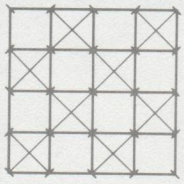


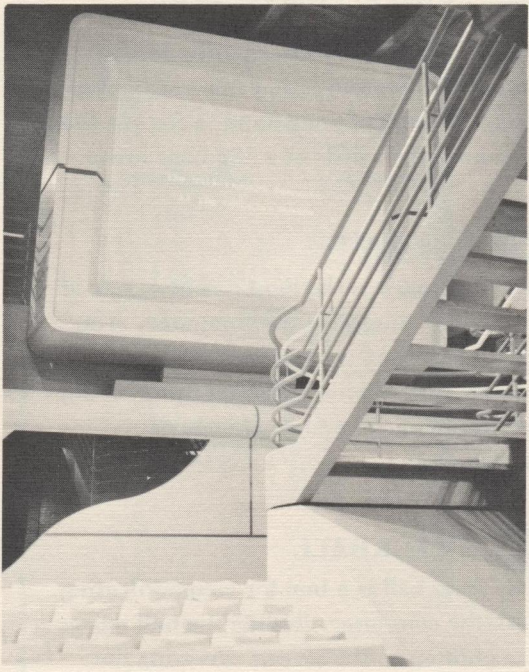
The Computer Museum

The Walk-Through Computer

Press Kit

A Landmark Exhibit at The Computer Museum

Museum Wharf 300 Congress Street, Boston, MA 02210



W E L C O M E T O

THE WALK-THROUGH COMPUTER™

This guide gives you a simple description of The Walk-Through Computer's parts. Panels in the exhibit offer more information. To help you find your way around the exhibit, match the numbers on the map to the numbers at the bottom of each exhibit panel.

1 Floppy Disk

Floppy disks carry information to and from the computer. In a space no larger than the palm of your hand, a floppy disk can store the words of a 350-page novel.

2 Keyboard

The keyboard is the most common way of communicating with the computer. You can type letters or numbers, just as you can on a typewriter. Special function keys let you send commands at a single keystroke.

3 Trackball

The trackball is a tool for communicating with the computer. Rolling the ball moves the pointer on the screen. Pressing the button says you've made a choice you want the computer to act on.

4 Power Supply

The power supply unit takes the strong, uneven current from a household wall outlet and produces the low, steady stream of electricity the computer needs to power its delicate circuitry.

5 Power Plug

Just like a lamp in your living room, a desktop computer runs on standard household electricity, drawn from a wall outlet. Unlike a lamp, a computer uses ordinary electricity to do some extraordinary things.

6 Motherboard

The "motherboard" is a printed circuit board that holds the computer's essential electronic parts, supplies them with power, and provides the wiring they need to communicate with each other.

7 Video Board

The video board controls the picture you see on the screen. The Central Processing Unit tells the video board what to show, and the video board tells the monitor which dots to turn on and off to create the picture.

8 Keyboard-Trackball Interface

When you type on the keyboard or move the cursor with the trackball, a message is collected and held by the keyboard-trackball interface until the Central Processing Unit (CPU) asks for it.

9 Clock

Like an orchestra conductor, the system clock beats a steady tempo that all the other parts of the computer can work to. This guarantees that when one component sends a signal, another is timed to receive it.

10 Central Processing Unit

The Central Processing Unit (CPU) is the heart of the information machine. An amazing feat of human engineering, the CPU packs more than one tiny million switches on a chip of silicon the size of a postage stamp.

11 Software Meets Hardware

The CPU carries out the instructions that make up the *World Traveler* computer program—controlling the flow of information throughout the computer and directing the work of all the other parts.

12 Random Access Memory (RAM)

RAM is where the computer puts the information it needs to access quickly. RAM usually contains a copy of the computer program and all the data the program is working with.

13 Read-Only Memory (ROM)

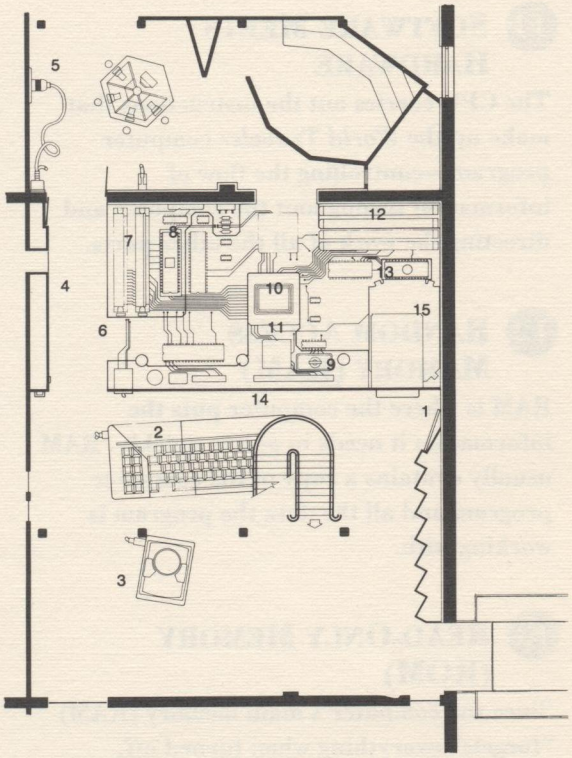
Since the computer's main memory (RAM) "forgets" everything when turned off, computers have a second, permanent memory called Read-Only Memory, or ROM. When the computer is first turned on, the information in ROM reminds it what to do.

14 Monitor

The monitor is your visual link to the computer. It displays the information you put in, any questions the computer may ask you, and the results of the task you ask it to perform.

15 Hard Disk

The computer uses the hard disk to store large amounts of information. It can store about as much as 500 floppy disks and can read and write at least 20 times faster.



1. Floppy Disk
2. Keyboard
3. Trackball
4. Power Supply
5. Power Plug
6. Motherboard
7. Video Board
8. Keyboard-Trackball Interface
9. Clock
10. Central Processing Unit
11. Software Meets Hardware
12. Random Access Memory (RAM)
13. Read-Only Memory (ROM)
14. Monitor
15. Hard Disk

THE INFORMATION MACHINE

We live in a world of information. Every picture you see, word you read, and sound you hear carries information.

The same information can be represented in many ways. For example, a piece of music can take the form of sound waves in air, magnetic patterns on a cassette tape, or microscopic pits on a compact disc.

Computers are machines that manipulate information, including text, numbers, pictures, or sounds. But first, the information has to be converted into a form that the computer can deal with. ***The Information Machine*** shows you how this is done.

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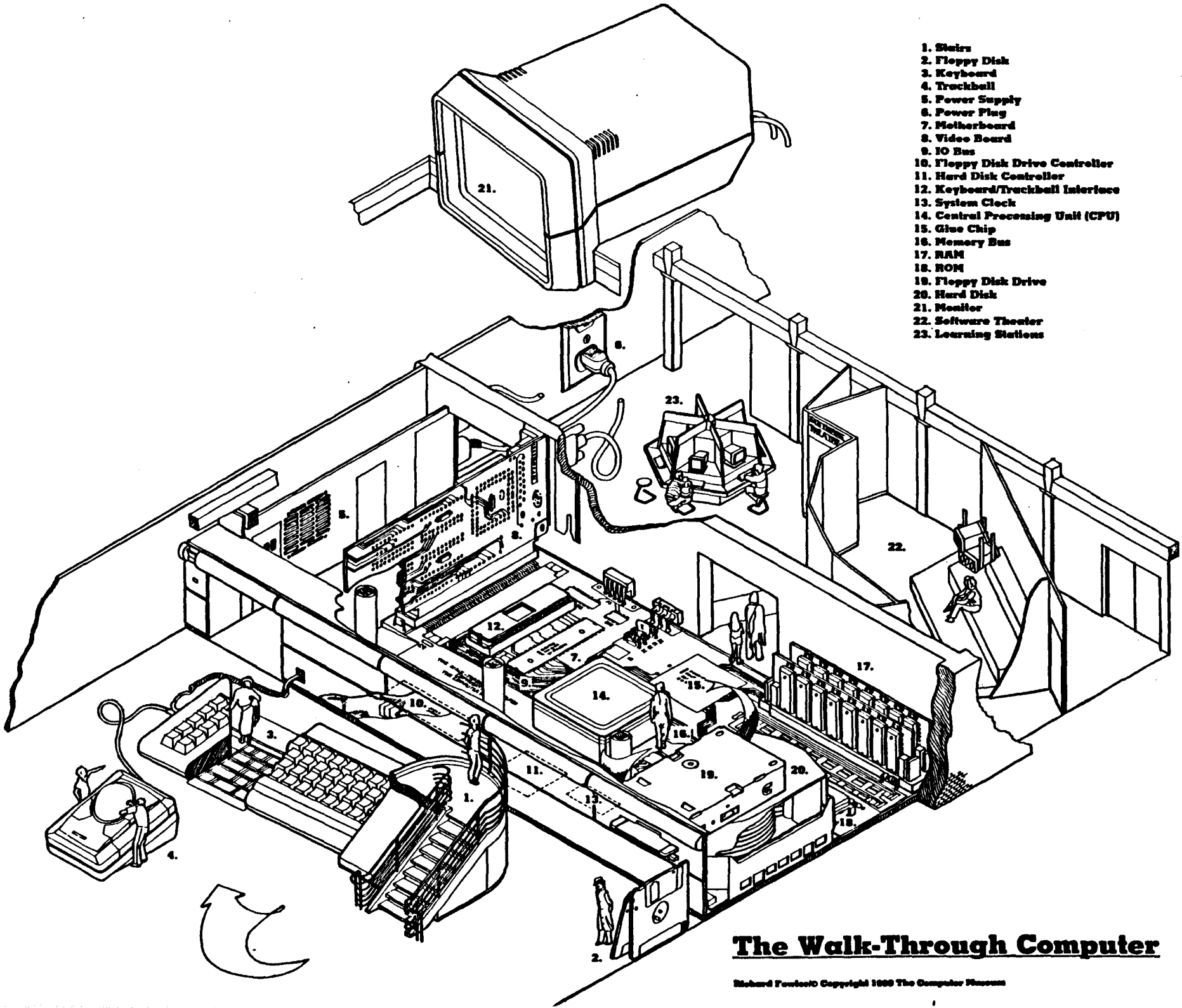


The Walk-Through Computer

The Computer Museum

300 Congress Street
Boston, MA 02210
(617) 426-2800

FACT SHEET
THE COMPUTER MUSEUM

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%.

CAPITAL CAMPAIGN Phase I goal of $3.3 million reached. Phase II in progress.

EXHIBIT HIGHLIGHTS
- o The Walk-Through Computer (opening June 23, 1990)
- o Smart Machines Gallery: Artificial Intelligence & Robots
- o Four Classic Computers (Univac I, PDP-8, Cray-1, IBM PC)
- o IBM 1401 Programming and Computer Rooms (re-creation)
- o Interactive Personal Computing
- o The Computer and the Image with Animation Theater
- o Traveling Exhibits: Computers in Your Pocket; Terra Firma in Focus

COLLECTION 1,500 artifacts; 1000 photographs; 325 videotapes & 70 films; The Museum collects computers, robots, and related materials of significant historical and technical interest.

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

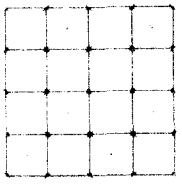
MEMBERS 2600 individual from 45 states and 13 countries; 142 corporate members worldwide.

MUSEUM BOARD 38 directors; 21 trustees

Chairman: Gardner Hendrie; Treasurer: Nicholas A. Pettinella

STAFF Executive Director/Acting Curator: Dr. Oliver B. R. Strimpel
Director of Development and Public Relations: Janice Del Sesto
Director of Collections: Dr. Gwen Bell
Director of Marketing: Noel Ward
Public Relations Manager: Gail Jennes

MUSEUM HOURS Winter hours: Tuesday through Sunday, 10am to 5pm, Fridays until 9pm; Summer hours: open 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.

4/19/90

The
Computer
Museum

300 Congress Street
Boston, MA 02210

(617) 426-2800

THE WALK-THROUGH COMPUTER

INTERESTING FACTS ABOUT THE WALK-THROUGH COMPUTER

o The trackball, with a diameter of 48", is built from two fiberglass halves formed from a hand-turned wooden mold. The two halves are lined with foam to soften the interior reverberations, and then perfectly joined to appear seamless. The ball is carefully weighted in order to roll without drag.

o The disk drive spins at a speed of thirty miles an hour at its outer edge.

o The exhibit covers 5,300 square feet and the total weight exceeds eight tons. The ribbon cables alone weigh 1500 pounds and measure one third of a mile if laid out end-to-end.

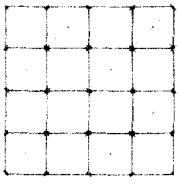
o 800 square feet of silk were used for silkscreening.

o 325 sheets of plywood make up the core construction. Most components are skinned with fiberglass, epoxy, acrylic, high-pressure laminates or custom plastic finishes.

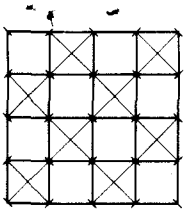
o More than 200 colors were custom matched to the actual components, to make over 100 gallons of lacquer, vinyl, and epoxy paints.

o The parts are scaled directly from actual computer equipment, measured with verniers and micrometers to several thousandths of an inch. Even a small error multiplied by 50 times can be a very large error, so great care must be taken.

For more information contact: Gail Jennes/Liz Armbruster (617) 426-2800.



RELEASE: NOVEMBER 13, 1990



THE COMPUTER MUSEUM

NEWS RELEASE

Contact Gail Jennes
Liz Armbruster
617-426-2800 ext.341/329
SLIDES/PHOTOS AVAILABLE

THE WALK-THROUGH COMPUTER™ CITED BY POPULAR SCIENCE AS ONE OF 1990'S OUTSTANDING PRODUCTS & TECHNOLOGICAL ACHIEVEMENTS

Showcased in Magazine's Annual "Best of What's New" Section

BOSTON, MA - The Walk-Through Computer has been chosen by the editors of POPULAR SCIENCE as one of 1990's outstanding products and technological achievements for the magazine's annual "Best Of What's New" special awards section in its December issue.

The giant $1.2 million exhibit--the only one of its kind in the world--features an authentic, two-story working model of a desktop computer enlarged to 50 times its normal size. People can walk through it and see how a computer actually works.

"POPULAR SCIENCE regularly provides its readers with news and analysis of innovative products and technological achievements," says Editor-in-Chief Fred Abatemarco. "We are extremely pleased that our 'Best Of What's New' awards will give recognition to products and technologies that help shape our lives."

Aimed to foster understanding of computers and technology, The Computer Museum's exhibit lets visitors use a giant trackball and keyboard to find the shortest route between two cities, see a slide show on the giant monitor of sights they would see on the way, and then go inside the computer to see how it does what they ask.

In addition, an educational video based on the exhibit, called HOW COMPUTERS WORK: A Journey Into The Walk-Through Computer, was featured in POPULAR SCIENCE's 1990 "Best Of What's New" Exhibition on November 13 at New York's Tavern on the Green. CNBC, the Consumer News and Business Channel, will air a special prime-time cable program on the "Best Of What's New" Sunday, November 18, at 8:00pm, EST, with a repeat telecast at 1:00am.

-More-

The Museum undertook the exhibit because "We concluded that a giant working model of a computer that people could walk through was the most exciting, effective way to help the public understand these mysterious, all-important machines," says Dr. Oliver B.R. Strimpel, the Museum's Executive Director.

The single largest project in the Museum's history, The Walk-Through Computer has captured the imagination of media around the world from the TODAY show, ABC Evening News, CNN, TV networks in Germany, Japan, and Australia, as well as the AP, UPI, The London Times, Der Spiegel, The New York Times, and Newsweek.

POPULAR SCIENCE's December issue, featuring the "Best Of What's New," has been the magazine's best-selling issue since the awards were introduced in 1988.

Among other winners cited by POPULAR SCIENCE: Microsoft Corporation's Windows 3.0, Ford Motor Company's Explorer Truck and Modular V8 Engine, TRW's CPUAX Superchip, NASA Goddard Space Flight Center's Milky Way Photo, Mattel Toys' Super Glove Ball Game, and Northrop Corporation's Advanced Tactical Fighter YF-23.

The only museum in the world devoted solely to computers and their impact on society, The Computer Museum is for people of all ages and interests. More than 75 interactive exhibits, two award-winning theaters, and the finest collection of vintage computers and robots ever assembled educate and entertain over 125,000 visitors a year from around the world. Each year the Museum's artifacts, events and programs offer recreational learning in an informal atmosphere to some 40,000 students and 2,000 educators. Its national touring exhibits serve an audience of over a million.

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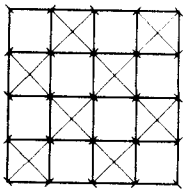


THE COMPUTER MUSEUM

NEWS RELEASE

RELEASE: IMMEDIATE
Contact Gail Jennes
617-426-2800 ext.341
SLIDES/PHOTOS AVAILABLE

THE WORLD'S ONLY GIANT WALK-THROUGH COMPUTER TO OPEN AT THE COMPUTER MUSEUM, JUNE 23, 1990

BOSTON, MA - The Walk-Through Computer™--the only exhibit of its kind in the world--will open Saturday, June 23, 1990, at The Computer Museum, Boston. This giant $1.2 million exhibit will feature an authentic, two-story working model of a desktop computer enlarged to 50 times its normal size. People will be able walk through it and see how a computer actually works.

A Giant Computer Visitors Can Use and Walk Through

The Walk-Through Computer will demonstrate a software program that takes people on a tour of the world. Visitors will stroll past a mammoth (108 square feet) screen, 25-foot operational keyboard, and six-foot-tall floppy disk. Using a giant (9'x6'6"x5') trackball to point, they will choose starting and destination points from among more than 300 major world cities. The computer will find the shortest land route between them, and offer a slide show on the giant monitor of sights they would see along the way.

Walking inside the computer, visitors will see how the computer does its route-finding task. Pulsing lights will simulate the flow of data through the computer and its peripherals. Visitors will walk past a ceiling-high video board to view the microprocessor or "chip." Looking down through one of the many viewports, they will see the chip magnified 500 times. They also can peer inside banks of random access memory chips, and watch a giant spinning disk drive retrieve data. As visitors leave the computer, they can learn about software by watching an entertaining video in the Software Theater or explore interactive "learning stations," offering in-depth information about computer architecture and programming.

-More-

Exhibit to Foster Understanding of Computers and Technology

"There is an urgent need in this country to improve scientific and technical education and literacy especially with respect to computers," says Dr. Oliver B. R. Strimpel, the Museum's Executive Director. "We concluded that a giant working model of a computer that people could walk through was the most exciting, effective way to help the public understand these mysterious, all-important machines." The Walk-Through Computer is at the center of Dr. Strimpel's vision for the Museum's future which calls for "more dramatic exhibits that span the evolution, applications, and impact of computing and are rich in hands-on experiences."

Museum's Largest Project

The Computer Museum's largest project since its 1984 Boston opening, construction of the 5,300 square foot exhibit began offsite in October 1989 at F. W. Dixon Company, specialists in large-scale exhibit and model building. After the exhibit components are trucked to the Museum and reassembled, the electronics and special effects will be installed.

International Experts Work Together to Ensure Technical Authenticity

To build The Walk-Through Computer, the Museum has drawn upon creative and technical expertise from more than 100 people and 25 institutions and corporations from three countries. Among them: designer Richard Fowler, from Britain's award-winning National Museum of Photography, Film, and Television (known for his dramatic, larger than life, 3-dimensional exhibit environments); BBC producer John Palfreman, NOVA producer Nancy Linde, and New York animator Dean Winkler, who are creating the humorous computer animated video for the Software Theater; award-winning illustrator David Macaulay, author of The Way Things Work, who has created 30 panels telling the computer's "inside" story.

An extraordinary amount of attention to detail at all levels has made the exhibit as authentic as possible. For example, the giant model of the printed circuit board holding the computer components is based on a real board specially fabricated for the Museum by a consortium of local companies.

The Museum has also convened a distinguished panel of exhibit advisors: Art Bardige, Director of Learningways; C. Gordon Bell, Vice President, Research & Development, Stardent Computer Inc.; Daniel C. Dennett, Professor of Cognitive Science, Tufts University, co-author of The Mind's Eye; Allison Druin, Tell Tale Technologies; Signe Hanson, Director of Exhibit Design, Boston Children's Museum; Museum Chairman Gardner Hendrie, Sigma Partners, designer of the first fault tolerant computer to use commercially available microprocessors; Danny Hillis, Founding Scientist and Director of Research, Thinking Machines; David Macaulay; Philip Morrison, Institute Professor, Massachusetts Institute of Technology; Phylis Morrison, author and producer of science materials and programs, and co-producer with Philip Morrison of the PBS series, The Ring of Truth; David Patterson, Professor of Computer Science, University of California (Berkeley); Jonathan Rotenberg, Chairman, The Boston Computer Society; Richard Rubinstein, Manager of Technology Assessment, Digital Equipment Corporation.

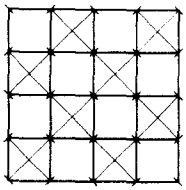
Exhibit Attracts Sponsors Committed to Science and Technology Education

Foundations, corporations, and individuals have shown their commitment to fostering public understanding of science and technology through their support of The Walk-Through Computer. Among them: The Kapor Family Foundation, The Alfred P. Sloan Foundation, Digital Equipment Corporation, Apple Computer, Inc., AT&T Corporation, Intel Corporation, Maxell Corporation of America, Kensington Microware Ltd., Lotus Development Corporation, and Cirrus Logic, Inc.

Walk-Through Video Available

To maximize the educational impact of this exhibit, a videotape taking viewers on a "walk through" The Walk-Through Computer will be available in the fall of 1990. It will be funded by Intel Foundation.

The only museum in the world devoted solely to computers and their impact on society, The Computer Museum is for people of all ages and interests. More than 60 interactive exhibits, two award-winning theaters, and the finest collection of vintage computers and robots ever assembled educate and entertain over 100,000 visitors a year from around the world. Each year the Museum's artifacts, events and programs offer recreational learning in an informal atmosphere to some 40,000 students and 2,000 educators. Its national touring exhibits serve an audience of over a million.



THE COMPUTER MUSEUM

NEWS RELEASE

RELEASE:IMMEDIATE
CONTACT GAIL JENNES
(617)426-2800 EXT.341
SLIDES/PHOTOS AVAILABLE

CALENDAR/PUBLIC SERVICE ANNOUNCEMENT

To: Calendar Editors

From: Gail Jennes, Public Relations Manager

PLEASE PLACE THE FOLLOWING IN YOUR 1990 CALENDAR SECTION UNDER OPENINGS/NEW EXHIBITS

THE WORLD'S ONLY GIANT WALK-THROUGH COMPUTER

A NEW PERMANENT EXHIBIT OPENS AT THE COMPUTER MUSEUM, JUNE 23, 1990

"THE WALK-THROUGH COMPUTER™" See how a computer actually works by walking through a giant, two-story working model of a computer blown up 50 times! Imagine a 108-square foot screen, 25-foot operational keyboard, and six-foot-high floppy disk! The mammoth machine will give you a tour of the world. Just point with the giant (9'x6'6"x5') trackball to your starting and destination points from among 300 major world cities. The computer will find the shortest land route and offer a slide show on the giant monitor of sights along the way. Inside the computer, walk past a ceiling-high video board to view the microprocessor, peer inside banks of random access memory chips, and see a giant spinning disk drive retrieve data. Pulsing lights simulate the flow of data through the computer. A Software Theater, interactive learning stations and viewports, and giant murals tell more of this authentic computer's "inside story." At The Computer Museum, 300 Congress Street, Boston, MA.

FREE WITH PRICE OF ADMISSION.

-0-

The Computer Museum, the world's only museum devoted solely to computers and their impact on society, is for people of all ages, interests, and backgrounds. More than 60 interactive exhibits, an award-winning Animation Theater, and a multimedia robot show educate and entertain some 100,000 visitors a year from around the world. The Museum's collection of vintage computers and robots is the finest ever assembled. Each year, the Museum's artifacts, events and programs offer recreational learning in an informal atmosphere to some 40,000 students and 2,000 educators. Its national touring exhibits serve an audience of over a million. LOCATION: At Museum Wharf, 300 Congress Street, Boston, MA. ADMISSION: Adults $6.00, students and seniors $5.00. Children under 5 free. Half price Friday evenings. Free to Museum members. OPEN: SUMMER DAILY 10am-6pm, Friday until 9pm. WINTER TUESDAY-SUNDAY 10am-5pm, Friday until 9pm. Public tours every Saturday and Sunday at 1:30 and 3:00pm. For more information, call the talking computer at (617)423-6758.

The Computer Museum

300 Congress Street
Boston, MA 02210

(617) 426-2800

FACT SHEET ™
THE WALK-THROUGH COMPUTER
The only one of its kind in the world
Public Opening June 23, 1990, at The Computer Museum, Boston, MA

THEME

This authentic, two-story working model of a desktop computer blown up 50 times its normal size addresses the basic question--how computers work. It combines state of the art hardware, software, special effects, and computer animation to show how computers process information from the flow of electrons in transistors through the algorithms of a computer program. To demonstrate a typical application, the exhibit runs a software program that lets visitors operate the giant computer to tour the world.

QUESTIONS THE EXHIBIT WILL ANSWER

- How does a computer work?
- How do you talk with a computer?
- How does it store information?
- What is computer software?
- What does the inside of a computer look like?
- What do its components do and how do they work together?

APPLICATION

World Traveler Program: To demonstrate a typical application, the exhibit lets visitors use the giant trackball and keyboard to find the shortest route between two cities, see a slide show on the giant monitor of sights they would see on the way, and then go inside the computer to see how it does what they ask.

MAJOR COMPONENTS

- The Information Machine (Interactive Panels)
- Monitor
- Trackball
- Keyboard
- Motherboard
- Video Board
- Clock, Memory, Disk Drives
- Microprocessor/Central Processing Unit (CPU)
- Learning Stations
- Software Theater

DIMENSIONS

5,300 square feet (total area)
Keyboard (25'x10'6")
Trackball (9'x6'6"x5')
Chassis (55'x26')
Monitor (21'x14'x12')
Disk drives (15'x9')
Central Processing Unit (7'6" square)

PRODUCTION

Designed and built from May 1989 to June 1990

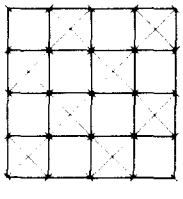
SPONSORS

Principal Sponsors: The Kapor Family Foundation and The Alfred P. Sloan Foundation
Major Sponsor: Digital Equipment Corporation
Additional Funding: Apple Computer, Inc., AT&T Corporation, Intel Corporation, Maxell Corporation of America, Kensington Microware Ltd, Lotus Development Corporation, Cirrus Logic, Inc.

COST

$1.2 million (including more than $200,000 in equipment and professional services)

For more information, contact: Gail Jennes/Liz Armbruster (617)426-2800



The Computer Museum

300 Congress Street
Boston, MA 02210
(617) 426-2800

THE WALK-THROUGH COMPUTER
EXHIBIT DESCRIPTION

A WALK THROUGH THE WALK-THROUGH COMPUTER™: HIGHLIGHTS

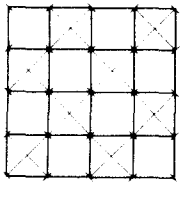
The Walk-Through Computer demonstrates a computer software program, called **WORLD TRAVELER** that lets visitors find the shortest driving route between any two cities in eight regions of the world. As you leave the elevator on the 6th floor and approach The Walk-Through Computer, you will see a giant **MONITOR** (21'x14'x12') displaying a nine by twelve foot image of a map.

Descending the stairs, you see a huge (25'x10'6") **KEYBOARD.** Press one of its ten operational function keys to select a continent. A cutaway view shows the one-foot-square key making contact with a grid of wires underneath, completing an electrical connection that tells the computer which key has been pressed.

To the left of the keyboard, stands a giant (9'x6'6"x5') fully functional **TRACKBALL** which is used to locate the cities. A cutaway view into the trackball shows its roller bearings, light-emitting diodes, and light detectors. As you roll the ball to guide the cursor on the giant monitor, lights flash down a cable connecting the trackball to the computer's central processing unit (CPU), and the cursor moves across the map on the screen. Point to one of more than 300 world cities and click the trackball button. Click on another city and the program traces out the shortest land route between starting and destination points, and also offers views of sights along the way.

To the right of the keyboard, **THE INFORMATION MACHINE** is a large set of introductory panels to help visitors understand how computers handle different kinds of information as electronic signals. Illustrated by David Macaulay, award-winning author of The Way Things Work, these panels are studded with interactive devices, including switches, a keyboard, microphone, and television camera. Information panels featuring Macaulay's drawings are also located throughout the exhibit. Where applicable, his anatomical blow-ups of the computer's working parts link to computer animated viewports, explaining how the parts work.

A six-foot-high **FLOPPY DISK**, complete with moveable access window and write-protect tab, rests against the computer's chassis.



Entering the computer, visitors will see a landscape of giant printed-circuit boards, disk drives, and drooping ribbon cables. The **POWER UNIT** stands on the left with a ventilation grille and warning labels. You then walk through the **MOTHERBOARD**, the printed circuit board holding the computer's components. The first plug-in unit is the **VIDEO BOARD** controller (10' x 20') that extends through the ceiling. Pictures of places along the route come off the disk onto the video board where they are processed for display. Visitors can see the images leave the board and pulse along the cable to the monitor. Special viewports show interior views of the circuitry in the board's processors and memory banks. Computer animation demonstrates the function of the different devices.

Reproduced at 50 times actual size, the **MOTHERBOARD** is made of a translucent resin material that looks and feels like a real printed circuit board. Cutaway views reveal the six layers of the board with its complex pattern of wires, insulating sections, power and ground planes. The layout of the wiring and placement of the components is highly realistic, based on an actual prototype board designed and fabricated especially for The Computer Museum.

The data and information wires are illuminated and picked out in copper on the board. Pulsing lights embedded in the floor simulate the flow of data from one component to another and throughout the computer and its peripherals.

Through a viewport in the **KEYBOARD/TRACKBALL INTERFACE**, you can see how the interface gathers and retransmits data entering the computer from the trackball and keyboard.

At the center of the motherboard is the **CENTRAL PROCESSING UNIT (CPU)** or "chip." As the control center of the computer, it carries out all the instructions written by the programmer and stored in memory. Everything you see on the board is controlled by the CPU. Based on the Intel 486, the CPU houses a three-foot-by-four-foot viewport that shows the chip's surface blown up 50 times. Periodically, a computer animated "flight" down over the surface of the working chip brings the individual conducting lines into focus, magnified hundreds of times. Based on video taken through a scanning electron microscope (SEM), this will be a novel view of the CPU even for many computer hardware engineers!

Stooping under some ribbon cables, you find the system **CLOCK** which contains a cutaway view of the oscillating quartz crystal, which serves as a metronome for the other components. Lighting effects throughout the motherboard's surface simulate the clock's pulses, keeping all activities synchronized.

The four banks of random access **MEMORY (RAM)** chips stand four feet high. (Random access memory is memory you can use to store and retrieve data. ROM is read-only memory.) A series of viewports lets visitors examine the circuitry at different levels of magnification and see how blocks of data are stored and fetched from individual memory cells.

At the far end of the motherboard is a 15-foot **HARD DISK** drive. A cutaway view shows the spinning platters and read-write heads moving back and forth across the disk surfaces. A viewport gives visitors a computer animated "ride" on a read-write head as it flies over the disk's surface--like a jet hurtling above a desert.

Leaving the motherboard, visitors can watch a lighthearted video show (running continuously) in the **SOFTWARE THEATER**, which explains how computer software drives the hardware--how the explicit instructions in a computer program make up an algorithm for solving a particular problem and how these are executed by the CPU. The show features a computer animated character who takes you by the hand on a journey from human intentions to programming instructions and the pulses of electricity that drive a computer.

During the show, a screen on the left shows a visitor using the computer. A screen on the right shows what is on the monitor from the World Traveler demonstration program. The center screen shows the animated characters, video footage taken on the actual motherboard, other computer animation, and images designed to help viewers understand how a computer program works.

Six **LEARNING STATIONS** across from the Software Theater offer opportunities to pursue topics such as computer architecture and how a computer program is created.

The Computer Museum

300 Congress Street
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(617) 426-2800

STORY BEHIND THE WALK-THROUGH COMPUTER™

The Challenge

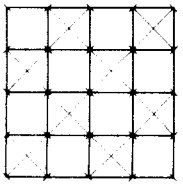
Building an exhibit which is an authentic model of a working computer 50 times bigger than the normal desktop size presented several challenges. How do you make a huge model act like a real computer? How do you show how a computer works when some of its parts, like the disk drive and the chip's circuitry, are sealed inside packages, and the electricity pulsing through all the components is invisible? How do you make the exhibit as authentic as possible, while also making it accessible to large numbers of people at various levels of understanding?

It was impractical simply to build a giant desktop computer that really worked. For one thing, a typical desktop computer draws 100 watts of electricity at a cost of $.10 per hour, but a computer blown up 50 times might draw 250 kilowatts and cost as much as $25,000 per hour! Also, chips work because they are small, and the technology is getting even smaller so computers can work even faster. A giant desktop, if it could be built, would run at least 50 times more slowly than a normal sized one.

In meeting these and other challenges, the Museum has employed state of the art hardware and software to achieve highly realistic detail wherever possible, relying on cutaways, viewports, interactive stations, and computer animation to enhance the learning experience, and on lighting and special effects to simulate the action of a computer.

Designing An Original Motherboard

Since no layout for an existing computer allowed enough room for visitors to walk around inside it when magnified 50 times, the Museum decided to design and fabricate its own computer prototype with the aid of a consortium of computer companies. Computer architects first sketched an outline of a design for the prototype of a 6"x10"x1/16" working "motherboard"--the printed circuit board that holds the computer's main components. These had to be presented in a logical order while allowing visitors to walk around them. That outline was then translated into a workable schematic showing how the wires or "traces" would interconnect the parts. The major interconnection paths (buses) had to be visible so lighting and special effects could simulate them. This model became the basis for the exhibit, and makes it highly realistic.



Building the Giant Motherboard Simulation

The Museum used special lighting to simulate the flow of electricity, slowed down by millions of times per second. (In a real computer, the electrical switches go on and off at millions of times per second.) The lights simulate signals on the data and address wires. These signals show how the central processor communicates with the other parts of the system. Visitors literally walk through the motherboard, following a path around the computer's main components. A special acrylic fiberglass sheet material was found that resembles the green epoxy material of a typical motherboard and is also translucent to show the flow of electricity.

Showing the Complexity of the Central Processing Unit (CPU) Microprocessor

A modern 6/10"x 4/10" microprocessor has 1.2 million transistors! To show this richness of detail, the CPU was blown up 50 times. A rear projection screen was embedded in a 7'6" square table exactly where the actual silicon chip would be. The screen presents real images that zoom down over the actual surface of a silicon chip magnified up to 500 times, based on video shot through a scanning electron microscope. Also, computer animated videos show how information and electrical charges flow through the chip.

Disk Drives: Displaying the Invisible

The hard disk (used for storing and retrieving the images that make up The Walk-Through Computer's database of travel scenes) would normally be sealed. Its surfaces would spin and its heads would move back and forth rapidly reading data that is invisible to the eye. A viewport shows computer animation allowing visitors to experience sitting behind the head as it flies over the disk's surface reading data. Visitors are also given a privileged view of magnetic fields and electrical currents--the life's blood of the disk drive--that would otherwise be invisible.

Building the Giant Monitor: Avoiding an Explosion!

Desktop computers use a special cathode ray tube. A vacuum tube large enough for The Walk-Through Computer would implode! So the Museum put a giant three-tube rear-screen beam projector inside the monitor to project the images of cities in the World Traveler demonstration program on the screen. To ensure clear images on the 108-square-foot screen, a high-quality projector, retailing for $20,000 and similar to the type used in movie theaters, was selected.

Making the Trackball Work

While many people are more familiar with the "mouse," a hand device that moves across a pad to move a cursor on the screen, imagine the problems that might arise when pushing a mouse big as a bumper car around a giant pad! Also sometimes a mouse must be picked up or moved off the pad. A giant trackball with a 40-inch in diameter roller ball was safer and easier to use.

To build a functioning trackball on a 20 times scale, the Museum would have had to involve a entire manufacturing plant! Instead, a giant (9'x6'6"x5') simulation was built and linked to a much smaller functioning trackball hidden inside the power supply. Normally a trackball rests on one inch diameter bearings that produce pulses letting the computer know how much the ball has moved. The giant trackball works just like a real one, resting on three large bearings. A system of wheels, light emitting diodes, and detectors generates an electrical signal. Since the giant trackball does not have its own microprocessor, the signal is sent to a real trackball hidden inside the giant model power supply. This trackball analyzes the signal and sends it to the small computer running the World Traveler program.

Exhibit staff rolled the ball back and forth for hours, experimenting with its weight so it would feel and act like a small roller ball.

Via a viewport, you can see the roller ball, wheels, light-emitting and photo diodes. As you move the ball, you will see how lights shoot down the cable connecting it to the computer as a pointing arrow moves across the map on the screen.

Steamrollering the Keyboard

Here, a big problem was making the giant (one-foot-square) keys of a mechanical keyboard--some 25 feet long--accessible to small visitors. The solution was to flatten out a section in the middle of the keyboard that would also be a walkway into the computer. To the left, visitors press fully operational keys (one is shown in cutaway view) to make selections. The keys are controlled by sponges that act like springs, but are more reliable. Connectors send input to the exhibit software. The keys on the right of the walkway look real but don't operate. This device of steamrollering (flattening 3-dimensional objects into two dimensions) is used throughout the exhibit to allow free movement of visitors, while not leaving out important detail.

World Traveler: A Computer Visitors Can Use

It was decided that the most exciting and effective way to show people how the inside of this giant computer works was for them to use the computer themselves in the World Traveler route-finding application.

The Walk-Through Computer actually runs on a Macintosh II. This computer takes the visitor's inputs from the giant trackball and keyboard, calculates the best path, and projects the results on the giant screen.

Another computer, a Digital Equipment Corporation Microvax, coordinates lighting and special effects to simulate the flow of data around the motherboard. It also drives the lighting effects for the giant keyboard. Visitors can press one of ten fully operational keys to make selections. The keys are controlled by sponges that act like springs. Connectors send input to the exhibit software. A cutaway view shows the key making contact with a grid of wires underneath. Each time the key is pressed, lights shoot down the cable that connects it to the computer. Lighting effects show the CPU "running" the application as it checks the keyboard's input, fetching route data and images from the hard disk, and sending display information to the video board.

Explaining Software: The Software Theater

How do you simulate or model something as ethereal as software, especially when it looks one way to a human programmer and another to the computer? To a programmmer, software is a series of words, English-like instructions. But to the computer, it is electronic signals or voltage changes. Another problem was how to show people that computers are not inherently intelligent, but only follow the instructions in a computer program.

To overcome any anxiety visitors might have about this subject, it was decided to create a humorous conversation between a knowledgeable cartoon character and two fledgling computer programmers. The six-minute multimedia presentation in the Software Theater combines the use of computer animation, in creating the cartoon character, and video footage of real humans to explain how computer programs are written and translated into instructions the computer can follow and carry out.

The Computer Museum

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(617) 426-2800

THE WALK-THROUGH COMPUTER™

WHY THE WALK-THROUGH COMPUTER?

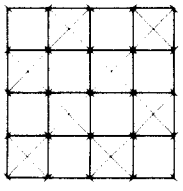
The rapid emergence of the computer as a central tool in society has left many people without a basic understanding of computers. While exhibits at The Computer Museum and other institutions have addressed computer history and applications, no public institution has tackled what is arguably the most important question of all--"How do computers work?"--in a way that overcomes the fear and inadequacy many people feel about understanding technology.

The Walk-Through Computer will help meet this need. To see how a computer actually works, visitors can walk through the inside of an authentic, two-story working model of a computer blown up 50 times its normal size. The 5,300 square foot exhibit takes people on a eye-opening excursion past a huge keyboard, monitor, and trackball into the interior of the computer with its ceiling-high interface boards, banks of RAM and spinning disk drive. There, they see how the different parts of the computer work to perform a task--finding the shortest land route between two major cities.

In addition, The Software Theater introduces visitors via a humorous three screen video show to the subject of computer software, while special interactive stations offer in-depth information to those who want to know the details.

As the only museum in the world solely devoted to computers and their impact on society, The Computer Museum has a mission to educate and inspire all ages and levels of the public about computers, their impact and applications, to promote the understanding of computers worldwide, and to be an international resource for research into the history of computing.

Since its incorporation as an independent non-profit educational institution in 1982, the Museum has assembled the world's largest set of public exhibits on computing, built one of the finest collections of historical computers and robots, and welcomed more than half a million people. Its traveling exhibits and Computer Exhibit Kits Program now serve over a million people. Its highly popular computer graphics and Smart Machines galleries have moved the Museum into the forefront of interactive computer exhibit design.



The Walk-Through Computer is the first of four major new exhibits which the Museum plans for the future. The others are: Milestones of a Revolution, The Computer Discovery Center (a joint project with The Boston Computer Society), and The Networked Society. They will span the evolution, applications, and impact of computing, and will be rich in hands-on experiences.

FOR WHOM IS THE WALK-THROUGH COMPUTER?

Each year, The Computer Museum attracts more than 100,000 people of all ages and levels of knowledge about technology from around the world. The Walk-Through Computer is designed to engage them all. The Museum already offers special programs to help support visitors from under-served communities. Educational materials on The Walk-Through Computer will help prepare educators and students prior to their visit. A video and book are also planned.

As the world's only computer museum, it also attracts large numbers of American and foreign tourists, especially in the summer. The Walk-Through Computer will appeal both to families with small children who may know little about computers and to computer-knowledgeable visitors intrigued by the exhibit's spectacular character and authenticity. Visitors will be able to select the level of depth and detail at which they experience the exhibit--from something as simple as pressing down a giant key to see lights shoot down a cable to peering through a viewport for a scanning electron microscope's view of a microprocessor!

WHAT DOES THE WALK-THROUGH COMPUTER TRY TO ACCOMPLISH?

With the Museum's diverse audience, the exhibit will try answer a few important questions: How does a computer work? How do you talk with a computer? How does it store information? What is a software program? What does the inside of a computer look like? What do its components do and how do they work together?

A rich array of further information is available for those who seek it through interactive, computer-based learning stations.

The Computer Museum

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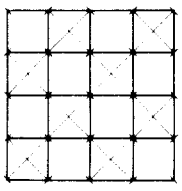
PEOPLE BEHIND THE WALK-THROUGH COMPUTER™

o **DR. OLIVER B. R. STRIMPEL** - The Museum's Executive Director has overseen the design and development of exhibit from the start. It was he who concluded that a giant working computer that people could walk through was the most exciting, effective way to show the public how a computer works. When he arrived as Curator of the Museum in 1984, he had a vision of the importance of computers and how they could be used in exciting interactive exhibits to reach a wide public, profoundly affecting the museum experience. He has moved The Computer Museum into the forefront of interactive computer exhibit design. Dr. Strimpel was responsible for the Museum's most successful permanent exhibitions, "The Computer and the Image" and "Smart Machines," two 4,000-square-foot galleries with more than 60 interactive stations. Prior to joining the Museum, he was Curator for Mathematics and Computing at The Science Museum, London, where he developed major interactive exhibits on information technology and electronic imaging. He was educated at both Cambridge and Oxford Universities.

o **RICHARD FOWLER** - The Walk-Through Computer's designer, Richard Fowler, is on loan from Britain's award-winning popular National Museum of Photography, Film and Television, where he is head of design. Known for his ability to translate technical fields into large-scale, engaging and educational, 3-dimensional exhibits, Fowler translated Dr. Strimpel's concept for The Walk-Through Computer into an exhibit plan that would make the best use of the Museum's space. Formerly senior designer at The Science Museum, London, he has designed several highly acclaimed exhibitions including a full-scale model of a nuclear reactor core.

o **DAVID MACAULAY** - As Exhibit Illustrator, David Macaulay has created 30 information panels which hang suspended inside the giant computer and tell The Walk-Through Computer's "inside story." The prizewinning author, illustrator, and television producer is also on the exhibit's Advisory Committee. He is known for his special talent for making complex mechanisms comprehensible to the layperson. He has written 15 books. Among them: the popular series of imaginative books on architecture, including Cathedral, City, Pyramid, Castle, and Unbuilding (the imaginary dismantling of the Empire State Building). His most recent book, the bestselling The Way Things Work, is an entertaining, fact-filled guide to the workings of over 250 machines from the zipper and photocopier to the computer.



o **DONALD MORRISON** - Exhibit Developer Donald Morrison had day-to-day responsibility for advancing the project. A co-author of Immigrant, the popular AppleWorks-based curriculum package, and Just Enough Pascal, an innovative programming tutorial, he has a varied background in computers and education, including software development and more than 15 years of classroom teaching. He recently received an Ed.D from the Harvard Graduate School of Education.

o **JOHN PALFREMAN** - Award-winning British producer John Palfreman is producing the whimsical video for The Software Theater. A Senior Producer of Horizon, a science program broadcast by the British Broadcasting Corporation, he is in the United States developing a six-part series on the history of the computer. He has produced documentaries on a wide range of topics including the history of surgery, advances in embryology, new bugging technologies, Soviet science and technology, and the mysteries of sleep. "The Case of the Frozen Addict," a documentary which he produced for the PBS TV series NOVA, showed how a drug tragedy in California led to a breakthrough in the treatment of Parkinson's Disease. It won five awards. He has a BS in physics and an MS in History and Philosophy of Science from University College, London, and Sussex University, respectively.

o **DEAN WINKLER** - New York animator Dean Winkler is creating the computer generated animation for the Software Theater. He is the Vice President, Director of Creative Services, at Post Perfect Inc., a $15 million electronic special effects facility in New York. A computer/video artist, he has created more than five and a half hours of video art which have been shown across the world. Among the most popular: a piece called Act III, created with John Sanborn (music by Philip Glass). Another piece, Renaissance, an abstract artistic view of the Boston skyline, is on exhibit at The Computer Museum. Possessing interests that span art and engineering, Winkler holds a U.S. patent for a digital programmed ramp generator, has received numerous awards in the television industry, and often lectures abroad.

The Computer Museum

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SPECIAL NOTICE TO MEDIA

Support from corporations, foundations, and government agencies is vital to maintaining the continuing strength of exhibits and programs offered by The Computer Museum. In your coverage of The Walk-Through Computer,™ we ask that you give public recognition to the generous support of the exhibit's sponsors, without whom the exhibit would not have been possible. The total cost of The Walk-Through Computer is $1.2 million. Support has come in the form of cash donations and donations of equipment and professional services.

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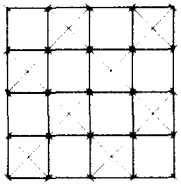


ADVISORY COMMITTEE

The Museum has convened an advisory group of some of the world's leading experts in educational psychology, educational software, exhibit design, computer science, and classroom teaching. Their input helped the Museum implement the concept of exhibit effectively. They are:

- Art Bardige, President of Learningways, and former teacher
- C. Gordon Bell, Vice President, Research & Development, Stardent Computer Inc.
- Daniel C. Dennett, Professor of Cognitive Science, Tufts University, co-author of The Mind's Eye
- Allison Druin, Tell Tale Technologies
- Signe Hanson, Director of Exhibit Design, Boston Children's Museum
- Gardner Hendrie, Sigma Partners, and Chairman of The Computer Museum
- Danny Hillis, Founding Scientist and Director of Research, Thinking Machines
- David Macaulay, author and illustrator of a series of best-selling books including The Way Things Work
- Philip Morrison, Institute Professor, Massachusetts Institute of Technology
- Phylis Morrison, author and producer of science materials and programs, and co-producer with Philip Morrison of the PBS series, The Ring of Truth
- David Patterson, Professor of Computer Science, University of California (Berkeley)
- Jonathan Rotenberg, Chairman, The Boston Computer Society, the world's largest society of computer users
- Richard Rubinstein, Manager of Technology Assessment, Digital Equipment Corporation

PROJECT MEMBERS

The Computer Museum's Executive Director, Dr. Oliver B. R. Strimpel, has directed the project from its inception.

EXHIBIT STAFF

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

OUTSIDE CONTRACTORS

F. W. Dixon Company	Fabricator
David Macaulay	Illustrator
Ruth Murray	Assistant Illustrator
John Palfreman	Video Producer (Software Theater)
Nancy Linde	Assistant Video Producer (Software Theater)
Michael Callahan	Sound and Video Consultant
Jane Cuthbertson	Typographer
Ted Groves	Typographer
Marjorie Waters	Editor
Absolute Precision Silkscreen	Silkscreener
Design Systems	Newsletter layout
Interface Flooring Systems Inc	Flooring
Warren Jepson Leeds	Professional Photo Labs

SPECIAL CONSULTANTS

Drew Huffman (Paracomp)	Animator
Dean Winkler (Post Perfect)	Animator
Tony Fernandes (Lotus Corporation)	Project Consultant
Mitchel Resnick (MIT)	Project Consultant
Tom Flotte (Mass General Hospital)	Programmer
Joe Siegal (Digital Equipment Corporation)	Engineer
Len Dougherty (Digital Equipment Corporation)	Engineer
Marcia Cohen (Bingham, Dana, and Gould)	Researcher

The Computer Museum

300 Congress Street
Boston, MA 02210
(617) 426-2800

THE WALK-THROUGH COMPUTER
SOURCE CONTACT SHEET

EXHIBIT STAFF

o Dr. Oliver B. R. Strimpel, Project Director	(617)426-2800
o Richard Fowler, Designer	(617)426-2800
o Donald Morrison, Developer	(617)426-2800
o Dan Griscom, Technical Consultant	(617)426-2800
o Alan Symonds, Technical Director	(617)426-2800

CONTRACTORS

o Kevin Griffin, F. W. Dixon Company, Fabricator	(617)935-8855
o David Macaulay, Illustrator	(401)247-2560
o John Palfreman, Video Producer (Software Theater)	(617)492-2777x3474

CONSULTANTS

o Drew Huffman, Animator (viewports)	(415)956-4091
o Dean Winkler, Animator (Software Theater)	(212)972-3400

PRINCIPAL SPONSORS

o Mitchell Kapor, The Kapor Family Foundation	(617)225-2545
o Sam Goldberg, The Alfred P. Sloan Foundation	(212)649-1649

MAJOR SPONSOR

o Lewis Karabatsos, Digital Equipment Corporation (508)493-4323
(Digital also provided MicroVax 3400 for special effects)

SPONSORS

o Lawrence Tesler, Apple Computer, Inc. (408)974-2219
(Apple also provided Macintosh IIfx for World Traveler)
o Susana Thompson, AT&T Corporation (617)574-3158
o Cliff Purkiser, Intel Corporation (408)765-4468
(also helped design giant replica of Intel 486 chip)

DONORS

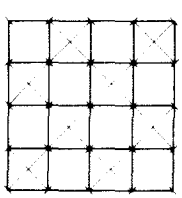
o Leesa Young, Maxell Corporation of America (201)794-5932
(floppy disk)
o Carol Andreuzzi, Kensington Microware Ltd. (212)475-5200
(trackball)
o Richard Eckel, Lotus Development Corporation (617)225-1284
(Software Theater)

CONTRIBUTOR

o Dr. Suhas Patil, Cirrus Logic, Inc. (408)945-8300

AMONG CONTRIBUTORS OF EQUIPMENT AND SERVICES

o Donald Glass, DGA Associates (617)935-3001
(fabrication of authentic motherboard)
o Devorah Canter, MacroMind, Inc. (415)442-0200
(software for animation in viewports)
o Meredith Lyons, MASS Microsystems, Inc. (800)522-7979
(disk drive)
o Steve Blank, SuperMac Technology, Inc. (408)245-2202
(monitors for viewports/learning stations
o Karyn Scott, VideoLogic, Inc. (617)494-0530
(learning station)



An Exhibit That Gets Inside the PC

SUMMARY: Technical ignorance of the personal computer may be almost as widespread as its use. But an unusual model at the Computer Museum in Boston uses a very large scale and one-fiftieth speed to demystify PCs. Visitors can step inside the Walk-Through Computer to explore its main components and how they work.

JACK McWILLIAMS

Strimpel wants to minimize mystery.

Howard Miller is not just another child with a computer. When he returns home to Royersford, Pa., from his summer vacation, the 12-year-old will be able to boast to his friends that he saw the biggest computer in the world. And not only that, he actually explored inside it. Howard's buddies might be skeptical, but they will likely be impressed. It is hard not to be when you are reduced to a midget by a machine.

That is precisely the effect the Walk-Through Computer, the latest exhibit at Boston's unique Computer Museum, is intended to have. By applying the concept of "big" to a personal computer, its developers theorized, perhaps they could help explain what really goes on inside. The result is this unusual exhibit, a $1.2 million, two-story wonder that is 50 times larger than the standard personal computer on which it is based.

Computers have come a long way since the 1946 premier of ENIAC, the 30-ton, 15,000-square-foot monster built at the University of Pennsylvania and generally considered the first electronic digital computer to run working programs. Since then, the use of computers has grown just as fast as the machines themselves have shrunk, and now as many as 50 million personal computers are in use every day.

Because the devices have become such an integral part of society so fast, especially in recent years, many people are intimidated by them and reluctant to admit that they really have no clue as to how computers work, says Oliver Strimpel, the museum's executive director and the man credited with coming up with the idea.

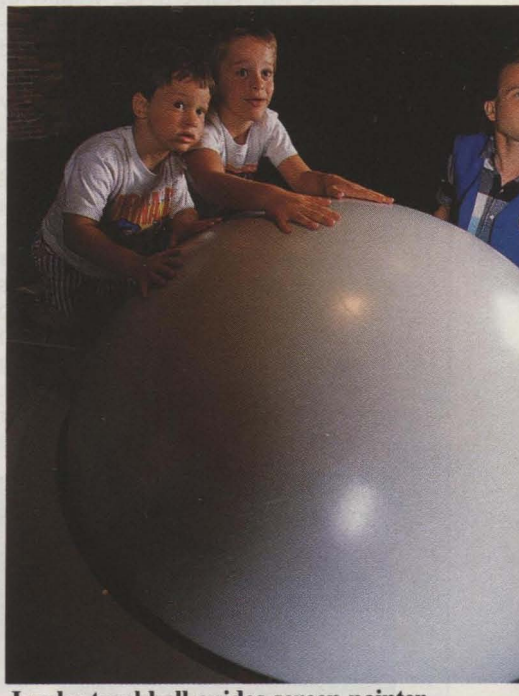
"The level of ignorance is astonishing," he says. "The computer is difficult to understand, though, because it's so small and invisible. At least with a car, you can see it — you open the hood and there's stuff in there. You can't do that with a computer."

The exhibit's goal, he says, is to "make people realize that the computer is not a mysterious, totally intangible thing. It has numerous components and they do their respective jobs with no mystery anywhere."

For Strimpel and his team of about 70 designers, engineers and computer specialists, a dilemma presented itself early on. As they planned the exhibit, they puzzled over how to come up with an authentic model of a working computer that could demonstrate the technology in action and at the same time be understandable to computer illiterates, interesting to sophisticated computer users and fun for everyone.

They decided to go giant-sized. The keyboard, where the exhibit begins, is 25 feet long, and the individual keys are large enough for adults to sit on and sturdy enough for kids to stomp on.

Press one of the designated keys and the monstrous computer jumps to life by running a program called World Traveler that appears on the 14-foot-tall monitor screen. Serving as the exhibit's grabber, World Traveler acquaints visitors with a simple program and lets them play with behemoth computer hardware before they venture inside the machine. By rolling a jumbo "trackball" that controls a screen pointer,



Jumbo trackball guides screen pointer.

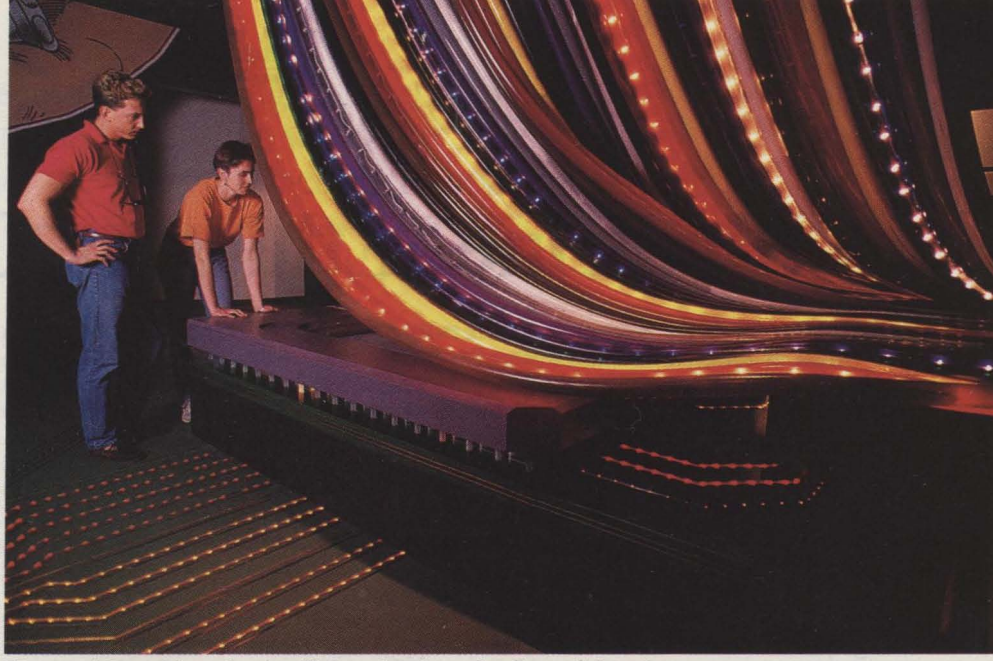
users pick two cities, and the computer — actually a Macintosh II behind the scenes — finds the shortest driving route between them and shows slides of attractions along the way. Another computer, a Digital Equipment Corp. Microvax, controls all the exhibit's special effects.

A stroll along the "motherboard," the panel on which the main components sit in a real computer, reveals the computer's inner workings. Along the way is the central processing unit, or CPU chip, a model of the Intel 486 microprocessor at the heart of most of today's state-of-the-art personal computers. Normally the size of a postage stamp, this one is 7½ feet square.

Lined up neatly in the corner are the chips for random access memory, or RAM, which Strimpel calls the computer's scratch pad, storing only information that the central processing unit needs to access quickly. The computer's permanent memory is kept in the read only memory unit, or ROM.

Just across the way, spinning rapidly, is the hard disk drive, where images in the data base of travel scenes for the World Traveler program are stored and retrieved. As its four disks spin, a magnetic head reads the data, and images are sent to the video board for processing. The system clock makes sure all the components dance to the same beat.

Strings of pulsating lights illustrate the path the data follow throughout the com-



BRIAN WALSKI FOR INSIGHT

Huge cables with pulsating lights simulate the flow of data between components.

puter, and windows allow visitors to peer inside the components to see how they work. A glance inside the central processing chip reveals an enlarged picture of its surface, complete with multiple lines etched in silicon. In a moment, computer-generated artwork descends to its surface to reveal how it handles information. A special video, made with an electron scanning microscope, shows how a real chip acts.

At the end of the walk sits a software theater that introduces viewers to the art of programming. Next is a cluster of workstations with personal computers on which visitors can write their own elementary programs.

Figuring how to introduce the intricacies of what goes on beyond the monitor amid the machine's circuitry, memory banks and brain presented a huge challenge. "The inside of a computer has millions of things happening every second," Strimpel says. "And the question was, since we obviously can't keep up with that, do you show visitors just a very simplified high-level version or show them what's going on at the atomic level?"

The designers decided to "add a creative twist in which we show things happening inside the computer, but they are large chunks of things," he explains.

As it turns out, the only fathomable way to present the computer's activity was in slow motion, one-fiftieth the speed of a normal computer. So what happens with each World Traveler sequence is not occurring simultaneously with what visitors observe as they stroll inside the computer.

The members of Strimpel's team expect their giant computer will have everyday applications for anyone who deals with computers. Many visitors on hand for the exhibit's recent public opening said they confront computers daily and were impressed with the way the exhibit demystified the whole process. The gadgetry, details and visuals impressed upon Howard Miller that he "can do a lot more programs and things on my computer than I expected."

Even the often confusing task of purchasing a computer can be made easier by seeing the exhibit, says Strimpel. "Anytime you buy a computer, the salesman is going to ask you, 'Well, how much of this do you want and how much of that do you want? How much memory, what kind of a disk drive, what processor, what kind of monitor?' Most people just aren't equipped to answer those questions," he says. "They'll say, 'I don't know, I just want a computer, just give me a computer.' "

Given that what is hot today in computer technology may well be obsolete tomorrow, one may legitimately ask how representative the Walk-Through Computer will be for future museum patrons.

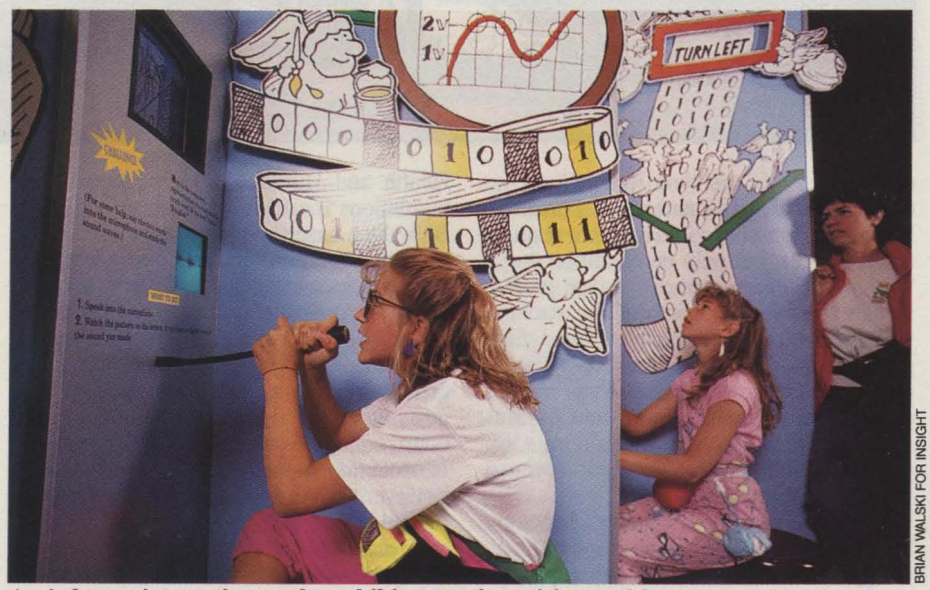
"Fifteen years down the road, this exhibit will still accurately represent the computer," says Steve Golson, a free-lance hardware design consultant. "The fundamental physics will still be the same and most of the mechanics will still be very useful. Things like disk drives and RAMs will always be used." Elements such as the Intel 486 likely will become outdated in a decade, he adds, but they probably could be replaced easily in the exhibit.

"What I would like to see is showing what can and does go wrong in a computer," says Golson. "What does it mean when the software crashes, or when the computer hits a bug? Even people who have some computer training are constantly afraid of breaking the machine, but you can't really break it."

The Walk-Through Computer is a permanent fixture at the museum, housed in a renovated wool warehouse on Boston's waterfront. A wider national audience may have the chance to explore similar oversize computers because other museums have shown an interest in licensing its design, Strimpel says. A videocassette narrating the exhibit and how it evolved will eventually be available through the museum's store and various educational materials outlets.

"Giant things have the capacity to entertain and make people laugh and think," says Strimpel. "When they are in that frame of mind, they lower their defenses and they aren't thinking, 'Oh my god, I'm stupid, because I can't understand this.' They say, 'Hey, this is fun. I can get this.' That's why we did it."

— Dina Van Pelt in Boston



BRIAN WALSKI FOR INSIGHT

An information station at the exhibit acquaints visitors with computer lore.

Vol. 4, No. 3 February 1991

U·S kids®

A *Weekly Reader* Magazine

Fun Things To Do Inside

The Big Computer

See page 34

FIELD PUBLICATIONS

The Computer Adventure

by Deborah H. DeFord

Have you ever dreamed of diving deep into the ocean? Have you ever imagined a journey into the heart of a steamy green jungle? Have you ever hoped to hop aboard a spaceship and head for the stars?

How about a walk through a giant computer? Have you ever thought about that? Some kids do more than think about it. They stand with two feet on a single key and then jump across the keyboard. Then they watch a screen that is too big to fit in a person's house.

But they don't stop there! Their adventure has just begun! They are about to enter the Walk-Through Computer. The Walk-Through Computer is just like the computers at school or at home, only it's 50 times bigger! Now why don't YOU join the Computer Adventure! ⇨

The Computer Adventure

You can find your way through the Walk-Through Computer. Your stops are numbered in order. But to get from stop to stop, you need to follow the correct path through the maze. Are you ready? Read on!

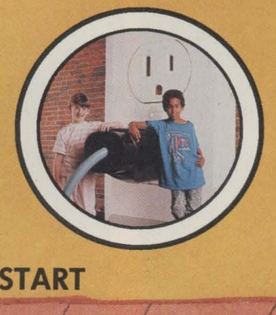
No computer works without power. So start your adventure at the Power Supply (1).

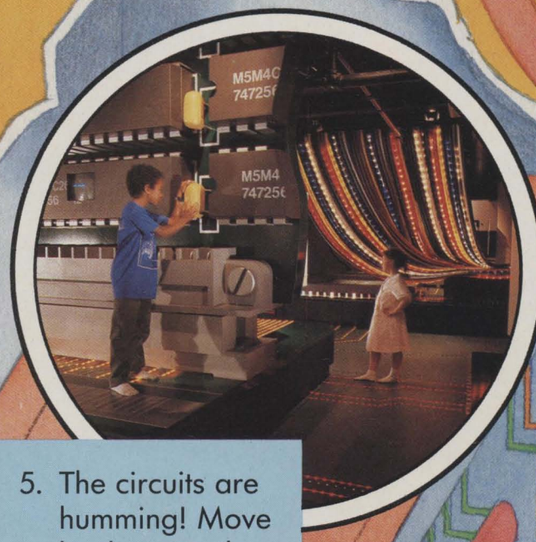
Along the Computer Trail

1. Power Supply
2. Floppy Disk
3. Trackball
4. Hard Disk
5. Video Board
6. Monitor

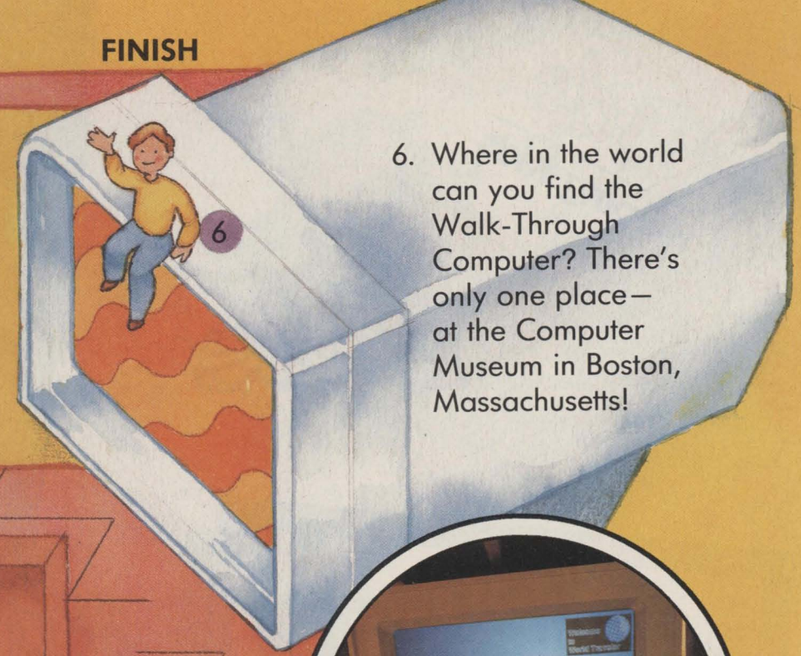
START

1. You are plugged in! Now hurry to trace a clear path from here to your Floppy Disk (2).



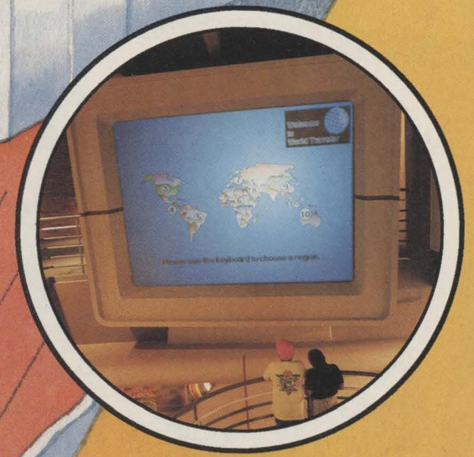


5. The circuits are humming! Move back out to the Monitor (6) to see what's happening.

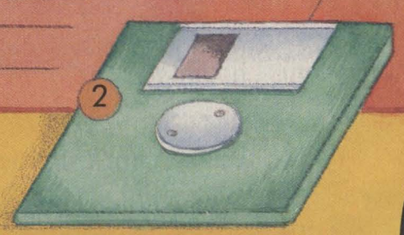


FINISH

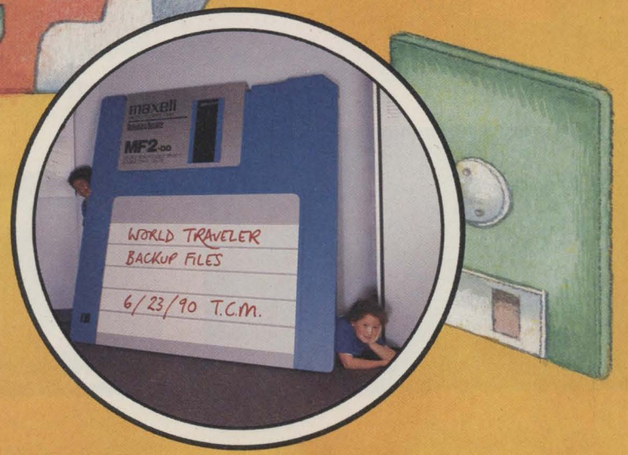
6. Where in the world can you find the Walk-Through Computer? There's only one place—at the Computer Museum in Boston, Massachusetts!

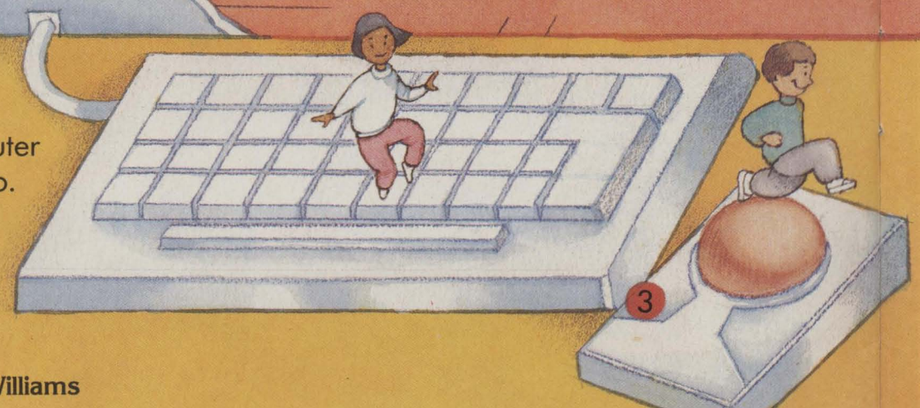


4. The computer is working for you. Hurry to the Video Board (5).



2. The disk is in place, but don't stop yet! Move to the keyboard and Trackball (3).





3. You've told the computer what you want it to do. Move inside to the Hard Disk (4).

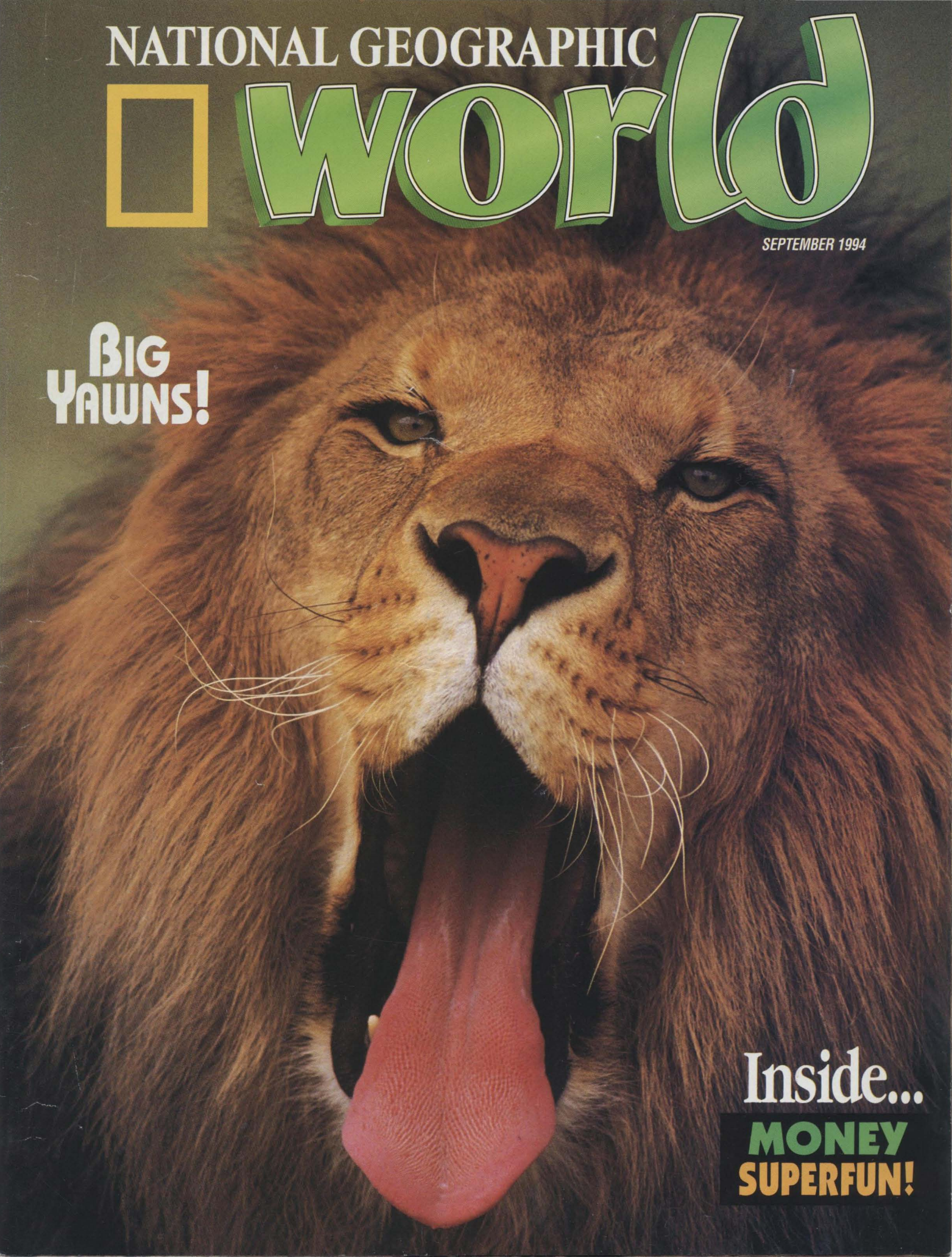
Photos by Jack McWilliams

Illustration by Frederic Winkowski

NATIONAL GEOGRAPHIC

world

SEPTEMBER 1994



BIG YAWNS!

Inside...

MONEY

SUPERFUN!

COMPUTERS

THE INSIDER'S TOUR

Okay, so you see computers every day. But do you know what goes on *inside* those mysterious machines? You would if you visited the Computer Museum, in Boston, Massachusetts. There visitors step inside a working computer that is almost like any other—except it's 50 times as big as a desktop one. To show you how big that is, Cara Pina, 11, of Somerville, Massachusetts, and Emily Knight, 12, of nearby Scituate, have hopped onto the keys, something visitors are not usually permitted to do. Have an inside look at this megamarvel by turning the page.

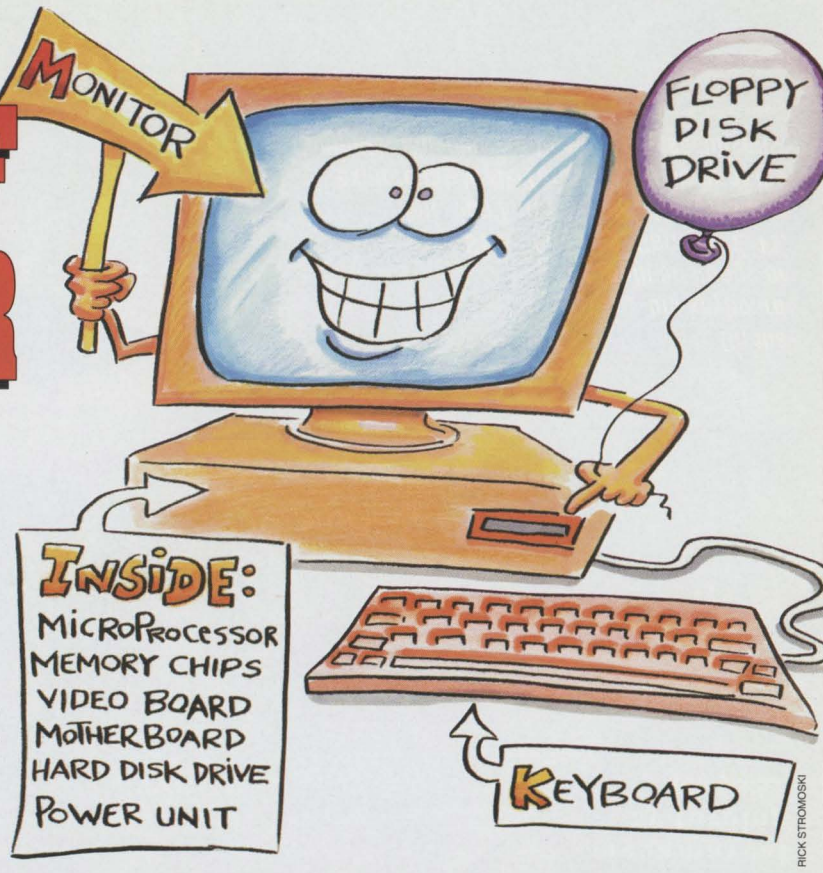
On the big keyboard beneath an image of South America, Cara Pina, 11, left, and Emily Knight, 12, get set to explore the Walk-Through Computer at the Computer Museum, in Boston, Massachusetts.

PHOTOGRAPHS BY PAULA LERNER

GOING INTO THE GUTS OF A COMPUTER

The museum's giant computer actually runs off two smaller computers. Videos and windows called viewports let visitors see the inner workings of the boards, circuits, and chips.

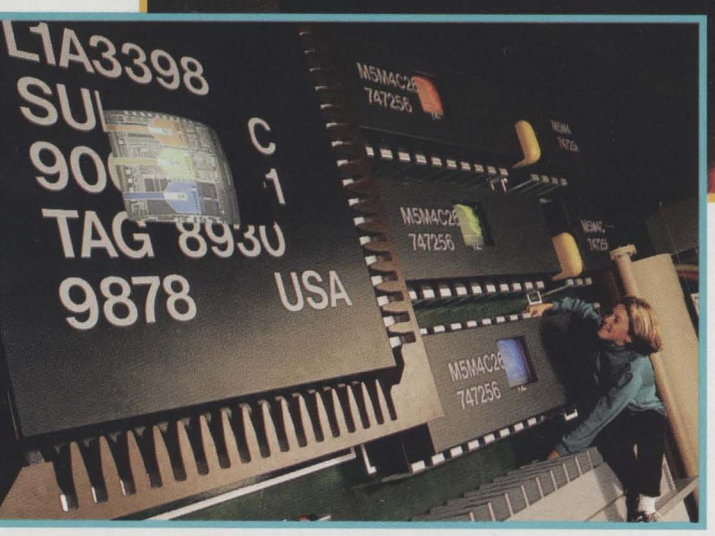
KEYBOARD *By pressing a key on the giant keyboard (left), Emily tells the computer to change the image on the monitor. When the key makes contact with a grid of wires beneath it, electrical impulses travel into the computer, signaling which key was pressed.*



RICK STROMOSKI

MICROPROCESSOR *The girls peer into the computer's brain: the microprocessor (big picture). It controls everything. They're standing on the motherboard—the main electronic circuit board that interconnects the machine's basic parts. Pulsing lights trace the flow of data.*

MEMORY *A module holding four banks of RAM (random access memory) chips dwarfs Cara and Christian Kiley, 12, of West Newton, Massachusetts (right). These chips store program instructions and data for quick access.*



COLORS *Using data from a disk, the video board (above) decodes information into red, green, and blue signals. The signals then travel to the monitor. Viewports on the board let Emily see how its inner circuits work together to mix the colors.*

INFO TO GO *A 6-foot-tall model of a floppy disk attracts attention (right). Floppy disks let users transfer data files between computers. The hard disk drive stores other information on a built-in hard disk.*

POWER PLAY *Christian and Emily pull on a huge plug (below). If real it would feed electricity to the power unit. Later the visitors will check out some of the 120 other hands-on displays and exhibits.*

BY MARGARET MCKELWAY

THE TIMES

THURSDAY JUNE 7 1990

Inside a computer's mind

IN A hall at the Computer Museum in Boston, Massachusetts, an Anglo-American team of designers, special effects experts and videographic animators are putting the final touches to an audacious educational exhibition of technology.

The display, to be officially unveiled in two weeks, is the world's first walk-through computer – a massive, two-storey working model of a desk-top model blown up 50 times and complete with pulsing lights simulating the flow of data and a giant spinning disc.

The exhibit, which cost £800,000, is the inspiration of Dr Oliver Strimpel, the Boston museum's executive director and former curator for mathematics and computing at London's Science Museum.

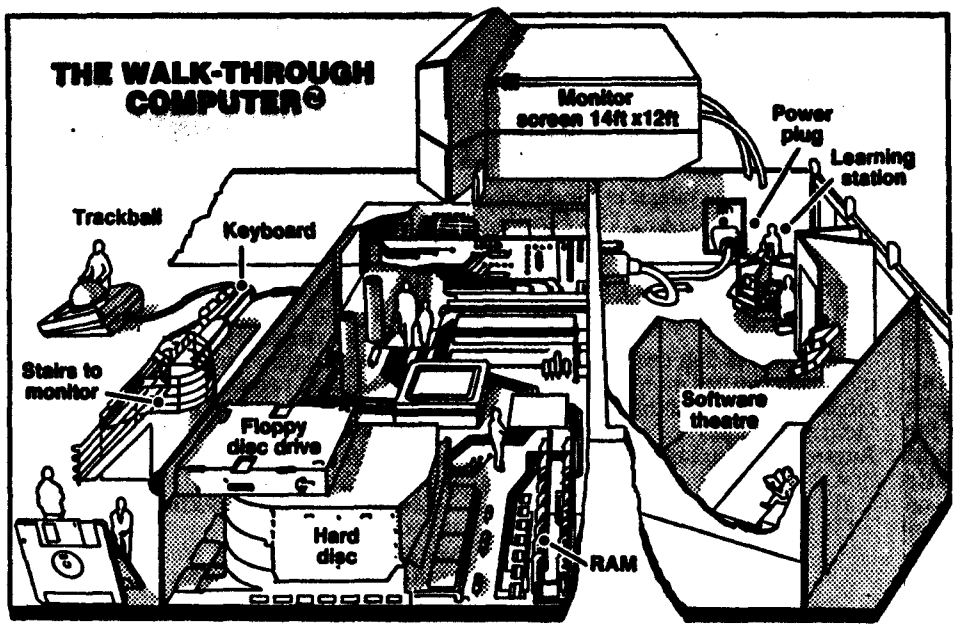
The designer was Richard Fowler, the head of Britain's National Museum of Photography, Film and Television and former senior designer at the Science Museum, where he once produced several highly acclaimed exhibitions, including a full-scale model of a nuclear reactor.

Through combining advanced hardware, software and special effects, the walk-through machine is able to demonstrate how computers process information from the flow of electrons in transistors through the alogrithms of a program.

Dr Strimpel, who joined the Boston museum in 1984, believes a giant walk-through exhibit is the most effective method of educating the public to the mysteries of the computer by answering key questions, including how a computer works, how to communicate with a computer, how information is stored, the machine's inner workings and the roles of the various components. To demonstrate a typical use, the exhibit runs a software program, called World Traveller, that allows visitors to operate the computer to tour the globe.

On arrival in the hall the first sight is of the exhibit's 108 sq ft monitor, 25-ft keyboard and six-foot-high floppy disc. When a 40-inch trackball is pointed at two cities, the computer, with design, equipment and building backed by companies including Digital Equipment, Apple, AT&T and Intel, begins calculating the shortest land route between the two cities. By stepping inside, people can see how the computer processes the data for the program while on the monitor slides are shown of sights along the way.

Designers have installed wall-to-floor video boards showing digital bits changed into analogue pictures while view ports allow visitors to peer into the micro-processor, random access memory chips and key parts.



A theatre has been included, complete with computer-generated animation by New York cartoonist Dean Winkler and a specially commissioned video by John Palfreman, of the BBC's science programme *Horizon*, who is in the US making a six-part series on the history of the computer. In many ways, the Boston exhibit highlights how the computer is becoming a feature of mankind's cultural heritage and landscape.

NICK NUTTALL

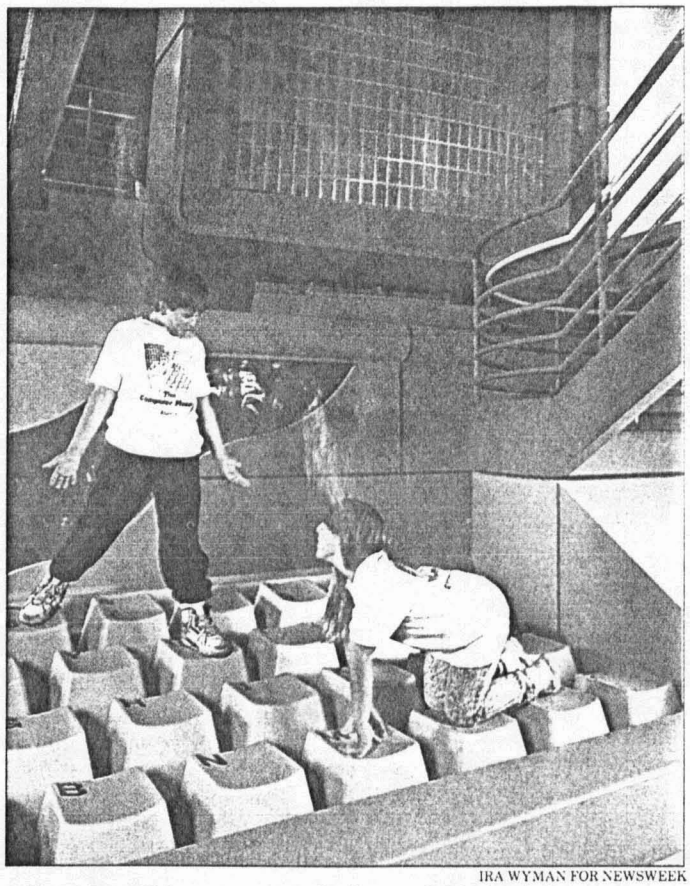
THE LONDON TIMES
June 7, 1990

TECHNOLOGY

This Is Big. Reeeeally Big.

The Computer Museum's new exhibit combines high-tech education with razzle-dazzle

For years, the goal in computing has been to make things smaller, building down from early room-size monsters to today's palmtop PCs. Even computer terms—like "bit" and "microprocessor"—connote tininess. Now The Computer Museum, Boston's repository of vintage number-crunchers and intriguing interactive exhibits, has gone the other way: a really, really BIG computer, two stories tall. It boasts keys a foot across, six-foot-wide disks and—get ready for this oxymoron—the biggest microchip in the world, 7½ feet square. The Walk-Through Computer, a new permanent exhibit modeled after such displays as the walk-through human heart at Chicago's Museum of Science and Industry, will give visitors a chance to see the soul of a new machine close up. No wonder the museum is calling the June 21 unveiling "the biggest event in computer history." Steve Jobs, eat your heart out.



IRA WYMAN FOR NEWSWEEK

A bit of fun: *Kids cavort on the keys of the work in progress.*

From the outside, the machine looks like most any PC with a pituitary condition. It will even run a program—"World Traveler," designed by museum staffers. Using the gargantuan keys and a pointing device known as a trackball—this one measures almost 10 feet by 7 feet—visitors choose two spots on a map. The computer figures the shortest route between the two cities and flashes pictures of sights along the way—say, San Francisco's Golden Gate Bridge, or Amarillo's Cadillac Ranch. The trackball, keyboard and screen are connected to an Apple Macintosh squirreled away backstage that does the actual computing. A Digital Equipment Corp. computer controls special effects.

After fiddling with the program, visitors can enter the chassis and walk from component to component, guided by the circuitry itself and illustrations by David Macaulay, author of the best-selling "The Way Things Work." Each part of the machine tells its own story. At the center of the board lies the microprocessor "brain," a replica of the Intel 486 found in today's most powerful PCs. Looking into a window on the chip, visitors will see a hugely enlarged picture of the actual lines etched in the silicon. That image fades, and computer-produced artwork takes over, zooming down to the surface for a step-by-step animated portrayal of the chip's operation—the tiny mundane steps that it accomplishes millions of times each second, such as asking the memory for a chunk of data and shooting that information out to the screen. That image is in turn replaced by footage taken by a scanning electron microscope which shows a real 486 chip at work. (Since the microscope's image is made up of electrons, it can "see" the changes in voltage along the chip.) Beyond the PC itself, a video "software theater" explains the way the computer's programming interacts with the hardware. So that visitors could learn as much or as little as they wish, the designers kept as their motto, "Simple message, rich context." A bank of terminals on the way out of the exhibit allows even further delving into the arcana of computing.

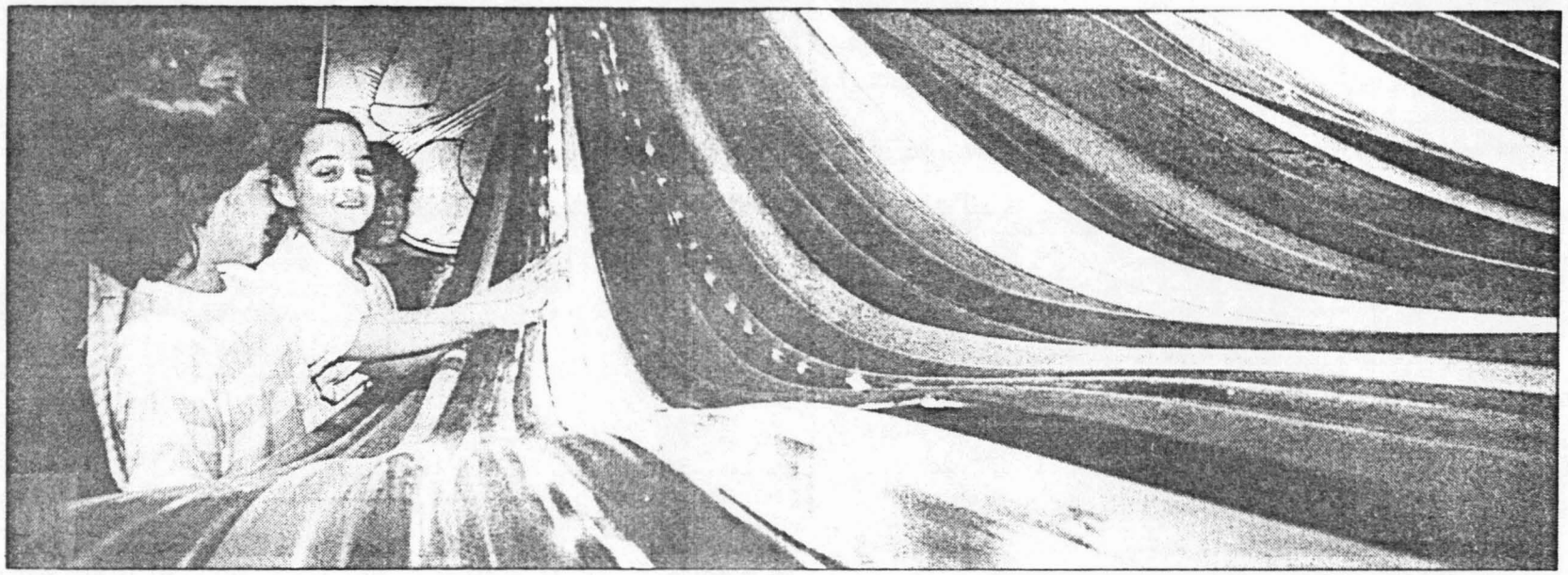
The elegant idea is the brainchild of the museum's executive director, Oliver Strimpel, who has been working on the $1.2 million exhibit for three years. Despite the expense, Strimpel found it the easiest sell of his career. "It clicked immediately with everyone," he says, glowing. "Everyone said, 'Of course! You've got to do that'."

'Make it sing': Putting it together hasn't been quite as easy. Even though the museum staff had decided from the beginning that their mock-up computer would not actually perform the computations, they wanted verisimilitude—a computer that *could* work. The museum took on the extra challenge to satisfy the technologically demanding Route 128 crowd. "We believe that authenticity is what's really going to make it sing for the technical people," Strimpel says. So they turned to a group of companies that design computer boards. Creating the main board, or "motherboard," usually takes two weeks, but this job took two months. The designers faced unusual constraints, says museum spokesperson Gail Jennes: "They not only had to worry about how to move data around, they also had to move people around." (To get to the men's room, you have to walk through the "power supply.") Now "it can work," says Donald Glass, whose company, DGA Associates, coordinated the design effort and had several small-scale models with real chips made for the museum. He admits DGA stopped short of a thorough debugging. "I just hope they don't plug it in."

All right, so we all agree it's cool. But what else? Strimpel says the Big Box should fulfill one of the first missions of the museum, which is to demystify computing. "Any place you've been is less of a mystery than any place you haven't been," Strimpel says. It should thrill kids and satisfy inquisitive adults. Once visitors have ventured into this cross between "Fantastic Voyage" and "Land of the Giants," they will know more about computers—as much as most would ever want to know. So the big computer will have done something that its pygmy brethren have so far found nearly impossible: making learning fun.

JOHN SCHWARTZ *in Boston*

NEWSWEEK, JUNE 4, 1990
Circ: 3,149,253



GLOBE STAFF PHOTO / YUNGHI KIM

Rakeo Sakan, Daniela Birrittella, Margaret Wright and Sasha Birrittella, front to back, feel the giant cables inside The Walk Through Computer at the Computer Museum. Wright is from Brookline, other girls are from Newton.

High-tech funds the ultimate computer course

THE BOSTON GLOBE
June 22, 1990
Circ: 500,106

The Walk-Through Computer, which opens tomorrow as the newest exhibit at Boston's Computer Museum, is a two-story working model of a personal computer. But at $1.2 million, this unique machine carries a pricetag more fitting a mainframe.

Indeed, the project would never have gotten off the ground without the financial backing of several computer companies and two charitable foundations with strong ties to high technology. "Without their support, it would not have happened," says Gail Jennes, a spokeswoman for the museum, whose annual operating budget is $1.5 million.

The principal sponsors were Mitchell Kapor's Kapor Family Foundation and the Alfred P. Sloan Foundation, which each gave $250,000. Digital Equipment Corp., whose president, Kenneth H. Olsen, started the Computer Museum, kicked in $150,000 plus another $100,000 in computer equipment. Other donors included Apple Computer Inc., American Telephone & Telegraph Co. and Intel Corp.

Their motivation? They say the exhibit, which allows visitors to roam through the innards of a personal computer, will help educate children and adults about computers and the way they work. And people who understand how a computer works are more likely to feel comfortable using it, they say.

"It demystifies technology for the general public, which is earnestly needed," said Kapor, an early museum supporter. "When Oliver told me about it, I thought it was just the perfect project."

Oliver is Oliver Strimpel, the museum's executive director and the creator of the Walk-Through Computer. He says the exhibit caught the imagination of many in the computer industry, making it easier than usual to raise money.

LAWRENCE EDELMAN

LIVING

THE BOSTON HERALD
June 22, 1990
Circ: 355,355

Kids exhibit computer skill

Help design museum show

By CAROL KORT

Who says grown-ups never listen to children or take their advice seriously?

That's not true at the Computer Museum, where sophisticated adults turned to school-aged children for help in making their latest project visitor-friendly.

Today the public can see the results of their collaboration when the museum's new exhibit, The Walk-Through Computer, opens.

When the Computer Museum began planning the giant show — which features an enormous, 50-times-normal-size working model of a desktop computer — it had a bevy of computer-savvy consultants on hand to offer expert advice.

But the show's organizers wanted to be sure its primary audience — children — understood and liked the exhibit.

So last December, Natalie Rusk, the museum's education coordinator, asked students at two Boston-area schools to come up with a list of the five most interesting questions they thought people would like to have answered at the exhibit.

Exhibit developer Donald Morrison used the questions to draft the exhibit's initial script. Then Rusk took the script to Brookline's Edward Devotion School and asked 40 seventh-graders to read it over, noting what they liked and disliked.

Some of their comments were not exactly "user friendly" for staff who had worked on the text.

Morrison admitted it was tough for him when 13-year-olds called his copy "boring," or his titles "stupid," or his phrases "repetitious."

The students circled words they felt most seventh-graders (or their parents) would not understand. They put question marks by explanations they felt were unclear and stars by those they particularly liked.

They were frank and that was helpful, Morrison said. "As computer-knowledgeable adults, we swallowed our pride and made substantive changes in tone as a result of their comments."

The students, including a group from the Lincoln Park School in Somerville that had not previously studied computers, were also responsible for what was included in the exhibit.

One student, for example, wanted to know how what you type on a computer keyboard ends up on the screen. "It was a good question," said Rusk, "and one of the show's interactive learning stations grew directly out of answering it."

The project was a natural for curious kids, according to Jane Manzelli, curriculum coordinator for computer sciences in the Brookline schools.

"Children love working on com-

Turn to Page 43

THAT'S THE KEY: Netta Naor, left, and Natalie Rusk test the giant keyboard at the Computer Museum's new exhibit, The Walk-Through Computer. Staff photo by Michael Fein

It's more than just fun and games

For rainy summer days, there's nothing like a computer to keep children occupied. Although they probably would prefer spending hours playing Nintendo games with each other, there are more constructive alternatives. And they're fun!

● THE WALK-THROUGH COMPUTER, the only one of its kind in the world, opens today and will be a permanent exhibition at THE COMPUTER MUSEUM, 300 Congress St. (Museum Wharf), Boston, MA 02210. For further information, call (617) 426-6758, ("a talking computer will answer"). Open summer daily, 10 a.m.-6 p.m., Friday unil 9 p.m. Adults, $6; students and seniors, $5; children under 5 free. Half price Friday evenings. The Museum's Education Department has planned several special activities for children, including a "Parts Search," where children work as teams to find out where real computer components belong. Call 426-2800, ext. 345, for more information.

● THE MUSEUM OF SCIENCE COMPUTER DISCOVERY SPACE is one of the nation's largest free, public interactive computer centers for families. It offers summer courses and programs for kids and adults, including "Summer LEGO/-LOGO Fun (grades 4-12) and "First Byte: A course for parents and kids grades K-1." The learning has 20 participatory computer exhibits.

The Computer Discovery Space is located at the Museum of Science, Science Park, and is free of charge and open in the summer 7 days a week, 10 a.m.-4 p.m. It's located adjacent to the second floor of the Science Museum's garage. It's air-conditioned. For more information, call (617) 589-0303.

— CAROL KORT

Kids byte into computer exhibit

From Page 41

puters and know a lot about them," she said, "but few know how they actually work." They liked the premise of the exhibit — to walk inside a computer to find out what makes it tick, she said.

Twelve-year-old Netta Naor agrees. "Going inside the computer is a great idea. The usual overload of signs and information at museums gets boring," she said. "The Walk-Through Computer makes learning a game."

Manzelli asked students from a computer class at Brookline High School what they would focus on if they were designing the show.

They suggested showing how a chip works and what the inside of one looks like, what a byte is and how data flows, and why a floppy disk is square.

The Walk-Through Computer provides the answers to these questions and many more.

Visitors will be able to use the enormous operational keyboard by pressing a one-foot-square key that plugs them into a program. They'll then be able to pick out one of 300 cities as a destination, and the computer will find and illustrate the shortest driving route between the two points.

"When they walk onto the motherboard, they'll see a simulation of the program in every chip as the data flows in," said David Greshler, a media designer who created the World Traveler program used by The Walk-Through Computer.

To walk inside the guts of a gigantic computer, continued Oliver Strimpel, the Computer Museum's director, is to grasp technological information while being thoroughly entertained. That's why designers included flashing Tivoli lights, animation, humor and viewports, where you can look into computer parts not just at them.

DISC IS THE WAY: Oliver Strimpel, the Computer Museum's director, at the The Walk-Through Computer exhibit.

To further enhance the fun, Strimpel asked prize-winning illustrator and author David Macaulay to create 30 enormous informational panels that hang inside the giant computer and tell the inside story.

"We've found that people don't read in museums," said Strimpel. "They *look* in museums. So the text for the show was annotated only to enhance the fact-filled but appealing drawings."

Macaulay, whose book "The Way Things Work" was an earlier effort to decode the mysteries of machines, also illustrated the large introductory panels for the exhibition's Information Machine, which explain — through interactive devices — how computers handle different kinds of information.

"My goal for the show was to make the information clear and enlightening," said Macaulay. "The exhibit itself is so playful and whimsical, that I didn't need to put those elements into my drawings this time."

In some cases, Macaulay's drawings will link to computer animated viewports, explaining how the parts work.

"Because computers are so micro, small and mysterious, the bigness of The Walk-Through Computer will make these machines seem less strange, fragile and intimidating," said Macaulay. "I think viewers will let down their defenses and have fun playing on and in the computer."

For kids growing up in a high-tech society, computers are part of the natural landscape — not something to be feared. "Using computers makes them feel part of adult culture," said Hillel Weintraub, an educational consultant at Massachusetts Institute of Technology's Media Lab. "Kids aren't allowed to use dad's power saw but they can use his computer, sometimes better than he can."

In this show, Brookline's students further demonstrated their computer prowess by catching a mistake that had to do with decoding the binary code. "It's a good thing the adult experts came to us," said computer teacher Joanne Robinson with a laugh.

The Daily Telegraph
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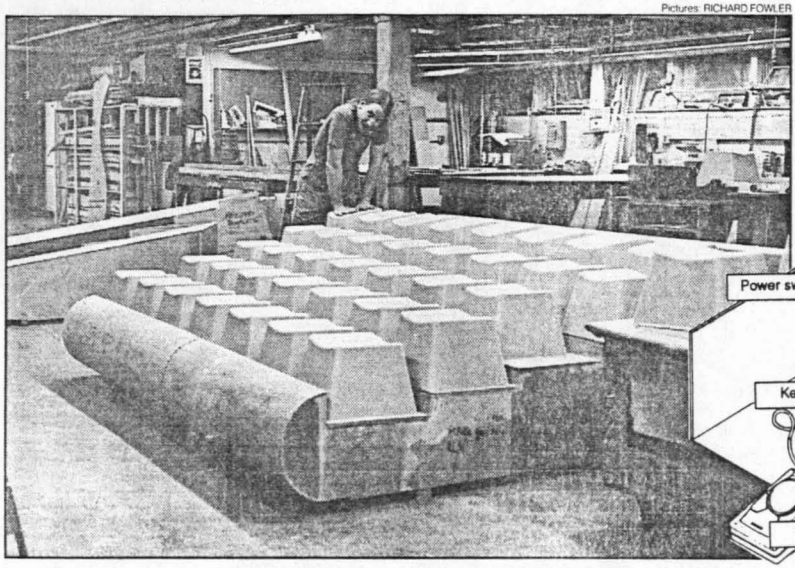
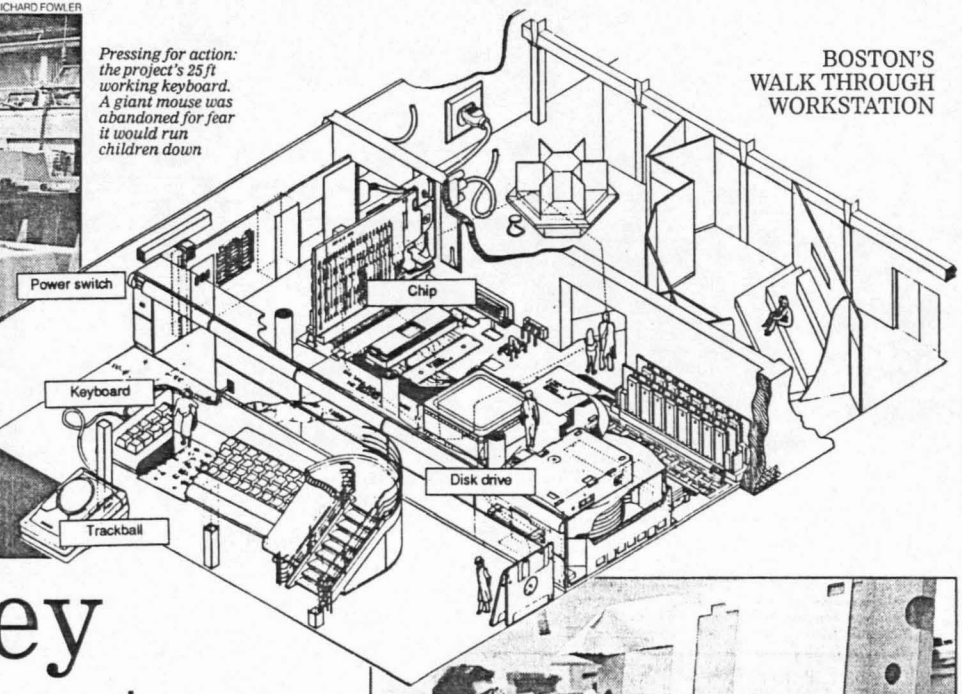
Pictures: RICHARD FOWLER



Pressing for action: the project's 25 ft working keyboard. A giant mouse was abandoned for fear it would run children down



The two-storey desktop computer

In Boston Roger Highfield, Science Editor, discovers plans for a 50 times lifesize PC

THE WORLD'S most expensive – and largest – "desktop" computer will be up and running in June. Costing $1.2 million (£750,000), it will be two storeys tall – 50 times the size of a normal desk top PC or workstation.

Rather than sitting on a table, it is being built in a former wool warehouse on Boston's historic waterfront, home of the world's only dedicated computer museum.

The Walk Through Computer exhibit will provide a view of computers that even a computer hardware expert will find breathtaking. It is the brainchild of a Briton, Dr Oliver Strimpel, the museum's newly appointed executive director.

"The Walk Through Computer will be about the technology itself, where you can learn how it works and what is inside the computer's box in a way that we hope will not alienate anybody," he said.

The impact of computers and their difference from, say, a dishwasher, are not appreciated, according to Dr Strimpel. "The idea that computers are information machines is very subtle" he said.

"I do not think people realise that almost everybody is involved with handling and manipulating information while relatively few are involved with manufacturing."

Two other Britons are playing a key role: Richard Fowler, the award winning designer from the National Museum of Photography, Film and Television in Bradford, and BBC producer John Palfreman who will make a humorous film explaining software.

Overall, more than 100 people and 25 institutions from three countries are collaborating on the project.

The Walk Through Computer will demonstrate a program that takes the museum's visitors on a world tour.

Images of the world on a high resolution computer screen will be projected on a 108 sq ft monitor. It will also offer visitors a 25 ft working keyboard and five foot floppy disk.

Ideas for a giant mouse were dropped because it would have been the size of a bumper car, and, Dr Strimpel explained: "We were scared of running over children."

Instead users will turn a "trackball" 40 in in diameter to point a cursor to one of 500 major cities displayed on screen.

The computer will find the shortest land route between two of them and offer a slide show on the mammoth monitor of the sights one would see en route.

The computer operating the screen display will be an Apple Macintosh II, and a powerful Digital Equipment Corporation Microvax will control the special effects.

Walking inside the computer past drooping ribbon cables, visitors will see it operating in slow motion, from the whirr of a giant spinning disk as it retrieves data to the frenetic electronic activity in banks of memory chips.

Peering inside, they will see a film of a real chip at work taken with an electron microscope at DEC.

The action of the computer will be described in the simplest language: each sliver of silicon lights up in a chip that is "as complex as a city".

Computer graphics will also be used. "You will appear to fly down into the chip and see it working in a realistic way," said Dr Strimpel.

"We want people to see it is complex but feel that if they had the time they could understand it. It is not a mystery – there is no ghost in the box."

In case this realistic approach intimidates some visitors, there will also be a "warm and fuzzy" display: humorous illustrated panels will be used, produced by David Macaulay, author of The Way Things Work.

Pulsing light fibres embedded in its translucent floor – a mock printed circuit board – will simulate the flow of data through the computer.

The Walk Through Computer is the Boston museum's largest single project since opening in 1984.

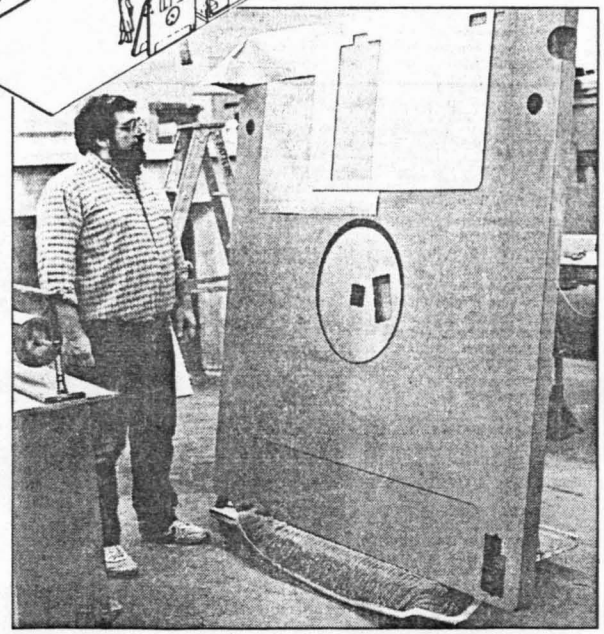
The museum boasts one of the best collections of early computers. The size of this exhibition underscores the soaring power and plunging price of the machines.

A marvellous selection of hands-on exhibits, computer animation, robotics and artificial intelligence, is also on offer to its 100,000 visitors each year.

They can hear advice from a computer on what wine will complement a fish dish, argue with a grocer (an artificial intelligence program) over the cost of strawberries or even commission a work of computer art.

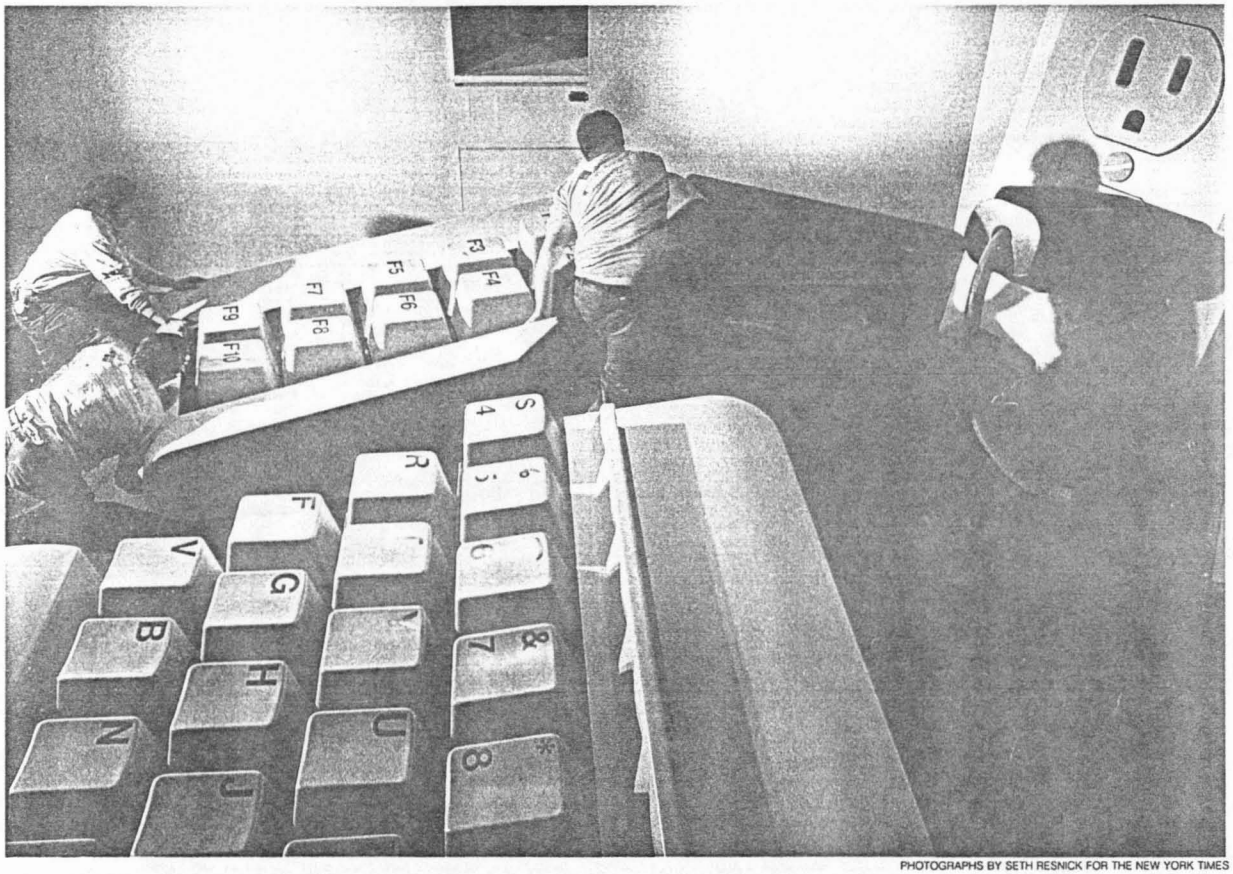
"Computers are also a wonderful vehicle for getting over some extremely deep mathematical ideas," Dr Strimpel said.

Before joining the museum, Dr Strimpel was curator for mathematics and computing at London's Science Museum, but in 1983 lack of resources and focus on scholarship rather than public education there pushed him to move to Boston.



Giant floppy: George Vanikiotis, exhibit fabrication project manager, inspects a five foot high replica of a computer disk

Sunday, May 20, 1990
CIRC: 1.6 million



PHOTOGRAPHS BY SETH RESNICK FOR THE NEW YORK TIMES

Byte-Sized, but Big

THE MONITOR (RIGHT) IS 14 feet high. The keyboard (above) is 25 feet long. The floppy disk is six feet on a side. In an era in which the desktop computer stands as a monument to miniaturization, the walk-through computer exhibit being installed at the Computer Museum in Boston is iconoclastic in its dimensions, if more conventionally educational in its purpose. "We want to provide people with a compelling introduction to computers," says the director of the museum, Oliver B. Strimpel, who conceived the project three years ago.

Designed by Richard Fowler, an Englishman who is head of design at Britain's National Museum of Photography, Film and Television, and fabricated by the F. W. Dixon Company in Woburn, Mass., the exhibit includes learning stations and a video show that explains how software works. It opens to the public June 23.

The computer itself, two stories high, 50 times ordinary size, will allow museum visitors to run an actual program and, through a combination of hardware and software, special effects and animation, witness a simulation of the information processing system as the program is carried out. The program, called World Traveler, is designed to locate the shortest driving route between two specified cities. The visitor selects a starting city and a destination; the monitor will then display a brief slide show of sights along the route. Inside the computer, the working electronics are on display, with lights illustrating the path of data bits as they whip around on giant silicon chips.

"What a museum offers is a three-dimensional environment," Strimpel says. "You can put people into a space and control the sensory input from all directions. This is something you don't get from a film or a book or from interacting with a piece of software." — BRUCE WEBER

Wide-screen entertainment.

The New York Times Magazine

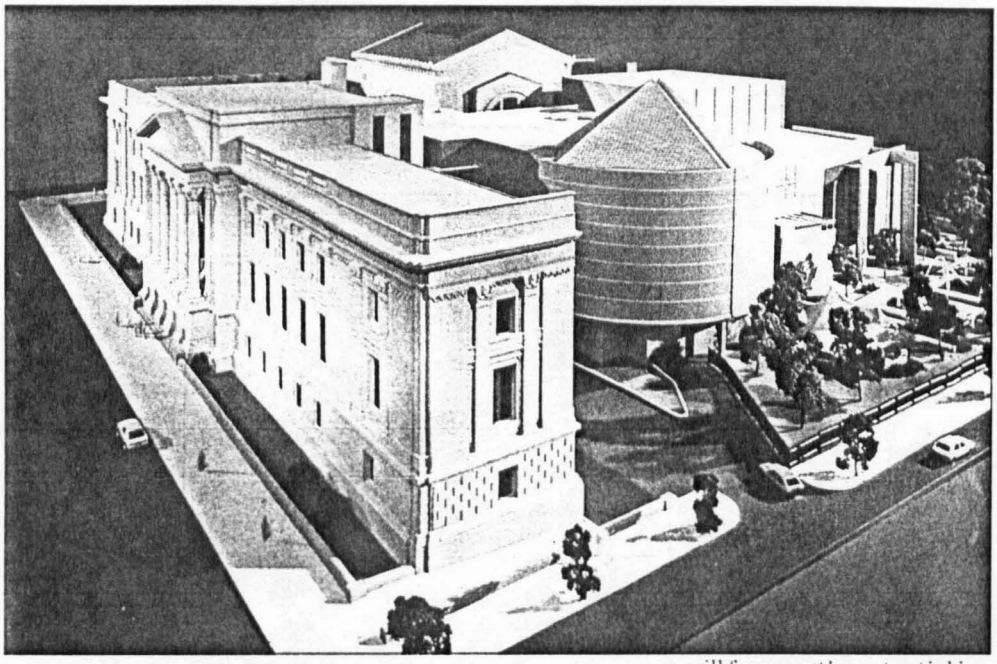
May 20, 1990

Cover: *Photograph by Bill Eppridge for The New York Times.*

SCIENCE

BY ABE DANE, Science/Technology Editor

POPULAR MECHANICS
MAY 1990
CIRC: 1,600,000



FRANKLIN INSTITUTE CHRISTOPHER RANSOM PHOTO

Museums For The Future

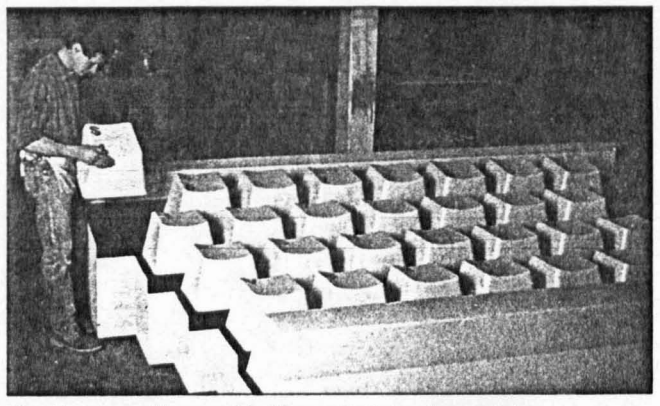
I'LL BE HONEST. A lot of museums put me to sleep. Except for the kind where you can push buttons and watch things move around, or otherwise tinker with the exhibits. Those are fun. Maybe that makes me childish, but if so, it's a kind of childishness that's sweeping the country. More and more science museums are finding ways to get visitors involved with their exhibits, and business is booming. Attendance is higher, and more new facilities are being built than at any time since the 1960s, when the *Sputnik* scare gave new urgency to science education. It's a heartening contrast to continuing reports of America's poor level of technological literacy compared to our economic competitors.

Most of the museums now springing up don't really fit the usual definition. Referred to typically as science centers, they place a heavy emphasis on teaching about science and technology, rather than simply serving as historical archives.

One of the most notable new examples is the $71-million Futures Center shown in the architect's model above. Opening this May at Philadelphia's Franklin Institute, the oldest hands-on science museum in the country, the 90,000-sq.-ft. complex of theaters and interactive exhibits is dedicated to illustrating technology's power to shape the future, and the choices that that power will oblige us to make.

Seven permanent exhibits will focus on the potential impact of science on space exploration, health, energy, the environment, information technology, materials and lifestyle. Among the items on display will be a 37-ft. walk-through mockup of Space Station *Freedom*, a giant model of a living cell, a simulated rain forest ecosystem and a scanning electron microscope visitors can look through to examine advanced materials.

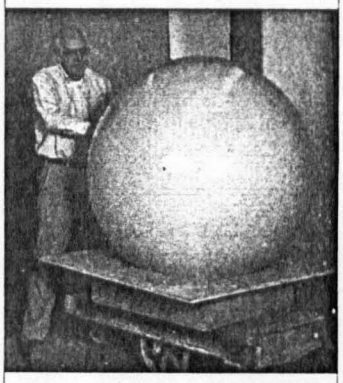
An eighth exhibit, called The Future and You, will give visitors an overview and explanation of the museum as a whole. Along with the introduction, visitors get cards that identify them to a computer system with terminals in each exhibit. After providing the computer with a profile of themselves and their interests, guests carry the cards with them, and check in at the terminals for suggestions about what to see, and followup information on a variety of science topics.



Giant keyboard is assembled for walk-through computer.

Choosing the future

Rather than presenting a single vision of a future high-tech wonderland, the overall aim of the exhibits is to demonstrate the multiplicity of alternate worlds that technology might bring. Driving this point home is a 150-seat auditorium called the Future Choices Forum. Each seat is equipped with a computer-



The trackball that will control the walk-through computer.

ized voting station that will let visitors respond to presentations that highlight the dilemmas we will face as our ability to manipulate nature steadily increases. Results of the votes will be projected on a large screen at the front of the auditorium and circulated to policymakers in Washington.

For many, however, the most important decision that the Futures Center can help with is the choice of a profession. The Future Careers

COMPUTER MUSEUM/MICHAEL SHACKLEFORD PHOTOS

Center will give access to resources that go far beyond what the typical school guidance office can muster. Central to the facility is an electronic version of a *Help Wanted* section from a typical 21st century newspaper. Visitors push buttons to pick ads and get a look at the accompanying job descriptions, education and experience requirements, starting and average salaries, and the number of jobs expected to be available in the selected field.

Behind the scenes

How do you design a museum to achieve all the ambitious educational goals that the Futures Center sets for itself? Speaking to Bill Booth, vice president for exhibits at the Franklin Institute, I got the sense that like any form of teaching, coming up with exhibits is as much art as science. But it also presents challenges all its own. Unlike textbook lessons, the unstructured learning that happens in a museum is nearly impossible to measure or predict. In a process Booth calls random access learning, people choose their own paths through the information made available to them, much as they do in the real world. As a result, the usual methods of quizzing people to gauge what they've taken away from the experience aren't really appropriate.

Typical ways of evaluating an exhibit include videotaping people's interaction with it, and questioning them on the concepts it's intended to convey afterward. Admittedly, such methods are imprecise, but they pick up basic flaws in a presentation. For example, surveys found that a common misconception among visitors to the Franklin Institute was that gravity was caused by air pressure. Exhibits that suggested otherwise were simply assumed to be broken. Booth's group responded by designing an exhibit that let visitors pump the air out of a cylinder and see for themselves that gravity still applied.

Over years of observation, it has been possible to extract some general principles to guide the design of exhibits. One thing that needs to be taken into account is the fact that people approach things with a variety of different learning styles. According to Booth, some like to talk, some like to interact with an object, and others prefer a more passive approach like watching a video. Ideally, an exhibit will present opportunities for all these activities.

It's also a good idea to gear an exhibit to accommodate mixed age groups, such as families. According to Bonnie VanDorn, executive director of the Association of Science-Technology Centers in Washington, D.C., such groups learn together more efficiently than groups of people who are alike. And it's not always the old teaching the young. Often, for example, a child will eagerly push buttons or manipulate an object in a way that yields surprises for adults who would have taken a more deliberate approach.

Perhaps the most basic principle of all is one that hardly needs restating in this magazine. As Booth puts it, "People like to learn by doing."

Boston's giant computer

One of the grander examples of how these common-sense educational ideas can be embraced in a single exhibit is a huge walk-through computer scheduled to open this June at The Computer Museum in Boston. Scaled up to 20 times normal size, the $1.2-million machine will incorporate a 25-ft. keyboard you step on to operate, a working, 5-ft.-high trackball and a 108-sq.-ft. monitor that displays the operation of a custom-designed hypercard program.

Aside from the sheer impact of its size, the exhibit promises to make computers understandable in a way that has up to now been maddeningly elusive to most people. Walking inside the machine reveals the network of components that makes these inscrutable boxes tick. The floor makes up the motherboard, complete with rows of memory chips and vertical expansion cards. At its center are the microprocessor brain and the clock that synchronizes the activities of all the different parts. Thrusting back from the front panel are a floppy drive and a spinning hard disk platter. Pulsing light fibers simulate connecting cables, and show how signals travel through the machine as visitors work the giant controls outside. Many of the components are equipped with viewports that let you see their inner workings right down to the most basic level. Interactive computer stations placed around the exhibit provide supplementary information.

Learning versus fun?

Certainly it's possible for people to understand technology without access to giant computers or $71-million museums. But the benefits of exposure to these carefully selected experiences should not be underestimated. "There's an incredible need to make the more symbolic things that happen in classes have a more concrete basis," says VanDorn. Abstract concepts are fragile and easily forgotten without a compelling illustration in one's own personal experience. And although the museums that put this idea into practice may seem a departure from tradition, the way they teach science is actually much more in tune with the experimental principles on which the practice of science has been based from the beginning. PM

THE BOSTON GLOBE
June 2, 1990
CIRC: 509,500

It's bigger than byte-size

By Ronald Rosenberg
GLOBE STAFF

If Hollywood were to make a sequel to the hit movie "Honey, I Shrunk the Kids," Boston's Computer Museum could be one of the sets.

Instead of riding giant ants and climbing into oversized Lego blocks, the movie characters could embark on an adventure inside and around a giant personal computer equipped with a 25-foot-long keyboard. The child-sized characters could climb the computer's letters and numbers. Adults could explore a geography program by turning a bumper-car-sized pointer, known as a trackball, that moves images on a towering 108-square-foot color monitor; using the World Traveler program, they can, for example, locate the shortest driving route between two cities.

Museum visitors are likely to feel like the shrunken kids in the film when they view the Walk-Through Computer, a new exhibit that opens this month. While there is no danger of a giant bumblebee attack, the change in perspective is momentarily startling.

"Making everything very big and very visible takes the mystery out of technology," said British-born Oliver Strimpel, the museum's executive director, who has wanted to create this exhibit for three years. "It's a very disarming approach, rather childlike."

Indeed, the electronic parts alone are 50 times bigger than an Apple Macintosh. One of the smaller parts of the exhibit, which opens June 23, is the 6-foot-tall floppy disk. It is only 21 times larger than today's 3.5-inch disk.

Visitors will be able to walk past a 6-foot-tall disc storage drive, gaze into giant memory chips and learn how information is passed from one part of this two-story computer to another.

"I want to reach out with this exhibit to people that know nothing about computers as well as those that have a fear of computers," said Strimpel.

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Oliver Strimpel at Boston Computer Museum exhibit: "Making everything very big and very visible takes the mystery out of technology."

GLOBE PHOTO / MILBERT ORLANDO BROWN

Exhibit is bigger than byte-size

■ **EXHIBIT**

Continued from Page 8

well as those that have a fear of computers," said Strimpel.

To design the exhibit, Strimpel tapped Richard Fowler, who was head of design at Britain's National Museum of Photography, Film and Television. Strimpel knew Fowler from his earlier work at the Science Museum in London, where the designer created a full-scale model of a nuclear reactor core.

"We've modeled everying on a working computer," said Fowler, who acknowledged knowing nothing about computers until he came to Boston last May. "Frankly, I never cared much about them – until now."

He and Strimpel agreed that the exhibit had to give visitors a sense that computers can be fun as well as instructive. They also hope the Walk-Through Computer will bring in new visitors, given the popularity of its next-door neighbor, the Children's Museum, on Museum Wharf.

Computer Museum officials see the exhibit as a way of widening their audience beyond the computer literate.

Computer Museum officials see the exhibit as a way of widening their audience beyond the computer literate, many of whom are children.

"We've seen a lot of parents coming here because of their children's fascination with computers," said Strimpel.

In addition to the giant keyboard, visitors can walk inside an oversized electronics forest and stop at 4-foot-long "chips" – memories, communications devices and a Central Processing Unit, the control center of the computer. They can peer into them through one of many viewports to see videos that show the inner workings right down to the most basic level. Walking from chip to chip, visitors will see pulsing light fibers that simulate wires to show how tiny pieces of information – data bits – zoom around in giant silicon chips.

To further disarm computer-phobes, the museum has retained Robert Macauley as exhibit illustrator. He is best known as the writer/illustrator of "The Way Things Work," a book that includes enlarged drawings of the inner workings of more than 250 machines. For the Computer Museum, he will produce 30 information panels as well as anatomical blow-ups of the computer's working parts. Macauley is also creating a 20-foot-long display studded with switches, keyboards, microphones and a television camera to explain how information flows.

This ambitious introduction to computers is costing the museum $1.2 million. Fund-raising for the exhibit was spearheaded by Mitchell Kapor, founder of Lotus Development Corp. and chairman of ON Technology, both in Cambridge. Kapor, who donated $250,000, says he's always wanted to break down the barriers to understanding computers.

With the funds in hand, more than 100 people, including 13 full-time carpenters, model-makers and electricans from F.W. Dixon Co., the Woburn exhibit fabricator, are scrambling to meet the late June deadline.

Fowler, who is returning to England to work on a new Children's Museum, said developing the Computer Museum exhibit differs from most British and American museum exhibits that take two to three years to design and build. The Walk-Through Computer will be completed in just over 12 months.

Still, there are last-minute problems, such as finding the most suitable material for the exhibit floor to accommodate the foot traffic from the 150,000 visitors expected annually. Already dozens of samples of plastic materials have been tested.

Just as a real computer's electronics sit on a multilayered plastic board, called the "motherboard," the museum is trying to build a similar green-colored floor.

"On the one hand, it's got to look right," said Fowler. "That means it's got to be a nice translucent green. At the same time, it has got to stand 10 years of wear and tear as a floor, and that's proving to be a very difficult combination."

Their solution: Have people walk slightly below the electronics using flooring that can be easily replaced.