suit, assembling 11 owners of successful computer companies—all women—for a "power" pose on the keyboard that ran on the front page of the *Living/Arts* section.

The big PC has also proven popular with corporations and event planners. In May, Microsoft Chairman and CEO Bill Gates introduced his company's Internet Discovery Kiosk program nationally at the Museum, simulcasting images and sound to the The *Walk-Through*'s screen. And on a lighter note, the giant PC made a guest appearance as "Boston's Favorite Byte" in a Papa Gino's television commercial highlighting local attractions.

THE BEST SOFTWARE FOR KIDS

A BOOK • A GALLERY • A WEBSITE • & MORE

The Computer Museum this year elevated the notion of a traditional exhibit to a new level by offering Museum-goers several mediums through which to explore a single subject. The subject was choosing the best software for children, and the Museum wrapped it in a comprehensive package that included a best-selling book, a vibrant on-site exhibit, and a constantly refreshed website.

THE BEGINNINGS

The spark for *Kids Software* was kindled a few years ago, when Museum staff began to realize the same question was surfacing time and again from Museum callers and visitors: What software should I buy for my kids? What's educational? What's worth the investment? Sensitive to the public's confusion and need for an answer, staff and volunteers began to brainstorm about how the Museum, as a source of accurate, reliable knowledge about technology, should respond to the question.

THE GUIDE TO THE BEST SOFTWARE

First to emerge from the brainstorming sessions was the concept for a book. Then began a search to find the right authors. Founding President Gwen Bell remembered Cathy Miranker and Alison Elliott, long associated with the Museum as members and supporters. California mothers with backgrounds in the computer industry, Alison and Cathy had discovered independently that no good sources of impartial information about software for kids existed. Gwen persuaded them that their collective experience in the areas of education, journalism, the computer industry, and parenting, as well as their belief in the Museum's mission of informal learning, made them the perfect pair to become authorities on the subject.

The match was thus made: Cathy and Alison would author the book, and the Museum would lend its expertise and objectivity. The result was *The Computer Museum Guide to the Best Software for Kids*, an informative, insightful collection of reviews published by HarperCollins in October 1995.

Cathy and Alison first worked with Museum staff to develop exacting standards by which to judge the software. They then tried out close to 1,000 titles for ages 2-12 with a group of test families. The *Guide*, which contains their final selection of 215 software programs, shows that the best titles are not necessarily the most popular on the best-seller lists.

Each title in the *Guide* is evaluated in rigorous detail, based on what the authors call the three L's: learning, looks, and longevity. A program, for example, should fit children's developmental needs and interests and have such a distinctive look and feel that they will want to play with it over and over again. The *Guide* met with immediate acclaim, and plans were put in place to publish an updated version each year.

THE WEBSITE

Meanwhile, the authors worked with Web developers and designers at the Museum to complement the print edition of the *Guide* with "electronic pages" on the Museum's website. Now people could choose the best

FAYFOTO

Some of the education staff. From left: (back) Patrick Mungal, Rina Granizo, Tanya Morris, Sheila Sibley, Andrea Browne; (front) Ann Fraioli, Jennifer Rich.

KIDS SOFTWARE GALLERY FUNDERS

The Best Software for Kids Gallery couldn't have happened without the generous support of these sponsors:

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- Measurement Techniques
- Quantum Corporation

of both worlds: the reassuringly low-tech book and its high-tech counterpart, the website (http://www.tcm.org/), for new information not included in the original *Guide*.

The website offered several sections to browsers:

- "Reviews" provided periodic new-product assessments, using the same categories and criteria developed for the book.
- "Parent Tips" delved into topics such as kid-proofing your computer and choosing reading software.
- "Best Lists" enumerated such things as the best programs for kids and parents to use together, or the best programming activities for kids.
- "Talk to Us" invited browsers to share their thoughts and opinions. Comments from kids, parents, teachers, and programmers helped to shape subsequent reviews.

Colorful icons of the book jacket (for information about the *Guide*), balloons (for Parent Tips), a mailbox (Talk to Us), and a propeller beanie (Best Lists) guided Web browsers as they made their selections.

THE EXHIBIT

While attention swirled around the *Guide* and website, exhibit and design staff were hard at work readying *The Best Software for Kids Gallery*, which opened in June. A logical outgrowth of the book, this permanent companion exhibit exemplifies the Museum's hands-on approach, as well as its belief that the best software will inspire kids to create, explore and learn by doing. Press and public response to the exhibit was immediate and substantial—parents and educators (not to mention kids!) never had a destination quite like this before. Their collective enthusiasm can be measured in the constantly high decibel level found in the gallery.

Copyright Mary Merrick

***Guide* authors Alison Elliott and Cathy Miranker with their kids. From left: Katie Blank, Alison Elliot, Emily Miranker, Sarah Blank, Cathy Miranker, and Molly Miranker.**

Illustrations courtesy of Soleil, Edmark and HMI Inc.

Exhibits staff chose 50 of the best titles in the *Guide* for the gallery, with representative selections on arts, animation, reading, math, story-telling, history, science, geography, and games. Sound effects, 3D graphics, and video abound, and the space is decked out in vivid kids' colors, adding to the exhibit's overall cheerfulness and energy.

Each of the gallery's 14 computer stations offers all of the unabridged titles, making software surfing easy for visitors. Once they sit down at a station, visitors can look for a specific title by name or type in a child's age and subject interest to obtain a unique list of the best titles in that category. In addition to downloading the program, they can read a short review that includes the suggested age range, assessments from the families who tested the software, a summary of the criteria used to evaluate the program, and a final recommendation, along with the publisher, platform, and price.

The stations also contain a checklist of criteria to gauge a program's learning, graphics, and replay value; purchasing tips; titles in Spanish and Japanese; software suitable for the hearing-impaired; and detailed information on computer viruses, made possible by support from Symantec Corporation. All the software is stored in two powerful, custom-made network servers, and all the stations, which were donated by Canon and Hewlett-Packard, are networked to a central file server using software by Novell.

The *Kids Software Gallery* is evaluated and updated regularly, and an expanded exhibit is planned for next year.

EDUCATIONAL PROGRAMS

Education and exhibits staff continue to implement special educational programming to help visitors get the most out of the gallery. For example, a "Play Group" for parents and toddlers (ages 18 months to five years) allows adults and kids to explore the software together.

For those a bit older, a "Software Discovery Group" (ages 10 and up) leads participants through half-hour tutorials about some of the gallery's expecially challenging titles. Each class focuses on one program in depth and is small enough so that everyone can play.

Visitors in search of more than skill-and-drill exercises and arcade games can sample "Selecting the Best," 15-minute demonstrations with tips on buying the best family software, using examples from the gallery.

THE COLLECTION

Kids Software also touches other areas of the Museum. As Cathy Miranker and Alison Elliott continue to review vast amounts of software, they continue to acquire mountains of packages—all of which currently reside in Cathy's basement. These will eventually become part of the Museum's permanent software collection.

LOOKING AHEAD

The fiscal year ended with a greatly expanded gallery and a brand new book in the works for next year. We're pleased to offer you a peek at the latter in the following pages.

GREAT SOFTWARE FOR KIDS & PARENTS

The Computer Museum continues its rewarding association with children's software gurus Cathy Miranker and Alison Elliott as they ready their second book, *Great Software For Kids & Parents*, for publication by IDG Books Worldwide, Inc. in early 1997.

Part of a new *...For Dummies* series for IDG, the book expands on the review-and-rating format of the original *Guide*, helping parents understand what kids of different ages can and should be doing with the computer. *Great Software For Kids & Parents* features chatty, personal reviews, with each chapter liberally peppered with snippets of practical yet inventive advice.

A sampling of reviews and snippets follows.

●●●

More than three dozen special software profiles provide an in-depth look at the best kids' titles. Here's a profile from Chapter 3, "Playing to Learn":

BUILD-A-BOOK WITH ROBERTO

This product is perfect for preschool-age children because of its unique focus: friends and feelings. If your preschooler is at the stage when you're constantly saying "Don't hit so-and-so, use your words," or if your child needs help putting words to feelings, consider *Build-A-Book*.

The hero, Roberto, is a hippo with a classic kids' problem. Hovering at the edge of the pool, he desperately wants to join the other hippos in a game of "hippo ball." But when Roberto asks, "Can I play with you?" his *friends* tell him to get lost. What's a hippo to do?

Kids help Roberto decide how to make his way into the game. Animated thought-balloons pop up over Roberto's head every time he gets an idea, and kids choose one. Sometimes the possibilities are emotional ("I could get angry" or "I could pout"). Sometimes they're imaginative ("I could amaze them" or "I could give them popsicles"). Sometimes they're outrageous ("I could pump all the water out of the pool"). When kids click their choice, the story resumes, and they watch the consequences. Sometimes, Roberto's strategy works. Sometimes the choice fails miserably, and then Roberto conjures up some more ideas, and kids make another choice.

SOLVING PRESCHOOL PROBLEMS

Playing with Roberto is great for preschoolers who are just becoming aware of how their behavior affects others. Kids get to experiment with different emotions and watch how others react. When Roberto throws a temper tantrum, for example, he scares the other hippos right out of the pool. And when he pouts, the others simply ignore him.

At any point, kids can choose to watch or print the story they have created. They can also experiment with emotions in an art room. By clicking on Roberto's face, they can watch his emotions change from angry to silly to surprised, and more. Print the face, and you have a perfect-sized mask for a small child. Kids can color the mask on the computer or print and color it by hand. Depending on their choice, kids can also create Roberto puppets that skip happily or scowl angrily. The Parents' Guide has some great tips about assembling Roberto books, masks, and puppets. (Theatrix Interactive, Ages 2-4)

Whatever the topic, readers of Great Software For Kids & Parents *will find sensible Parent Tips for getting the most from their kids' software.*

If your child is not ready for telling time, don't push it. Remember that kids have an internal developmental clock (please forgive the pun) that governs their readiness to learn. They need to develop a sense of time first—understanding today, tomorrow, and yesterday; morning, noon, and night; school days versus weekends—before they're interested in actually telling time. When they're ready, remember *The Time Twins in Trudy's Time* and *Place House* (Edmark). Even though the rest of the program may seem babyish to them, the clock activity may strike exactly the right note for kids in the second or even third grade.

Each chapter of Great Software For Kids & Parents *introduces Classroom Connections that show parents how different software titles dovetail with the school curriculum or build school skills.*

Writing or dictating stories helps kids get ready to read. As they watch their ideas take form as words on a page and hear them read aloud, kids make the connection between speaking, writing, and reading. They also encounter story-writing basics like settings, characters, and actions. And children sense the classic patterns—beginning, middle, and end—that make stories so satisfying.

The book is packed with special ideas for helping kids over the hurdles of schoolwork. Here's a sample from Chapter 6, "Using the Computer to Help Kids Master Math":

THE "I DESPISE MATH" SYNDROME
(& THREE WAYS THE COMPUTER CAN HELP)

An Ounce of Prevention

Cure the problem before it starts. Make a fun, no-pressure math program one of your child's first software titles. Read children's books that give you a chance to "talk math." (We especially love these authors: Mitsumasa Anno, Eric Carle, Tana Hoban, and Pat Hutchins.) That way, kids will have happy "math memories" by the time they reach elementary school. And they'll be less likely to pick up bad math "vibes" from older kids.

Try Togetherness

Talk to your children about how you handle math, whether you're checking the change from a purchase, keeping score at a game, or mortgaging property in Monopoly. Play with your kid's math software. It'll give them a chance to see you having fun with math; and it'll give you a chance to talk math in a no-pressure context.

Instead of hovering while your kids do their homework, hang out while they play a math CD-ROM. And play together, too.

Lighten Up

Humor helps. In one of our ventures onto the Web, we found a collection of math cartoons. Nothing fancy. The cartoons look as though they've been clipped from newspapers over the years and then scanned into the computer. But some are hysterically funny, and older kids may especially enjoy them. (www.csun.edu/~hcmth014/bamdad.html)

Great Software For Kids & Parents *contains scores of Family Fun suggestions for cooperative (and sometimes competitive) gameplay that extends software fun with off-the-computer activities.*

Just for fun, shelve the almanac that comes with your *Carmen* CD-ROM and don't touch the *World Wiz*. Play the game alongside your kids with you as the reference, instead. Share your geography know-how by thinking aloud as you puzzle out clues. (It's also a good way to show kids how to make an educated guess when you don't know the answer!) When you're right, your kids will be impressed. But be prepared for heckling when you're in the dark and the crook gets away!

In every chapter, practical Checklists help parents make choices among software titles. Here's one from Chapter 11, "Using the Computer for Explorations Back in Time":

How to choose among the scores of history titles available for home computers:

• • • First consider your kids. What are their personal interests? Egyptian pyramids? The gold rush?

• • • Next consider their schoolwork. Is this the year they tackle state reports? Are they studying colonial America?

• • • Here's the most important of the criteria. Make sure that the history titles give kids lots of experience with the "4 Rs"—Reading, Research, 'Riting and Reenacting:

✔ **Reading.** "Real" words from original sources and literature can attract and personalize kids' interest. Reading (or hearing) words written or spoken in the past tells kids that history is about real people, real places.

✔ **Research.** Kids need to "do" history as well as read about it. When they uncover information on their own about events and people, it really sticks with them.

✔ **'Riting.** For kids, writing history as they read and research hammers home the facts and flavors of times past. Good software invites kids to pretend on paper—writing diaries, newspaper accounts, imagined debates.

✔ **Reenacting.** Stepping into someone else's shoes is a powerful way of experiencing the hopes, hardships, and challenges of historical figures. Don't put this down as mere playacting! Envisioning how (and why) other people felt and acted is as important for understanding the world today as it is for grasping the significance of historical events.

Kid-friendly Web sites can be a real educational bonus—if parents can find them! WebVentures point out worthwhile sites that relate to reading, writing, history, science, geography, and more.

GREAT SITES FOR WORD LOVERS

Chances are kids (and parents!) who like codes also like anagrams and puns, knock-knock jokes, and crossword puzzles. Here are some Web sites to surf in your quest for wordplay:

Palindromes

A palindrome is text that reads the same backward as it does forward, like "Madam I'm Adam" or "Able was I ere I saw Elba." If your child finds those silly sentences intriguing, check out this amazing site for links to hundreds and hundreds of palindromes. You and your kids will find such gems as: "Flee to me, remote elf." "Was it a cat I saw?" "He did, eh?" "No lemons, no melon." (www.rdg.ac.uk)

Anagrams

An anagram is a word or phrase made from the letters of another word or phrase. Ideally, the new word(s) should also shed some light on the meaning of the original word(s). Because it's an exercise in mental agility and good for vocabulary, teachers often have students practice making anagrams. They're fun to do at home, too. Start kids off with simple words, and after they get the hang of it, have them compete with each other or with you by using longer words or names. We surfed the Web for inspiration and found these examples at www.geocities.com:

- The Morse code = Here come dots
- England's Queen Victoria = Governs a nice quiet land
- Funeral = Real fun

For an instantaneous anagram generator, check http://csugrad.cs.vt.edu/~eburke/anagrams.

Word Searches

Every week this site posts new crossword and word-search puzzles that are just right for third through sixth graders. (www.smartcode.com/isshtml/weekwsk)

Word Finds, Analogies & More

This site (http://syndicate.com) features word find puzzle contests (how many words of four letters or more can you make from "trestles" or "charisma," for example); word analogy puzzles (child is to mother as symphony is to x), rebuses (pictures that stand for letters or words), and more.

Illustrations courtesy of IDG Books Worldwide, Inc.

Coxhead-Mercedes adding machine, ca. 1905

COLLECTIONS

IDC ?

COMPUTERS

Altos Computers
Altos C8000, 1985
One of the first multi-user machines to use Digital Research's MP/M-80 and a large hard disk.
Donated by Andy Johnson-Laird. X1283.96

Apple Computer, Inc.
Apple Lisa
128K
Donated by Boston Computer Society. X1255.96a

Apple Computer, Inc.
Apple II, 1977
This was the first Apple computer sold in New England, specifically at the Harvard Coop in Cambridge. As Apple monitors were not made until 1978, this unit relied on a Sylvania TV, serial number A12142.
Donated by Boston Computer Society. X1262.96a

NA

Apple Computer, Inc.
Apple IIc Plus
Donated by Boston Computer Society. X1255.96b

Apple Computer, Inc.
Apple IIe
Donated by Boston Computer Society. X1262.96b

Apple Computer, Inc.
"Black Apple," ca. 1980
Commissioned by Bell & Howell, this unit is equipped to play videotapes.
Donated by Boston Computer Society. X1263.96

AT&T 7300 desktop computer, ca. 1984
AT&T's first foray into the desktop computer market. It runs a proprietary version of Unix with telephony extensions.
Donated by Andy Johnson-Laird. X1278.96

Atari, Inc.
800 XL computer
Donated by David Dellinger. X1258.96

Coleco Industries
Coleco Adam
Donated by James Patriquin. X1269.96

Compaq Portable Computer, Model 1, 1982
One of the very first off the assembly line.
Donated by Compaq Computer Center. X1234.96

Compaq Computer Corporation
Portable IBM PC-compatible, 1984
Donated by Frank W. Winne, Associates. X1227.96

Cromenco Z2, 1977
Donated by Andy Johnson-Laird. X1279.96
2Mhz/4Mhz Z80 CPU with 65,536 bytes of RAM

Data General Corporation
Data-General One, ca. 1984
Donated by Andy Johnson-Laird. X1281.96

Digital Equipment Corporation
Digital Rainbow, 1984
Donated by William Davis. X1274.96

Electronic Associates, Inc.
Pace 48 Analog Computer
Donated by Aeronautics Lab, MIT. X1248.96

Epson Apex Computer
Donated by Stephen Levine. X1268.96

GM Research
First patented portable computer, 1979
Invented by James Murez, includes patent.
Donated by Leonard Massey. X1243.96

Heath 161 portable computer
Donated by Mr. Micha Ronen. X1272.96

International Business Machines Corporation
IBM PC (first model), ca.1982
Donated by William Wachenfeld. X1261.96

International Business Machines Corporation
PC jr., ca 1983
Donated by Thomas Burchill. X1259.96

Kaypro 10 Computer, 1984
Donated by Neil Karl. X1231.96

NEC Corporation
8201a laptop computer, 1983
With miniature printer, tape recorder, cables, software tape.
Donated by Al Marsh. X1247.96

North Star Computers, Inc.
Advantage Computer
Donated by Connie Ducey. X1253.96

Olivetti ETV 260 word processor, ca. 1980
CPU built into printer.
Donated by Boston Computer Society. X1232.96

ON Computer
Donated by Jim Kahnweiler. X1242.96

Onyx Computers
Onyx C5000, ca. 1982
Donated by Andy Johnson-Laird. X1282.96
One of the first "professional" personal computers used in US businesses. A descendant of the Altos C8000, it uses a 5" hard disk manufactured by IMI and features a non-streaming tape drive from DEI for backup purposes.

Osborne 1 "luggable" computer, 1981
Donated by Joe Santangelo. X1226.96

Processor Technology, Inc.
Sol-20 Computer, ca. 1978
Donated by Richard Pence. X1254.96

Tandy Radio Shack
TRS-80, Model I, 1977
The TRS-80 (affectionately known as the "Trash-80") was a hit on the home front for those without the wherewithal to tackle the homebrew kits on the market. The set contained a monitor, keyboard, and already installed BASIC software and relied upon a standard issue cassette recorder to record programs or load taped programs. Word length was 8 bits. 16K memory.
Donated by Mark Corigliano. X1238.96

Tandy Radio Shack
TRS-80, Model 100 (laptop), 1983
Donated by Charles Zraket. X1233.96

Texas Instruments, Inc.
TI-99/4a, 1979
Donated by Susan McDougall. X1235.96

Texas Instruments, Inc.
TI-99/4 with speech synthesizer, 1979
Donated by Walter Tincher. X1245.96

Timex-Sinclair 1000 (ZX81), 1981
Donated by David Dellinger. X1240.96

Victor Computer Corporation
Two Victor 9000 computers, ca. 1982
One with internal hard drive, one with external hard drive.
Anonymous. X1293.96

Zenith laptop computer, ca. 1983
Donated by KSNW-TV, Wichita, KS. X1270.96

Zenith Z-100
Donated by Ruth Sheridan. X1257.96

SUB-ASSEMBLIES AND COMPONENTS

Amdahl Corporation
Integrated circuit with cooling tower element, embedded in lucite cube.
Donated by Rita Saltz. X1277.96

Cromenco, Hayes, et al.
Eight S-100 boards used in the Cromenco Z2, 1975-1978
(1) EPROM burner; (2) early PC speech synthesizer; (3) Tarbell audio cassette tape interface (made by PC pioneer Don Tarbell); (4) Speech-lab speech recognition board; (5) DC Hayes modem card (300 baud); (6) Digital/analog board from Cromenco; (7) S-100-based logic analyzer (connected to oscilloscope for test/diagnosis work); (8) 2 dazzler boards.
Donated by Andy Johnson-Laird. X1280.96

Intel Pentium Chips, 1995
Ten chips in tray, measuring 12 1/4" x 5 1/4".
Donated by Intel Corporation. X1289.96

Prime 9655 CPU board set
Donated by Paul Sliney. X1273.96

CALCULATORS

Burroughs Adding Machine Corporation
Portable Adding Machine, ca. 1940
Donated by Mrs. Eleri Gulliver. X1228.96

Contina Ltd. Mauren
Curta calculator, ca. 1950
Donated by Thomas A. Hyndt. X1225.96

Coxhead-Mercedes adding machine, ca. 1905
Donated by John Hancock Financial Services. X1244.96

Otis King
Helical Slide Rule, ca. 1930
Serial Number R1807
Donated by M.L. Petterson. X1265.96

MEMORY

Digital Equipment Corporation
Unused 1" PDP tape (1 box)
Donated by Walter Beesley. X1241.96

Ferranti
Cathode Ray Tube, ca. 1950
Suspended in wooden crate - 21"x11" x11"
Donated by Philip E. Fox. X1286.96

International Business Machines Corporation
Magnetic Core Plane Parts, 1955
These experimental parts represent some of the results of Dr. Hans P. Luhn's study of the core-plane winding problem. A green plastic plate was designed to hold 3-hole cores then being considered for a higher-speed memory. The tan and gray plastic strips held conventional cores for winding as is illustrated by several cores on one of the strips. A number of these strips were to be stacked so that an additional wire could be put through each core perpendicular to the wires that ran along the strips. These approaches were dropped when improved techniques for handling and winding toroidal cores were developed by MIT Lincoln Labs and IBM Poughkeepsie Manufacturing.
Donated by Philip E. Fox. X1285.96b

International Business Machines Corporation Two IBM 704 Magnetic disks, ca. 1955

36 cm in diameter, hole in middle 18 cm in diameter.

Donated by William Meyer, Inc., IBM. X1230.96

International Business Machines Corporation Unused IBM punch cards (1 box), ca. 1962

Donated by Shag Graetz. X1267.96

James Millen Manufacturing Company, Malden, MA Electrostatic Memory Unit, Type 706, 1953

Each unit holds 2 type IBM-85 3 inch cathode ray tubes, which were specially designed for Williams' storage use.

Donated by Philip E. Fox. X1284.96

MIT Whirlwind computer, ca. 1951

Plug-in circuit boards, 4X4 core memory planes, paper tape and peripherals (spoolers, transports).

Donated by Bill Wolf. X1256.96

Tandem Semi-memory Board, 256 KB, 1979

This board was used in a NonStop computer and once sold for $20,000.

Donated by Shanghai Tandem Division. X1290.96

LOGIC

International Business Machines Corporation IBM 701 pluggable logic units, ca. 1950

Donated by Philip E. Fox. X1285.96a

International Business Machines Corporation Two IBM 704 Plug-In Logic Modules, ca. 1955

Donated by William Meyer, Inc., IBM. X1229.96

TRANSDUCERS

Dataproducts Corporation Dataproducts Printer, 1962 Serial Number 1

Donated by Dataproducts Corporation. X1295.96

Includes a 500-page thesis by Rick Forman on the First 10 Years of Dataproducts.

Digital Equipment Corporation VT100, 1981

Donated by Dr. Thomas Altshuler. X1237.96

Hayes Microcomputer Products Smartmodem (300 baud)

Donated by Dr. Thomas Altshuler. X1236.96

International Communications Corporation Two 24 LSI modems, 1976

Donated by BBN. X1292.96

MICROPROCESSOR-BASED DEVICES

Bally, Inc. Pong Game (home TV version)

Donated by Stephen Levine. X1251.96

ROBOT

Heathkit Hero Jr. Robot

Donated by Steven Reich. X1260.96

CARD DATA PROCESSING EQUIPMENT

International Business Machines Corporation IBM 603 Multiplier Chassis, ca. 1946

The 603 was manufactured for a short time in 1946-1947 before it was replaced by the Type 604 Calculating Punch.

Donated by Philip E. Fox. X1285.96c

Wright Line Model 2600 Manual Card Punch

Donated by Joe Fisher III. X1271.96

SOFTWARE

Internet worm source code, 1988

Programmer's decompilation of the worm that brought the Internet down in 1988. The code was written by Robert T. Morris, Jr., then a student at Cornell University.

Donated by NASA Ames Research Center. X1294.96

OTHER

Data General College Campus Recruiting Poster, 1977

Executed in comic book style, this poster portrays four action superheroes, each bearing a Data General product or product name on his or her uniform.

Donated by Charles Polachi, Jr. X1287.96

IntelliChoice, Inc. *The Complete Car Cost Guide*, published in April, 1987.

The first database-published book to be computerized and automated.

Donated by IntelliChoice, Inc. X1276.96

International Business Machines Corporation Teakwood coaster holder with metallic IBM 360 logo, ca. 1964

Donated by John Esbin. X1266.96

Ungermann-Bass Access One 11/slot chassis (router)

Autographed by Ralph Ungermann, this is the 1000th Access One produced.

Donated by Microsoft Corporation. X1291.96

Hermann Zapf archive, ca. 1970-1990

Two linear feet of business-related material of the noted typographer. Collection includes design and printing examples; corporate information on his company, Design Processing International; format manuals; and miscellaneous clipped articles.

STUDY COLLECTION

The study collection is administered and stored separately from the artifact collection. The items in this collection are used for educational, exhibit, and research purposes. They often duplicate items in the artifact collection.

Commodore Business Machines Inc. Commodore PET

Donated by Stephen Levine. S#1250

Epson HX-20 portable computer, 1982

Donated by Jeff Purser. S#1239

North Star Computers, Inc. North Star Horizon

Donated by Alan Bowler. S#1252

Tandy Radio Shack TRS-80, Model 1, 1977

Donated by Khaled Ahmed Soliman. S#1288

Tandy Radio Shack Corporation TRS-80, Model 100, 1980

Donated by Ed Robin. S#1249

Timex-Sinclair Spectra 1000 (ZX81), 1981 Timex-Sinclair, Inc.

Donated by Khaled Ahmed Soliman. S#1264

DONORS TO THE LIBRARY, FILM/VIDEO & PHOTO ARCHIVES

Klaus Berkling
Rex Bienz
John Block
Cheryl Cooper & Bill Warriner
Digital Equipment Corporation
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Jeff Hecht
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Phil Janus
Andy Johnson-Laird
E. Paul Love, Jr.
Daniel McCracken
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John Rosche
Rita Seplowitz Saltz
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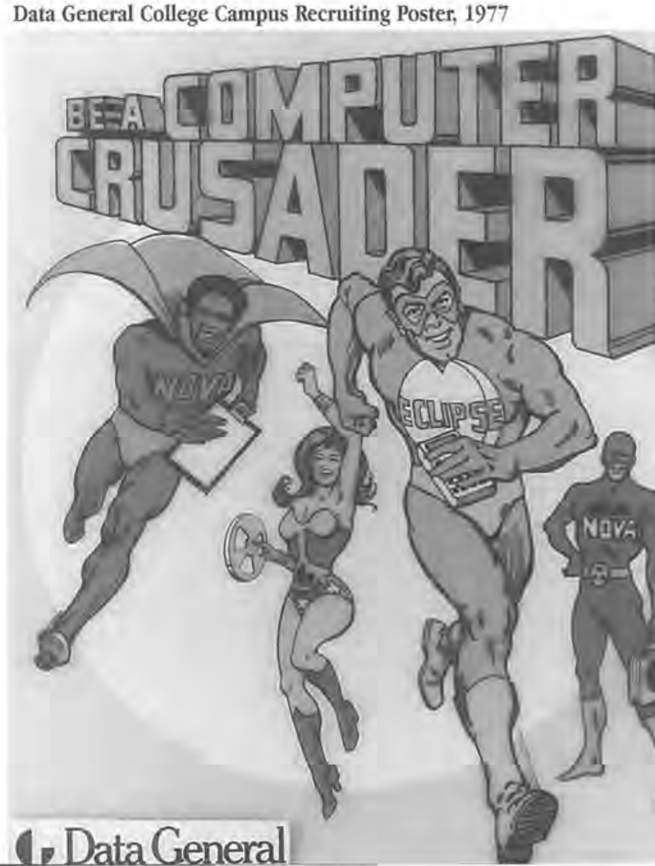
Shushan Teager
University Video Communications
John Van Geen
William Wolf
and other anonymous donors

Data General College Campus Recruiting Poster, 1977



A unique fundraising event to benefit the Museum's educational programs, The Computer Bowl™ plays out the legendary East/West Coast high-tech rivalry in a contest of computer knowledge. The 1996 Bowl marked the release of the Museum's *Official Computer Bowl Trivia Book* (see page 5), and videotaped cameo appearances by industry leaders. The score was the West 240, East 200. Since 1988, the Bowl has raised $2.5 million in donations and in-kind support. It attracts hundreds of sponsors and volunteers, and media coverage around the world. The Bowl would not have been possible without the support of those listed below.

Joe Czop

The winning West Coast team (from the left): Dave Anderson, Magdalena Yesil, Captain Steve Blank (hoisting the trophy), Gordon Eubanks and Eric Schmidt.

East Coast Team
George Colony
Forrester Research

Paul Gillin, Captain
Computerworld

Judith Hurwitz
Hurwitz Consulting Group

Ted Leonsis
America Online

Steve Mills
IBM Software Solutions

West Coast Team
Dave Anderson
Amdahl Corporation

Steve Blank, Captain
Rocket Science Games

Gordon Eubanks,
Symantec Corporation

Eric Schmidt
Sun Microsystems

Magdalena Yesil
CyberCash

The Questioners
Stewart Cheifet
Computer Chronicles

Heidi Roizen
Apple Computer

The Judges
John Doerr
Bob Frankston

The Computer Bowl Script
Christopher Morgan

The Scorekeeper
Steve Golson

The Computer Bowl Sponsors
Sprint
Presenter

Computerworld,
The Most Valuable Players Awards Sponsor
Underwriter

Intel Corporation,
The Official Microprocessor
Underwriter

Official Sponsors
ACM
The First Society For Computing

Adaptec
The Best Connections

Apple Computer
The Power To Be Your Best

Bay Networks
The Internetworking Company

Coopers & Lybrand LLP
The Accounting Firm

Kleiner Perkins Caufield & Byers
The Venture Capital Company

The Nasdaq Stock Market
The Stock Market For The Next 100 Years

Network General Corporation
The Sniffer Brand Network Analyzer

Powersoft Corporation
The Client Server Application Tool

Stratus Computer
The Fault Tolerant Computer Company

Symantec Corporation
Software For Desktop And Networks

Table Patrons (2+ tables)
ACM
Apple Computer
Coopers & Lybrand LLP
Cunningham Communication
Forrester Research
IBM Corporation
Miller Shandwick Technologies
The Nasdaq Stock Market
Sun Microsystems
The Weber Group

Table Sponsors
Amdahl Corporation
America Online
Anderson Consulting
Asset Management Company
Gwen and Gordon Bell
Business Week/LAN Times
Charles River Ventures
CyberCash
Edelman PR Worldwide
FitzGerald Communications
Inso Corporation
Interval Research Corporation
Lucash, Gesmer, Updegrove
Mathworks
David Nelson
Novell
Price Waterhouse LLP
Quantum Corporation
Rocket Science Games
SOFTBANK
Spectron Microsystems
Unison Software
Wired
Xerox PARC

Media Sponsors
Business Week
Byte
CIO Publishing, Inc.
Communications of the ACM
Computerworld
ENT
Forbes ASAP
Game Developer
Information Week
InfoWorld
Interactions
LAN Times
Midrange Systems
Network World
OS/2 Developer
PCWEEK
The Red Herring
Software
Software Development
UNIX Review
Upside
Web Techniques
Wired

The East Coast Team (from the left): George Colony, Judith Hurwitz, Paul Gillin, Ted Leonsis and Steve Mills.

Joe Czop

In-Kind Sponsors
1185 Design
American Airlines
America Online
Center for Electronic Materials at San Jose State University
Computer Literacy Bookshops
Cunningham Communication
Gordon Liquors
Gourmet Caterers
K&L Wines
Muller Printing
PCTV-Computer Chronicles
Upside
Wace Graphics
A Wild Flower

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Christopher Morgan

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Christine Hughes
Mitchell and Julie Owens
Kertzman
Christopher Morgan
Harry and Carol Saal

The 1996 Computer Bowl Committee
Kathy Sulgit Johnson, Co-Chairperson
Mark Johnson, Co-Chairperson
Brett Bondi
Joanne Ehrich
Vince Emery
Colleen Gleason
Catherine Keller
Diane Nelson
Lisa Payne
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Jay W. Forrester addresses The Friends of The Museum at their first annual dinner. He was named a Museum Fellow for his contributions to computing, i.e., the design and construction of the Whirlwind computer.


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Computer Museum Founding President Gwen Bell (left), Marabel Lopez-Howard, and Andrew Dod of Hayes Microcomputer Products discuss *The Walk-Through Computer* upgrade, which includes a giant replica of a Hayes modem.


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Cathy Miranker, co-author of *The Computer Museum Guide to the Best Software for Kids*, joins Museum members' children for the *Kids Software Gallery* ribbon-cutting.

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From left: Christopher Grotke, Computer Museum exhibit developer; Suhas Patil, Cirrus Logic Inc. chairman of the Board; Charles Zraket, Computer Museum chairman of the Board; and David House, Intel senior vice president, unveil *The Walk-Through Computer 2000*.

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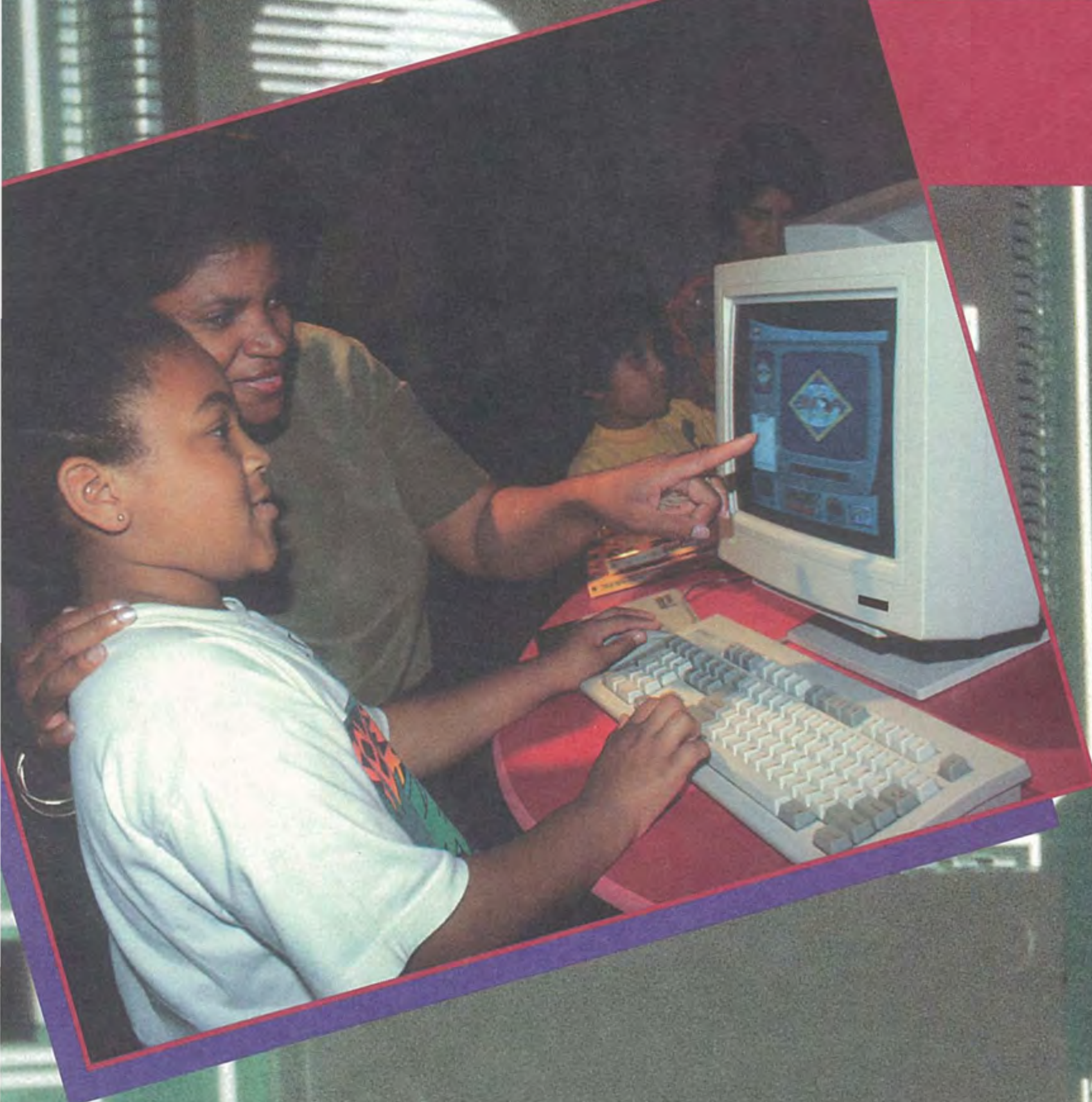

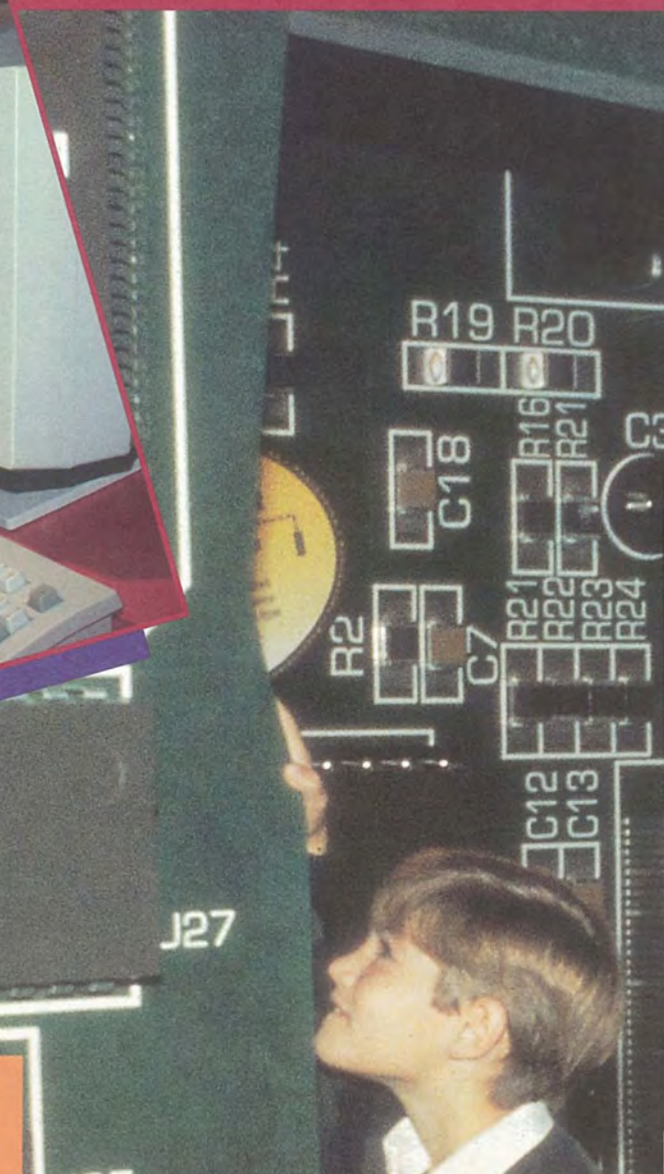

MISSION STATEMENT

To educate and inspire people of all ages and backgrounds from around the world through dynamic exhibitions and programs on the technology, application, and impact of computers

To preserve and celebrate the history and promote the understanding of computers worldwide

To be an international resource for research into the history of computing

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Winter: Tuesday-Sunday, 10am-5pm
Summer: daily, 10am-6pm

ADMISSIONS
$7.00 adults; $5.00 students, children five and up, seniors. Free for Museum Members and children four and under. Half price Sundays 3-5pm. Group rates by arrangement.

Cover photographs by FAYFOTO

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the computer museum

1997 ANNUAL REPORT

from **the chairman**

Dear Friends, Each of us associated with The Computer Museum shares in the exciting opportunities for supporting and celebrating the resources of this one-of-a kind facility. Every year, thousands of Computer Museum visitors experience the vital and growing role computers play in how we live, learn, work, and play. Through its collections activities and its ongoing educational programs, the Museum provides a unique perspective on our past and future cultures, documenting humankind's ongoing adventure with its machine likeness. It is in this same spirit that the Museum's new logo was designed, representing the infinite possibilities that computers offer society.

This is an amazing moment in time where technology has become the driving force for social, economic, and personal issues. We have much to look forward to as we join in helping the Museum lay the groundwork for future generations.

Larry Weber, Chairman of the Board

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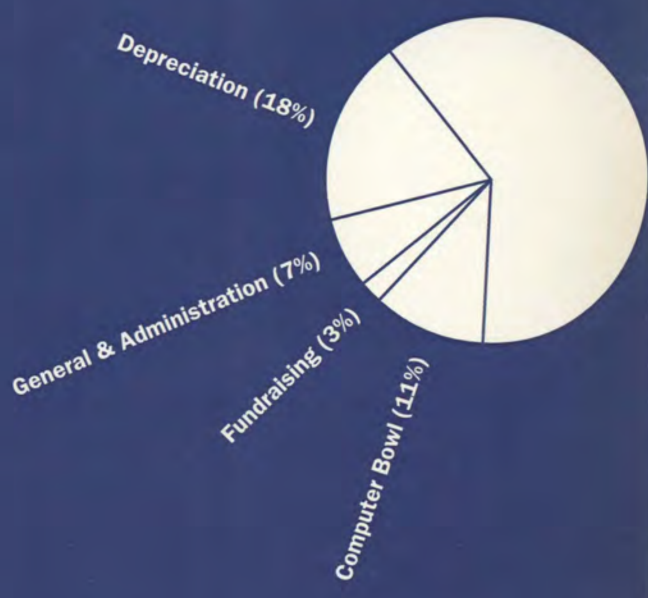
The Computer Museum, Inc. Expenses for the year ended June 30, 1997



from **the executive director**

The Museum Expands Its Scope

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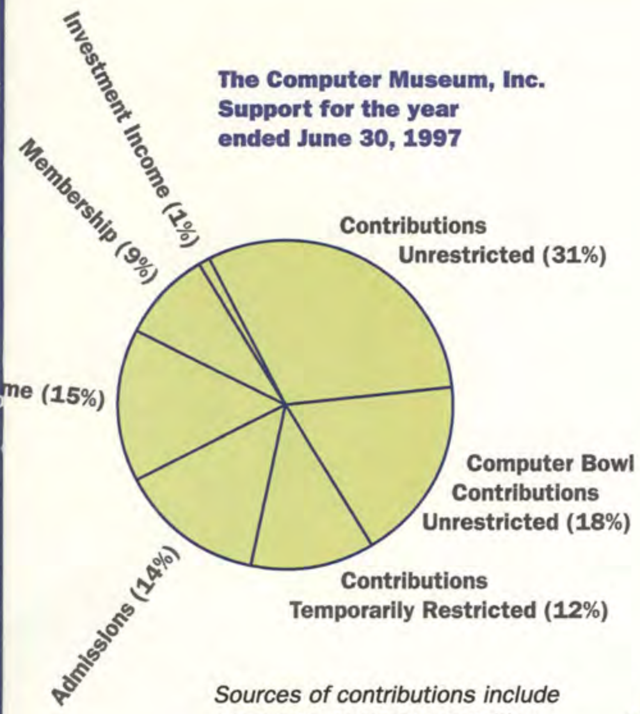

Sources of contributions include corporate, corporate matching, foundation, government and individuals.
Total Support: $3,784,533

After 12 years of growth on Boston's waterfront, The Computer Museum took momentous steps beyond its home base this year: We established a center for historic preservation in Silicon Valley, launched a "virtual" home on the Web, and expanded our Clubhouse locations nationally and internationally.

The Computer Museum History Center began operation last September in 10,000 square feet generously loaned by NASA Ames at Moffett Field in Mountain View, Calif. The majority of the Museum's collection is now stored there, and is viewable by appointment (contact collections@tcm.org). Under the leadership of the History Center's chairman, Len Shustek, and the Museum's founding president, Gwen Bell, staff and volunteers have scaled up our proactive collecting of computer artifacts. They are also working to build a base of support for a permanent public facility for the exhibition, study, and preservation of the material record of the development of computing.

Launched in July, our website (www.tcm.org) provides a wonderful way to spur on the Museum's mission to reach people "of all ages and backgrounds from around the world," as it offers Web browsers the chance to experience all facets of the actual Museum. Its content spans the history of computing, computer careers, and robotics, and features several Java-enabled interactive "exhibits" and messaging between online visitors. Barely 12 months after its launch, we are now improving the site to provide quicker access to information and more depth on computing history. Within the space of a year, the number of people visiting our website has climbed to 100,000 a month, about eight times the number who visit the Museum in person. The site also garnered the Massachusetts Interactive Media Council (MIMC) Award for the "nonprofit/public service online site" of the year.

Remarkable progress has taken place in the Museum's education programs. First, the number of school group visitors reached an all-time high of more than 44,000, as educators responded to the informative yet entertaining programs presented within our galleries. Second, under the strong leadership of Gail Breslow, the Computer Clubhouse is reaching increasing numbers of at-risk inner-city youth, with new satellites opening in Boston, New York, and Germany, and with plans in development for widespread dissemination in partnership with a national organization. Third, the Museum has opened the Education Program Center to train educators in new technologies. Equipped with 15 networked PCs, the innovative center offers workshops and courses to help teachers implement educational reform in their classrooms, especially in the way science and mathematics are taught. The center will also feature programs to help educators engage girls in becoming curious and expert computer users.

Program Services (61%)

Major program services include The Computer Museum History Center, The Computer Clubhouse, exhibits, educational programs, and Museum store.
Total Expenses: $3,578,493
(less depreciation of $773,351)

The Museum's rapid progress relies on the enthusiasm and committed efforts of volunteers. The creation of the Museum's new identity this year provides an outstanding example: A dedicated volunteer Board committee of professional marketers analyzed the Museum's requirements for projecting its "brand," and for determining the architecture of its various "products." Committee member Christine Hughes then secured the *pro bono* services of the top-notch New York design firm Frankfurt Balkind to implement the strategy. The result is the new logo and design featured on the cover of this annual report. The new Computer Museum History Center, The Computer Bowl®, the upcoming *Virtual Fishtank* exhibit, and the Museum's governing body of 22 Trustees and 49 Overseers are all driven by such dedicated volunteers.

On behalf of everyone at the Museum, I thank you, our contributors, for your hard work, ideas, and financial support, all of which make the Museum such a unique place.

Oliver Strimpel

Oliver Strimpel, Executive Director

the **year in** review

July 1996

On July 29, TCM launches The Computer Museum Network (www.tcm.org). Web visitors can now experience the Museum through Java-enabled, interactive exhibits, a historic timeline, educational materials, and the Web-Store.

The Museum establishes an administrative office in Santa Clara, Calif., for its new History Center.

The Patriots' Trail Girl Scout Council launches a Computer Clubhouse in the Boston community, based on the original model created in 1993 at the Museum. Other community Clubhouses will open later, at Boston's United South End Settlements and the Roxbury Boys and Girls Club.

The Association of Computing Machinery (ACM) collaborates with the Museum to produce the first two installments of the *Computer Pioneers and Pioneer Computers* video series.

Audio-tours of the exhibit galleries are introduced in French, German, Japanese, Spanish and English.

August

The Best Software for Kids Gallery wins *Boston Magazine's* Best of Boston 1996. A "wonderful gallery" with an "excellent selection," says *Boston*.

NASA Ames Research Center provides 5,000 square feet of warehouse space to The Computer Museum History Center. The space, located at Moffett Federal Airfield, Mountain View, Calif., will house the Museum's collection.

September

Completing its cross-country trek, half the Museum's historical collection (100,000 pounds) arrives from Boston at Moffett Federal Airfield.

A $600,000 grant from the National Science Foundation spurs planning and development of *The Virtual Fishtank* in partnership with the MIT Media Lab. When this immersive exhibit opens in mid-1998, visitors will create their own virtual fish, launch them into a virtual fishtank, and watch them interact with other visitors' fish.

October

On October 18, TCM officially announces the establishment of The Computer Museum History Center in Silicon Valley. Its charter is to build the Museum's comprehensive 16-year-old collection of artifacts and computing archive proactively; to be an international resource for research into the history of computing; and to create exhibits directed primarily to interested adults and scholars. Initial underwriting for the Center is provided by Gwen and Gordon Bell and Dr. Leonard J. Shustek, a founder of Network General, a Museum Trustee and chairman of the Center.

A poster, "25 Years of the Microprocessor," featuring 150 chips, is created by MicroDesign Resources and the History Center. In addition, an exhibit is mounted for MDR's conference in San Jose. Federico Faggin donates his prototype of the Japanese Busicom Calculator to the Museum for the exhibit.

The first step is taken to establish a Computer Clubhouse network worldwide, with the opening of a community Clubhouse near Stuttgart, Germany.

On October 26, the Museum, designated "NetDay Central," joins the grassroots effort to bring the Internet to some 400 Massachusetts schools.

The Computer Museum Network (www.tcm.org) receives the 1996 Massachusetts Interactive Media Council (MIMC) Award for "nonprofit/ public service online site."

November

The History Center and the Intel Museum co-curate "The Museum at COMDEX," a large-scale exhibit commemorating the 25th anniversary of the microprocessor. Sponsored by Intel, Motorola, Ziff-Davis and SOFTBANK COMDEX, the exhibit draws 30,000 people at COMDEX Las Vegas. Vignettes include a life-sized re-creation of a 1970s' hacker's garage, installed in the Museum's *People and Computers* exhibit in June, thanks to Intel, SOFTBANK, Michael Simmons & David Nelson.

The Best Software for Kids Gallery adds 17 new titles in time for the holidays.

© Louis Fabian Bachrach III

The Museum's collection has room to spread out in its new home at NASA Ames Research Center.

In a program partly funded by the Massachusetts Cultural Council, Computer Clubhouse Girl Scouts and Program Developer Stina Cooke build instruments using LEGO, sensors and "Crickets," tiny programmable devices developed at the MIT Media Lab.

January 1997

The History Center accessions IBM's 7030, the STRETCH supercomputer. Only seven were built. This 1960s' machine had been stored for decades by Lowell Wood before being donated to the Museum's collection.

To celebrate the birthday of *2001's* computer Hal on January 12, visitors try out a new series of educational activities on robotics and machine intelligence.

FAYFOTO

The Hong Kong Jockey Club vignette, enhanced for "The Museum at COMDEX" and installed in June at the Museum in Boston, re-creates an early use of a Lotus 1-2-3 spreadsheet running on an IBM PC.

© The Production Network Inc

Andrew Grove, president and CEO, Intel Corporation, steps back in time in the* Hacker's Garage*, which opened at "The Museum at COMDEX" in November and then traveled to Boston for permanent display in the Museum's historical gallery. Courtesy SOFTBANK COMDEX.

February

A new section on "Careers in Computing" is introduced on the website. Immediately popular, it links to actual job openings via The Monster Board, and offers data compiled from computer professionals, employment agencies, career-related websites, and the U.S. Department of Labor.

Wizards and Their Wonders previews at the ACM97 50th Anniversary Conference in San Jose. TCM founding president Gwen Bell worked with photographer Louis Fabian Bachrach III to organize the exhibit, which features photographic portraits of the computer industry's leading inventors and visionaries.

March

The first History Center Talk takes place at Moffett Field—Gary Starkweather speaks on the creation of the first laser printer at Xerox PARC.

Ken Olsen, founder of Digital Equipment Corporation and the Museum's first chairman, is named a Museum Fellow on March 20 at the annual Friends of the Museum dinner. He is the third Fellow to be honored for contributions to computing, joining the late Grace Hopper and Jay Forrester.

April

The Museum's first live audio Webcast, hosted by *PC Week* Radio, is featured as part of the second NetDay on April 5.

The Ninth Annual Computer Bowl®, presented by Ziff-Davis, takes place April 18 in Santa Clara, and is beamed by satellite to its Boston audience. Hosted by actor Robert Urich, star of ABC-TV's *Vital Signs*, the Bowl airs live on the Web and as a special edition of *Computer Chronicles*. The West Coast team, captained by Steve Kirsch, Infoseek, wins with a score of 230 to 140. The team includes Steve McGeady, Intel; Nathan Myhrvold, Microsoft; Kim Polese, Marimba; and Grant Saviers, Adaptec. The East Coast team, led by Sam Whitmore, Ziff-Davis, features Chuck Digate, MathSoft; Frank Ingari, Shiva; Ilene H. Lang, AltaVista; and Steve Vana-Paxhia, Inso.

May

The History Center's administrative offices relocate to Moffett Federal Airfield.

The TCM website generates 1.5 million hits for the month, an all-time high.

With support from the NYNEX Foundation and American Express, the "Clubhouse-to-College/Clubhouse-to-Career" initiative is launched to expose Clubhouse youth to professional and academic opportunities, including field trips to colleges and companies such as Lotus and BankBoston.

FAYFOTO

Museum Fellows Ken Olsen (left) and Jay Forrester (right) share a moment with Museum Executive Director Oliver Strimpel at the Annual Friends of the Museum dinner.

June

NASA Ames makes available an additional 5,000 sq. feet of warehouse space to the History Center.

The *Hacker's Garage* opens in Boston. This permanent exhibit features an Apple I board, Altair 8800, Nolan Bushnell's *Computer Space*, and *Pong*, among other '70s' memorabilia.

Spurred by a $79,000 equipment grant from Digital Equipment Corporation, the Education Program Center opens unofficially, with plans to use innovative applications of technology to address the issues of education reform and gender equity.

The fiscal year ends with school group visitation up 21 percent over FY96, the result of new and ongoing educational programming throughout the Museum.

Joe Czop

Computer Bowl Celebrity Host Robert Urich (third from left) congratulates the West Coast team on their win. From left: Steve McGeady, Nathan Myhrvold, Bowl Captain Steve Kirsch (with trophy), Kim Polese, and Grant Saviers.

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To educate and inspire people of all ages and backgrounds from around the world through dynamic exhibitions and programs on the technology, application, and impact of computers

To preserve and celebrate the history and promote the understanding of computers worldwide

To be an international resource for research into the history of computing

This year's annual report was **printed by unison/Boston a division of Unidigital.** An Indigo E print 1000 was used to print the report. The Indigo is the world's first all digital offset color press.

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Technology

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the **computer** museum

1998

Annual Report

From the Chairman

Fueled by the support of our donors and a dedicated Board, 1998 was a year of innovation and collaboration at The Computer Museum. This spirit fueled several exciting exhibits and programs, resulting in another successful year of educating people about computer technology.

For example, the Museum joined forces with MIT Media Lab Associate Professor and Board member **Mitchel Resnick** to create ***The Virtual FishTank***™, a stunning technical achievement. The Museum capitalized on the latest 3-D computer graphics and real-time character animation to present new ideas about how the world works, while captivating the public with a virtual undersea world where they build their own fish. **The National Science Foundation**, **the Kapor Family Foundation**, **Sun Microsystems**, **The Ernst & Young Center for Business Innovation**, and anonymous donors collaborated on funding, and the Museum signed on **Nearlife, Inc**., an MIT Media Lab spin-off, to do the exhibit design and programming.

Wizards and Their Wonders: Portraits in Computing, an unusual chronicle of computing visionaries in both exhibit and book form, was the result of another creative alliance designed to preserve the history of innovation as it was being made. Museum Founding President **Gwen Bell** and portrait photographer **Louis Fabian Bachrach III** were the architects of this fascinating chronicle, in collaboration with the **Association of Computing Machinery** and **Goldman, Sachs & Company**, the exhibit's underwriter.

In addition, the Museum's innovative educational programs have inspired corporate, foundation and community recognition and support.

Long-time supporters such as **State Street Foundation, The Boston Globe Foundation** and **the Massachusetts Cultural Council** have helped position the Computer Clubhouse program, winner of the prestigious **1997 Drucker Award for Nonprofit Innovation**, to go global in its mission of inspiring inner-city youths with the power of computers. **Bell Atlantic** and **American Express** provided seed money for the "Clubhouse-to-College/Clubhouse-to-Career" program that helps kids leverage their Computer Clubhouse experience to pursue college and careers. A grant from **Mellon Trust** exemplifies a rewarding public/private collaboration that enables the Museum to show Boston public school teachers how to harness the Internet for meaningful classroom learning.

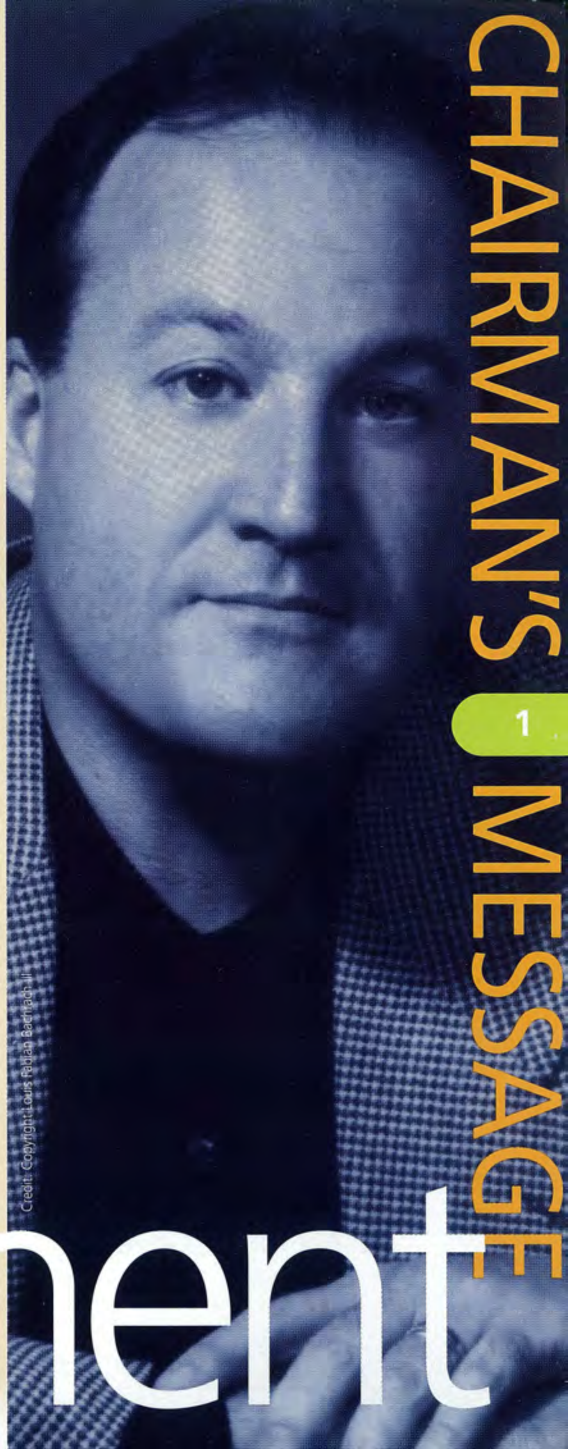
Meanwhile, led by a growing group of enthusiastic industry supporters in Silicon Valley, **The Computer Museum History Center** has also had a busy year, preserving and explaining the history of computing. The History Center accessioned more than 80 artifacts in FY 98, loaning its treasures to such industry conferences as **SIGGRAPH** and **MacWorld**.

More than 1,500 people enjoyed hearing about computing history from those who made it through the History Center SRO lectures, in association with the Bay Area Computer History Perspectives. Key industry individuals, groups and the press regularly tour the Visible Storage warehouse for a firsthand look at the gems in the collection. In addition, the Founding Membership campaign successfully concluded with 270 donors, and progress is being made in the search for a permanent home for the History Center.

These achievements could never happen without the support of our members, sponsors and volunteers. On behalf of my fellow Board members, I thank everyone who has participated in this convergence of innovation, technology and support. We invite all of you, old friends and new, to join us in the excitement to come.

Larry Weber
Chairman of the Board

achievement



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educ

"With The Computer Museum's Education Program Center, finally there is a place for educators to get the tools and insight to inspire girls' interest in computers and level the playing field for women in technology."

Sherry Turkle, Sociology of Science Professor, MIT

"I started going to the Museum when I was 12 or 13. The Museum was an integral part of my computer education. It's given me a base for social interaction, too. Everyone is intrigued by the things I saw there... the Univac computer, the artificial intelligence wing... Now I'm in computer animation. Ninety percent of what I do involves computers."

Justin Curtis, Creative Partner, Pixelworks, San Francisco

From the Acting Executive Director

It's an anomaly of our age: technology makes communication faster, easier and less costly, while capturing attention becomes ever more challenging! Yet we've been pleased and heartened to see more and more people becoming aware of the Museum's great programs and exhibits. It's happening through media coverage, through growing participation nationally and globally, and through word-of-mouth — which is the best form of promotion. Attendance has been holding steady through the Big Dig, and we saw a 24.7 percent spike in visitorship the week after ***The Virtual FishTank*** opened.

Our "**Educating with the Internet**" program was so successful that extra sessions have been added. **The Tenth Annual Computer Bowl®** set records for number of event sponsors (31), media sponsors (30 publications), attendees (650), revenue and press coverage.

As more people find out about the Museum and spread the word, we're able to do more for our members and supporters. When more people get involved, more ideas are generated… more partnership opportunities arise… more funds are available to do more things. That helps us stake our claim as a "must-see" for Boston visitors and residents alike. Spreading the word is a priority for the coming year. So we're hoping you, our friends and supporters, will get out there and shout about it.

Ellen J. Spear

Ellen Spear
Acting Executive Director

"A great place for kids and adults. We loved it. This is our second visit. It was better than the last one two years ago."

Roy Ciampi, Museum visitor, Union, N.J.

Credit: PAYFOTO

"If you talk in the abstract about decentralized behavior, people's eyes would glaze over. But the *FishTank* shows us that real-time computer graphics simulations can help us look at things that are hard to see in any other way."

Robert F. Sproull, Fellow, Sun Microsystems

Credit: Linda Haas

From the left: Alain Gregoire, 8; Zachary Putnam, 8; and Gabrielle Rossetti, 8; from Thompson, Connecticut, create and interact with their own virtual fish.

The Virtual FishTank

The Museum's newest exhibit and one of its most ambitious, a 2,200 square-foot virtual undersea world, opened in June. Visitors build their own fish, choosing behaviors such as appetite for food or responsiveness to temperature, human beings and other fish. Then they launch their creations into the 400-square-foot tank, and experience how the few simple rules they used lead to complex behaviors and patterns.

A collaboration with the **MIT Media Lab** and **Nearlife**, **Inc**., the *FishTank* was developed with a grant from the **National Science Foundation** and others. Future plans for the *FishTank* include a traveling version.

"In the *FishTank*, my children can do their own research, figure out for themselves what is going on, and make their own deductions."

Mary Marzec, Museum Visitor, Getzville, NY

Credit: FAYFOTO

From the left: Tinsley Galyean, Nearlife, Inc.; Oliver Strimpel, The Computer Museum; King Neptune (Joe St. Jean); a mermaid (Erin Cromwell); Mitchel Resnick, MIT Media Lab; and Bob Sproull, Sun Microsystems (an exhibit sponsor), cut the ribbon at the *FishTank's* gala preview.

"*The Virtual FishTank* presents important new ideas about the way the world works, and how we think about it. It is an unforgettable experience to enter and interact with such a graphically rich, sophisticated virtual world."

Mitchell Kapor, Founder, Lotus Development Corporation, and President, Kapor Enterprises, Inc.

wizards

EXHIBITS

From the left: Wizards Gardner Hendrie, John William Poduska, Sr., and David L. House rubbed shoulders at the Museum during a gala preview of the *Wizards* exhibit.

Credit: FAYFOTO

"New England is fortunate to have such a tremendous educational resource in its midst. The Museum is a wonderfully engaging place for families, school groups and budding computer whizzes of all ages to learn how to harness computer technology and the Internet."

Edward J. Markey, U.S. House of Representatives, 7th District – Massachusetts

Wizards and Their Wonders: Portraits in Computing

The exhibit opened in November, featuring specially commissioned color portraits by photographer **Louis Fabian Bachrach III** that reveal the human faces behind the inventions of the computer age — from the mouse and the microprocessor to applications software and the Internet. Underwritten by **Goldman, Sachs & Company**, *Wizards and Their Wonders: Portraits in Computing* introduces these visionaries in intimate profiles of their backgrounds and achievements.

"The contributions of nearly 200 wizards on display are indisputable. Their vision has influenced today's commerce, culture and community."

Charles House, President, Association for Computing Machinery

Wizards involved a selection panel of National Medal of Technology and other industry award-winners. The Museum collaborated with the **Association for Computing Machinery** on the exhibit's companion volume, written by **Christopher Morgan**. The brainchild of Museum Founding President Gwen Bell and Bachrach, *Wizards* grew out of a smaller portrait exhibit sponsored by the Museum's History Center in conjunction with the Association's 50th anniversary.

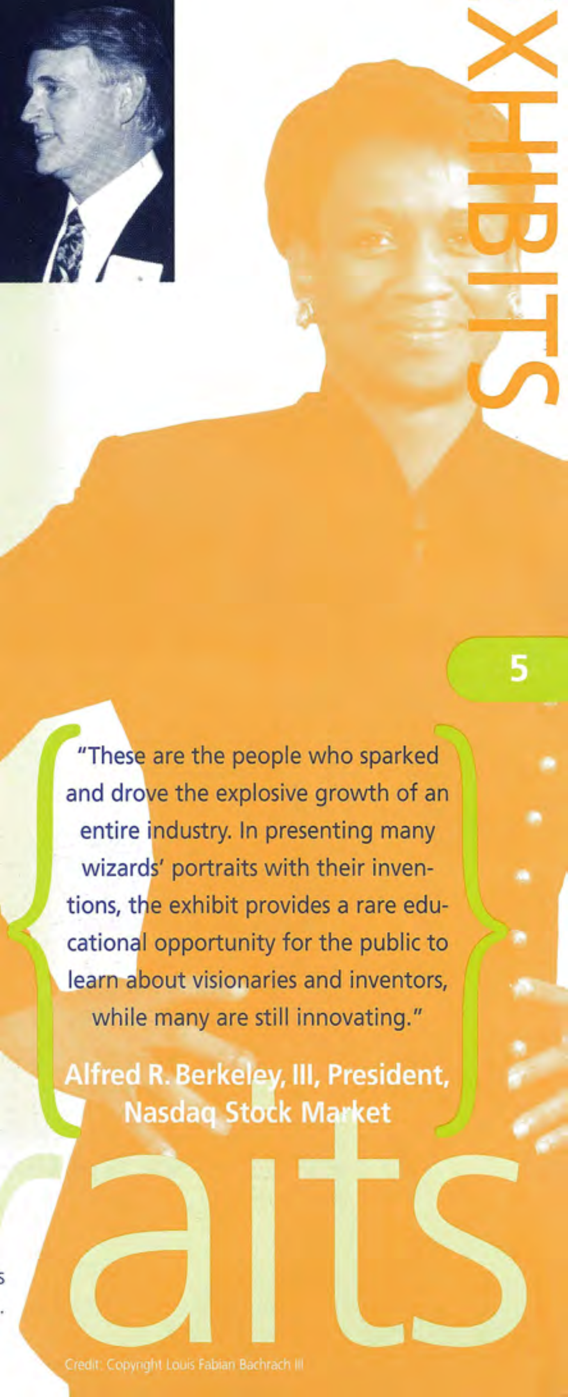
"These are the people who sparked and drove the explosive growth of an entire industry. In presenting many wizards' portraits with their inventions, the exhibit provides a rare educational opportunity for the public to learn about visionaries and inventors, while many are still innovating."

Alfred R. Berkeley, III, President, Nasdaq Stock Market

Credit: FAYFOTO

Museum Board Members Lynda Schubert Bodman and Paul Egerman were among the first people to explore *The Virtual FishTank* at a gala preview.

portraits



Wizard Dorothy Terrell also sits on the Museum's Board of Trustees.

Credit: Copyright Louis Fabian Bachrach III

"As someone with an interest in mathematics, computers and networking, I think it's important to understand where we are, how we got here, and where we're going. That's one of the reasons I support the Museum. Besides, it shows that some of this stuff can be fun!"

Gary Kessler, Member of The Computer Museum since 1985, Colchester, Vermont

Credit: FAYFOTO

The Museum's young visitors never tire of the over-sized input device.

Giant Mouse in the House

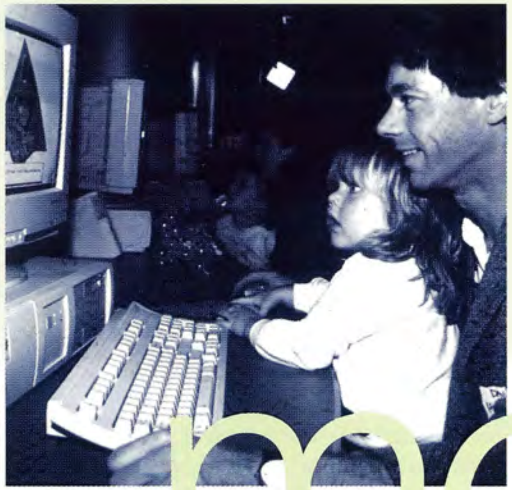
One of the most popular components of the giant ***Walk-Through Computer***™ was refurbished last spring with support from Kensington. The one-ton trackball has a new housing, resculpted to reflect the Kensington Expert Mouse's design. Also, a new roller assembly now evenly disperses the weight of the 350-lb. urethane ball.

"We at Kensington feel privileged to have been an integral part of *The Walk-Through Computer* from its inception. It continues to be the most innovative way for people of all ages to learn the inner workings of a computer."

Peter Dupont, President, Kensington Technology Group

Best Software for Kids Gallery

Children's software expert **Cathy Miranker** tried out the latest software for kids, choosing the Top Ten new additions to ***The Best Software For Kids Gallery***™ just in time for the holidays. The exhibit features 50 titles rated as among the best for hands-on learning, looks and longevity. Visitors like those below can search for titles based on a child's age, need and interests, then try out the software for as long as they like.



Credit: FAYFOTO

It's hard to know who is more engaged by *The Best Software For Kids Gallery*, father or daughter.

"The Computer Museum offers a wonderful way to learn about computers — whether it's *The Virtual FishTank*, *The Walk-Through Computer*, the Computer Clubhouse or the *Wizards* exhibit. By supporting the Museum, I can do something to introduce others to this important technology that is shaping all aspects of our lives."

David L. House, President, Nortel Networks

Credit: FAYFOTO

Clubhouse Manager Marlon Orozco (left) and Clubhouse Member/Mentor Steve Osemwenkhae (right), shoot a music video. Osemwenkhae is now a freshman at the University of Massachusetts (Boston).

"My son Peter has really grown tremendously through his experience at the Clubhouse and the mentors who have worked with him. The Clubhouse has made a big difference in the way he thinks about himself and relates to other people. He has turned out to be the computer guru at school. The Clubhouse has exposed him to so much more that wouldn't have been available to him."

Joan Eacmen, Parent

The Computer Clubhouse

Established in collaboration with the **MIT Media Lab**, the Computer Clubhouse Program now welcomes inner-city young people at eight different sites in Boston; Brooklyn, New York; Columbus, Ohio; Milwaukee, Wisconsin; and Stuttgart, Germany. Each site uses the original Clubhouse at the Museum as a model in engaging the creativity of the youth through self-directed projects based on their own interests. Every weekday afternoon and Saturday, curious young people age 10 to 18 drop in to explore sophisticated software and computer technology, creating animation, Web pages, multimedia presentations, music, robotic devices and science simulations. Adult mentors are on hand to answer questions — but just as often, to learn alongside their younger counterparts.

In October 1997, the Clubhouse was selected from more than 200 applicants around the country to receive the prestigious **Peter F. Drucker Award for Nonprofit Innovation**. The award recognizes innovative programs that have made a difference in the lives of the people it serves. In addition, the Clubhouse was a finalist for the **Global Information Infrastructure "Promise" Award**, created in collaboration with the **President's Summit for America's Future**.

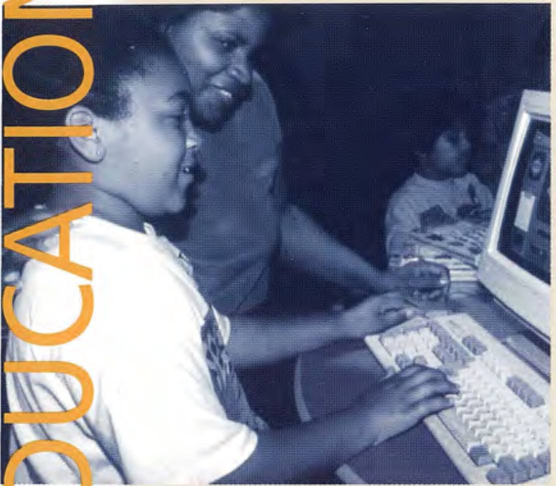
In May, the Museum was invited to set up a "model" Clubhouse at the national conference of the **Boys & Girls Clubs of America** in Orlando, Florida. The Museum is also working with Boys & Girls Clubs around the country to establish their own Clubhouses, while developing a collaborative program with the national Boys & Girls Clubs of America.

Meanwhile, a program organized with the **Patriots' Trail Girl Scouts Council**, **MIT Media Lab** and **Wellesley College** enables inner-city girls to open up the "black box" of science. Funded in part by the **Massachusetts Cultural Council**, "Beyond Black Boxes" lets Clubhouse Girl Scouts build instruments using LEGO, sensors and "Crickets," tiny programmable devices developed at the MIT Media Lab. Another initiative, "Clubhouse-to-College/Clubhouse-to-Career," launched with the support of **Bell Atlantic** and **American Express**, helps kids leverage their Clubhouse experience and skills by exposing them to professional and academic opportunities.

"I heard about the Computer Clubhouse in 10th grade. My art teacher said I could combine my artistic skills with computers. The Computer Clubhouse has helped me in school. I help my classmates with their projects and get extra credit toward my degree."

Ruby Fevrier, 19, Computer Clubhouse "alum," Museum staff member, and student at Massachusetts College of Art

This portrait was created by Clubhouse Member Francisco Santiago (on the right). The figure on the left is Ruby Fevrier (quoted above).



Credit: FAYFOTO

G'Tanya Small (second from left) and her niece Kristina, 9, explore one of the Museum's software picks. In the background are Patricia Sarango (far right) and her daughter Mariana, 9.

"The teacher's role is changing. We're no longer 'sage on the stage'...we're coach and guide. But if I'm a guide who can't use the Internet, where am I going to take my students? I now feel much more confident. I can really see how this technology gives me what I need to engage students."

Rita Newark,
Special Education Teacher,
Boston Evening Academy

Educating with the Internet

Through "Educating with the Internet," a series made possible by a grant from **Mellon Trust**, Boston public school teachers are finding out how to use and harness the power of computer technology to transform classroom learning. Geared to elementary, middle and high school teachers in all disciplines, the program targets Boston's Enhanced Enterprise Community, a technologically underserved area. The first workshops trained 300 educators. The successful pilot will be launched as a full program in the fall of 1998, training an additional 750 teachers.

The program is held in the Museum's **Education Program Center**, which opened in September thanks to a grant from **Digital Equipment Corporation** and further support from **Bay Networks**, **Bose Corporation**, **The Boston Computer Foundation**, **The New England Hi-Tech Charity Foundation**, and **The Children's Museum**. This networked multimedia teaching facility is available for use by education groups, businesses and trade associations.

"If teachers are to succeed in preparing their students for the technological challenges of the future, they must have access to the appropriate tools and training. We are very pleased to help The Computer Museum support teachers and their needs through the establishment of this unique Education Program Center."

Jane Hamel, Manager,
Corporate Contributions,
Digital Equipment Corporation

www.tcm.org

In August 1997, the Museum's website recorded an all-time high of 1.6 million hits, just one year after it first went up. The most heavily used areas of www.tcm.org are its educational resources. Educators frequently download activity pages and lesson plans for classroom use. The website has continued to evolve, responding to user feedback. Two "sub sites" have been developed for The Computer Bowl and Computer Clubhouse. The website's new look incorporates the Museum's new graphic identity, and uses advances in interactive technology for a livelier visitor experience.

"Studies show that barely half the teachers in the U.S. have had any training at all in using technology in their classrooms. 'Educating with the Internet' addresses that need. We are delighted to support this initiative, which gives us the opportunity to join forces with the many educators who work so hard to prepare our young people for the future."

Joanne Y. Jaxtimer,
Vice President and Director of
Corporate Affairs, Mellon Trust

online

www.tcm.org

"There is not another museum in the world which comes close to the breadth and depth of equipment and artifacts at the History Center. It is a great responsibility to preserve and share the collection with the community, the industry and the world."

Dave Babcock, Volunteer, History Center Technical Staff, Silicon Graphics

Credit: The Computer Museum Collection

In May, the History Center lecture, "Vigilance and Vacuum Tubes: The SAGE System, 1956-63," took place in front of the SAGE itself, which is notable for many now common technologies such as the light pen, the MODEM, real-time control systems and duplex CPUs.

visible artifacts

Credit: Copyright Louis Fabian Bachrach III

Len Shustek joined the History Center at its inception in 1996 in part because he had difficulty locating a vacuum tube to show to Stanford University computer science students.

The Computer Museum History Center

Silicon Valley is all about the next, best invention. In this "Why-look-back?" culture, The Computer Museum History Center is carving out a niche helping people think about where they've been as they go forward.

In FY 98, the History Center reached approximately 1,500 people through its monthly historical lectures, in association with the **Bay Area Computer History Perspectives**. Topics included: DEC and PCs; Apple early user interface design; Doug Engelbart on his early work; Lawrence Livermore's early hardware, the SAGE and Xerox Star. The talks are videotaped for future use by researchers.

Individuals and groups regularly tour the Visible Storage warehouse. The media make frequent use of these resources, too. *The New York Times*, *Forbes*, *Wired*, *National Geographic*, ABC News, *Stern*, and Rolling Stone Press are just some of the media outlets that call in search of photos or information. At monthly "workparties," dedicated volunteers contribute "sweat equity" to maintain and organize artifacts. A complete inventory of the collection, the world's largest, began in FY 98. The History Center also loaned its artifacts to such industry conferences as **SIGGRAPH** and **MacWorld**.

Meanwhile, work continues on finding a permanent home for the History Center in Silicon Valley. Much remains to be done but the History Center has inspired a devoted following in this fast-paced community.

"More than ever, we need to preserve the history of computing for future generations. The Computer Museum History Center is taking this important step."

John Doerr, Partner, Kleiner Perkins Caufield & Byers

"The development of computers will be a major part of our technological history a century from now. But who is preserving what our great-grandchildren will need to understand how it happened? It has to be done now, and it has to be done by us."

Leonard J. Shustek, Chairman, The Computer Museum History Center; Fellow, Network Associates

THE ? COMPUTER BOWL®

"My teammates and I thoroughly enjoyed playing in The Computer Bowl to benefit the Museum, and decimating the East Coast Team was a very entertaining bonus."

Denise Caruso, *New York Times* columnist, West Coast Team Captain

Computer Bowl X

East met West once again in this battle of computer brains — and the West trounced the East 230 to 70. But the Museum was the big all-around winner, netting more than $300,000 for support of its computer education and preservation programs. A Gigabyte Auction, powered by ***Forbes*** **Magazine** and conducted by **Christie's**, featured a Techno-Historian's Dream Trip to London and participation in the Forbes Balloon Festival in Normandy, France.

The Computer Bowl pits two teams of five high-tech industry luminaries in a live, one-hour game of computer industry trivia. This year for the first time, people around the world watched a live audio and video webcast of the Bowl, played in Boston at www.computerbowl.org, with play-by-play and color commentary from **PC Week Radio** and **ZDNet**. The event also aired on special editions of the public TV show ***Computer Chronicles***. Meanwhile, guests at the satellite party in Hangar 1 on Moffett Field, Mountain View, California, watched the Bowl live.

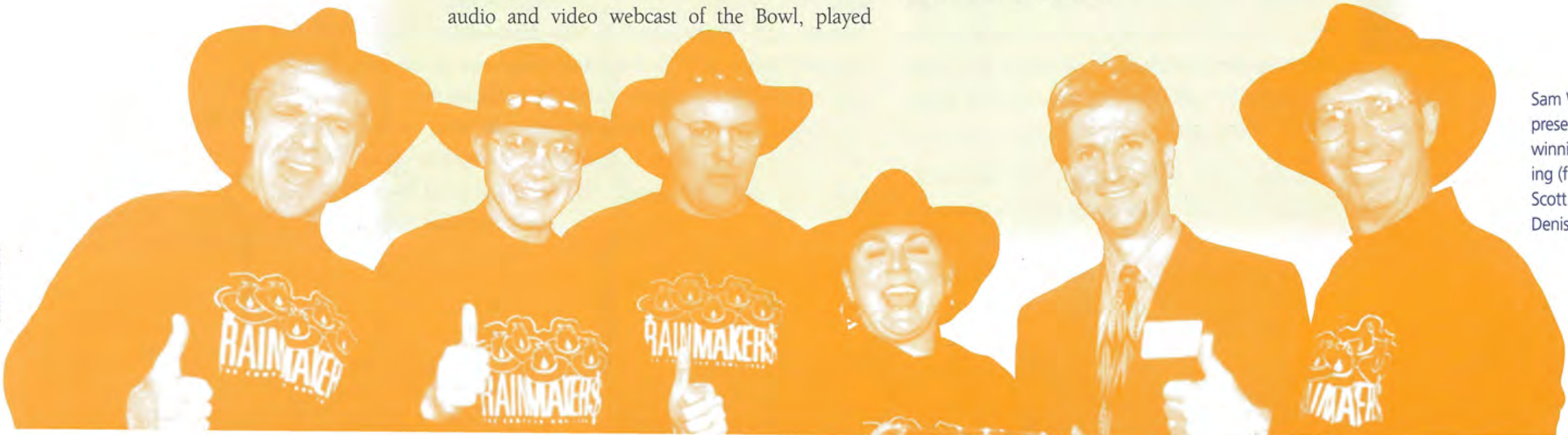
In the end, MVP awards went to West Coast Team player **Marc Andreessen** of **Netscape Communications** and two East Coast players, **Seth Godin** of Yoyodyne and **Walt Mossberg** of *The Wall Street Journal*.

"The Computer Museum's Computer Bowl program is great fun and a wonderful way to generate awareness of the importance of the Museum's role in technology education and the computer industry."

Thomas M. Menino, Mayor, City of Boston

"It's not often that Ziff-Davis can combine marketing, philanthropy, and a whole lot of fun as we can with The Computer Bowl."

Terri Holbrooke, President, Brand and Market Services, Ziff-Davis



Credit: FAYFOTO

Sam Whitmore (fifth from left), presents the Bowl trophy to the winning West Coast team, including (from the left), Mike Slade, Scott Cook, Marc Andreessen, Denise Caruso, and Bill Krause.

The 1998 Computer Bowl was presented by Ziff-Davis and underwritten by Bay Networks and Intel Corporation.

Official Sponsors included Arnold Communications, Association for Computing Machinery (ACM), *The Boston Globe's* Boston.com, Compaq Computer Corporation, Computer Sentry Software, Cunningham Communication, Fidelity Investments, Fleet Bank, Forrester Research, Infoseek, Kleiner Perkins Caufield & Byers, Lexmark International, Lizard Lounge Graphics, Lotus Development Corporation, Motorola, New York Stock Exchange, OnTarget, PricewaterhouseCoopers, LLP, *San Jose Mercury News*, Secure Computing Corporation, Stratus Computer, SuperDisk Technology Positioning Group, Thomson Financial Services, USWeb Corporation, and Yoyodyne.

Start-up Sponsors included InCert Software and The Password, a CMG Company.

All-Star Bowl 1998 Sponsor MediaOne Express.

Gigabyte Auction Sponsor *Forbes* Magazine.

Megabyte Auction Sponsor *WHERE* Magazine Boston.

"When they asked me to host The Computer Bowl, I thought it was strikes and spares with Steve Jobs and Bill Gates! It wasn't, but I enjoyed it anyway. Geeks Rule!!!"

John Ratzenberger, Host of The Computer Bowl, Actor, Producer, Director, Mailman Cliff Clavin from the TV series *Cheers*

Farewell

After 14 years, The Computer Museum bid farewell in June 1998 to **Oliver Strimpel** as executive director. "In recognition of Oliver's extraordinary role in shaping the visionary exhibits and programs that have made the Museum into the preeminent international institution it is today, the Board overwhelmingly decided to appoint him Director Emeritus," said Larry Weber, chairman, Computer Museum Board of Trustees.

Credit: FAYFOTO

Oliver Strimpel

Since Strimpel's arrival in 1984 as director of exhibits, The Computer Museum's interactive exhibits have grown from 25 to 170, its visitorship and budget have more than doubled, and the historical collection has tripled.

Credit: FAYFOTO

Charles A. Zraket

In Memoriam...

The Computer Museum marked the passing of former Chairman of the Board **Charles A. Zraket** at a dedication ceremony in June. His family, friends and the Museum's Board and leadership donors gathered for the unveiling of a plaque located in the Museum's sixth floor lobby. The text of the plaque reads: "In grateful memory of his major contribution to The Computer Museum, Charles A. Zraket, Chairman 1993-1996."

Zraket was a former Trustee, President and CEO of The MITRE Corporation. He advised President Reagan on defense and Pope John Paul II as a member of the Pontifical Science Academy, and was awarded the Department of Defense Medal for Distinguished Public Service in 1990. As the Museum's fourth Chairman, Zraket played a key role in the development and success of the Museum's educational programs and exhibits. As he once explained, "It is deeply satisfying to use my 40 years' experience to help the Museum realize its educational mission." He died last December in Boston at 73.

FINANCIALS

Selected Financial Information

The Computer Museum, Inc.

Statement of Financial Position

June 30,

	1998	1997
Assets		
Current Assets:		
Cash and cash equivalents	$1,113,663	$ 996,389
Accounts receivable - net of allowance for doubtful accounts of $36,695 for 1998	102,235	120,867
Pledges receivable - net of allowance for doubtful accounts of $0 for 1998 and $29,000 for 1997	195,463	94,500
Inventory	17,137	56,843
Total current assets	1,428,498	1,268,599
Pledges receivable, non-current	610,000	400,000
Investments	353,034	250,000
Land, building, equipment, and exhibits - net of accumulated depreciation of $6,916,373 in 1998 and $6,268,273 in 1997	3,985,866	3,378,883
Historical collection	-	-
Total assets	6,377,398	5,297,482
Liabilities and Net Assets		
Current Liabilities:		
Accounts payable	334,321	214,719
Accrued expenses	179,067	109,120
Deferred revenue	17,525	30,280
Current portion of bond payable	88,055	80,000
Total current liabilities	618,968	434,119
Bond payable, net of current portion	109,333	189,333
Net Assets:		
Unrestricted	3,368,729	2,846,807
Temporarily restricted	1,927,334	1,577,223
Permanently restricted	353,034	250,000
Total net assets	5,649,097	4,674,030
Total liabilities and net assets	$6,377,398	$5,297,482

The Computer Museum, Inc.

Statement of Activity

For the Years Ended June 30,

Revenues, Gains and Other Support:	Unrestricted	Temporarily Restricted	Permanently Restricted	1998 Total	1997 Total
Contributions	$1,673,439	$536,475	-	$2,209,914	$953,435
Contributions - Computer Bowl	1,244,039	-	-	1,244,039	737,099
Membership	294,329	-	-	294,329	327,315
Admissions	521,623	-	-	521,623	568,595
History Center	507,575	75,332	103,034	685,941	607,181
Computer Clubhouse	292,169	-	-	292,169	173,546
Investment income	5,187	-	-	5,187	9,271
Auxiliary income	407,298	-	-	407,298	635,918
Total	4,945,659	611,807	103,034	5,660,500	4,012,360
Net assets released upon satisfaction of program restrictions	261,696	(261,696)	-	-	-
Total revenues, gains, and other support	5,207,355	350,111	103,034	5,660,500	4,012,360
Expenses:					
Program services:					
Exhibits	988,629	-	-	988,629	785,625
Marketing and membership	364,298	-	-	364,298	481,488
History Center	472,132	-	-	472,132	331,205
Computer Clubhouse	328,311	-	-	328,311	234,577
Auxiliary activities	375,844	-	-	375,844	391,400
	2,529,214	-	-	2,529,214	2,224,295
General administration	534,148	-	-	534,148	774,777
Computer Bowl	905,621	-	-	905,621	497,506
Fundraising	68,350	-	-	68,350	81,915
Total	4,037,333	-	-	4,037,333	3,578,493
Change in net assets before depreciation	1,170,022	350,111	103,034	1,623,167	433,867
Depreciation	648,100	-	-	648,100	773,351
Changes in net assets	521,922	350,111	103,034	975,067	(339,484)
Net assets at beginning of year	2,846,807	1,577,223	250,000	4,674,030	5,013,514
Net assets at end of year	$3,368,729	$1,927,334	$353,034	$5,649,097	$4,674,030

The complete financial statements of the Museum are available upon request.

$1,000 and above *(continued)*

Jean and Sylvia deValpine
Mr. and Mrs. Charles Digate
Tom Franklin and Leonie Gordon
Robert Frankston and Eleanor Elkin
Sam and Carol Fuller
Gideon I. Gartner
Alain and Carol Hanover
Christine Hughes
Theodore Johnson
John and Linda Loewenberg
Carl and Wilma Machover
David Mahoney
John and Catherine Mandile
Barry W. Margolin
Howard and Colleen Messing
Isaac and Ronee Nassi
Barry and Catherine Nearhos
Katherine C. Patterson
Paul R. Pierce
Shirley Resnick
Fontaine and Judy Richardson
Dennis Ritchie
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Rich and Cindy Tennant
Gary and Janet Vacon
Eliot and Louisa Vestner
Allan and Nadine Wallack
William Wulf and Anita Jones
The late Charles Zraket and Shirley Zraket

Annual Supporters, $500 and above

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Michael and Marcella Thompson
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$250 and above

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