Charlie Reed - VP Chief Technical Officer

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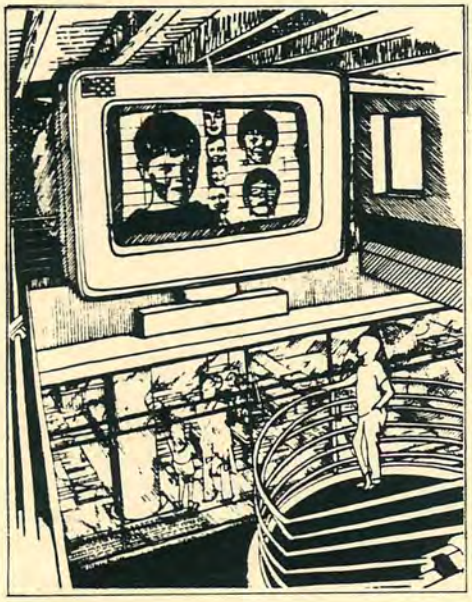
315-456-2974

# The Walk-Through Computer

*A Landmark Exhibit at The Computer Museum, Boston, Massachusetts, USA*

## Insider's Report #1



*Sketches & plans by Exhibit Designer Richard Fowler show just a hint of the exciting scope of this project.*

**The Walk-Through Computer**

In May 1990, The Computer Museum plans to open a major new exhibit featuring the world's only two-story model of a working computer.

Visitors to the Walk-Through Computer will take an eye-opening excursion past a huge keyboard and mouse into the interior of the computer with shoulder-high interface boards, spinning disk drives, and room-sized microprocessor. The exhibit will combine highly realistic detail with special lighting effects and animation designed to illustrate how software and hardware work together to perform a typical computing task. It will also give visitors a look at some fascinating new technologies, including high-definition large-screen displays, an optical disk drive, and image-recognition software.

Designed by Richard Fowler, on loan from Britain's award-winning and highly popular new National Museum of Photography, Film and Television, the Walk-Through Computer will occupy a 3,500-square-foot gallery in the center of the Museum.

Plans call for the Walk-Through Computer to perform an image-matching task. As they enter the exhibit area, visitors will be invited to pose for a video snapshot. The Walk-Through Computer will then search its database of faces (including both previous visitors and celebrities) for apparent resemblances. The closest matches, along with the original, will be displayed on the giant monitor. Walking through the computer, visitors will be intrigued to learn how the different parts of the computer carry out the matching task using the video images as data.

### Who the Walk-Through Computer Will Serve

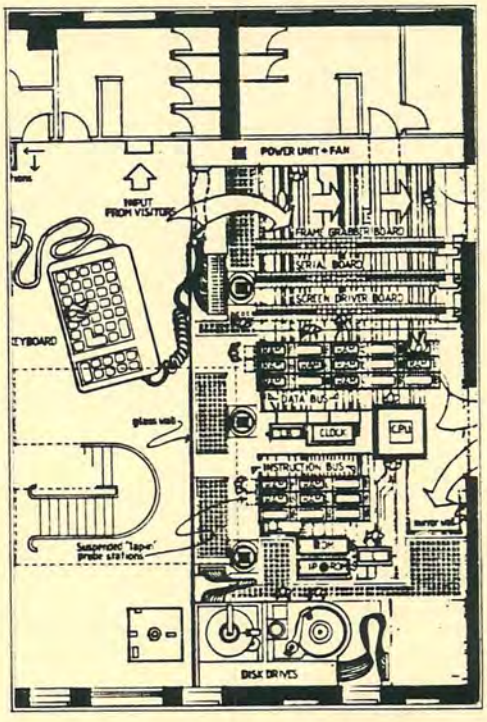
As the only institution of its kind in the world, The Computer Museum already attracts 100,000 annually. Many are American and foreign tourists, and a significant number hold higher degrees.

As a one-of-a-kind international attraction, the Walk-Through Computer is expected to draw an even wider range of Museum visitors – families with young children as well as technically sophisticated adults. The Walk-Through Computer will also serve as a unique educational resource for schools and colleges, providing a new way of introducing basic computer concepts and new technologies in a stimulating, thought-provoking environment.

### A Unique Sponsorship Opportunity

The Walk-Through Computer provides an opportunity for corporate and individual sponsors to be associated with the development of a highly visible international attraction.

The Museum is offering five levels of sponsorship for the new exhibit, ranging from Presenting Sponsor at $450,000 to Donor at $25,000. Each level carries appropriate benefits, including acknowledgement in all print materials related to the exhibit, exclusive use of The Museum for a function, and free or discounted admission to employees and family members. All sponsors and donors will be listed on credit panels placed prominently in the gallery, and will receive invitations to a special sponsor reception.




The Computer Museum

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## Equipment Donations

The Computer Museum is now working to identify a team of companies whose combined talents and resources will help make the Walk-Through Computer a reality. In return for their investment, these companies will have equipment and technology on display in what is expected to become a landmark exhibit.

Primary consideration for the opportunity to join the Museum in this venture will be given to companies that are willing to make a significant cash contribution toward the design and fabrication of the exhibit itself. Cash sponsors who also provide equipment and services will be credited separately for both types of gift.

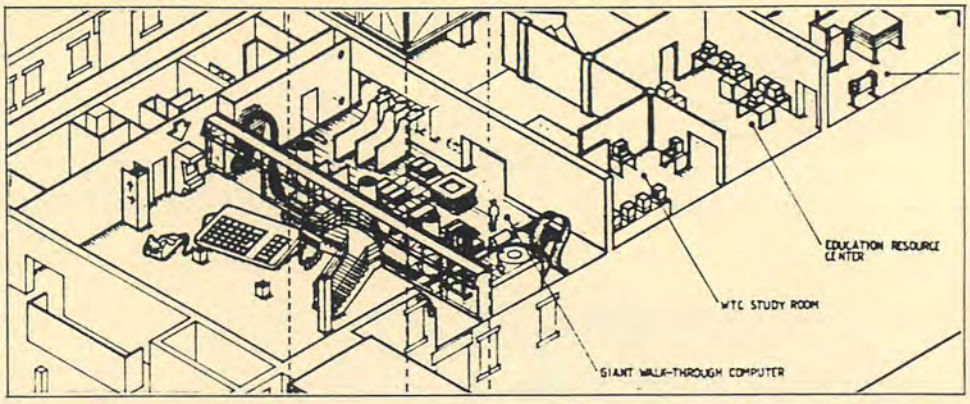
### Hardware Needs

Hardware components that will be required for the Walk-Through Computer include: a large-screen projection system; several smaller monitors placed at stations throughout the exhibit; controller hardware for the monitors; hardware for the video input stations, including video cameras, terminals, and keyboards; large-capacity storage devices; a system operator's terminal; one or more printers, and terminals for requesting output from the printers.

A powerful computer to drive the whole system will also be needed, as will special-effects devices for the giant frame grabber board, serial card, disk drives, clock, giant transistor, and giant logic circuit. A small number of personal computers will be required for the learning stations.

### System Software

System software will include the pattern-matching routines, a visitor-level user interface, a system-level interface (including database manager), a time-sharing system capable of serving several terminals, and a driver for an attraction loop. The Museum will employ a Systems Engineer to coordinate systems development.




## Walk-Through Advisory Group

The Computer Museum has convened an Advisory Group composed of some of the world's leading experts in educational psychology, educational software, exhibit design, computer science, and classroom teaching. This group will provide a range of input that will help the Museum implement the Walk-Through Computer concept accurately and effectively. The members of the committee include —

- **Art Bardige**, former classroom teacher, now director of Learningways, an educational software development firm
- **Daniel C. Dennett**, Professor of Cognitive Science at Tufts University and co-author of *The Mind's I*
- **Signe Hanson**, Director of Exhibit Design at the Children's Museum, Boston
- **Gardner Hendrie**, Sigma Partners, former computer architect, and designer of minicomputers and fault-tolerant computers
- **Danny Hillis**, Thinking Machines Corporation, computer architect, designer of the novel, massively parallel Connection Machine
- **David Macaulay**, author and illustrator of best-selling educational books, including *The Way Things Work*
- **Philip Morrison**, MIT, Institute Professor and co-creator of many popular films, articles, and programs on science, including the PBS series *The Ring of Truth*
- **Phylis Morrison**, former teacher, curriculum developer, and co-author and producer with Philip Morrison of science materials and programs
- **Jonathan Rotenberg**, founder and president of The Boston Computer Society, the world's largest society of computer users.

The project is being directed by The Computer Museum's Curator, Oliver Strimpel. Dr. Strimpel has directed exhibit development at The Computer Museum since 1984. He was responsible for "The Computer and the Image" and "Smart Machines," two 4,000-square-foot galleries with more than sixty interactive stations, which are the most successful exhibit areas in The Computer Museum. Prior to joining The Computer Museum, Dr. Strimpel was curator for Mathematics and Computing at The Science Museum, London.

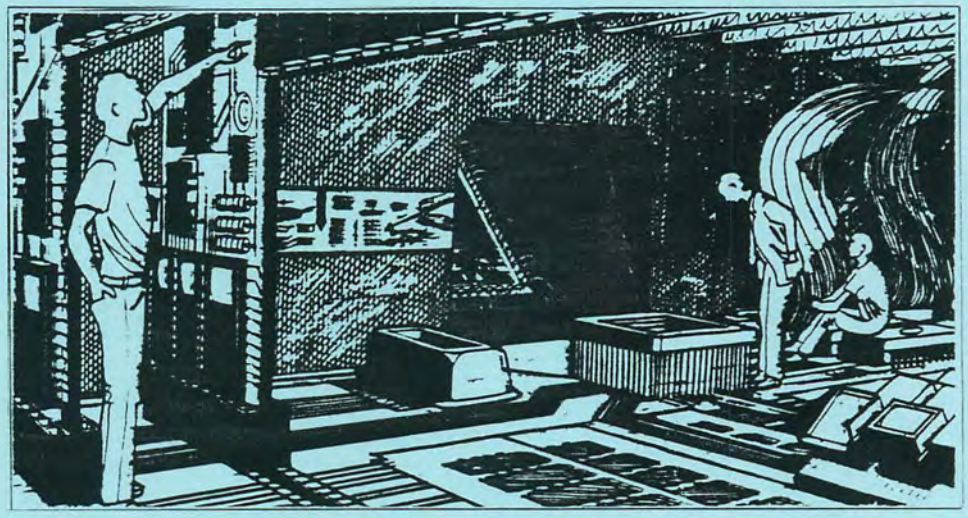
The Exhibit Designer for the Walk-Through Computer, Richard Fowler, is on loan from Britain's National Museum of Photography, Film, and Television, where he is Head of Design. Fowler is particularly known for his work with three-dimensional exhibit environments, including a television studio and a nuclear power reactor.

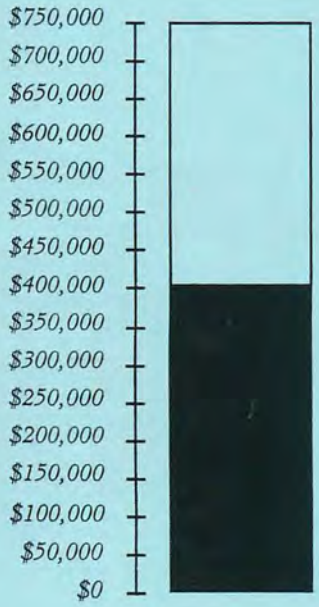
# The Walk-Through Computer

*A Landmark Exhibit at The Computer Museum, Boston, Massachusetts, USA*

**Insider's Report #2***

**The information in this newsletter is pre-release material. Please contact the Museum Development Office for further information.*






## More Than Halfway to the Goal!

Committed cash donations for the Walk-Through Computer, the Museum's ambitious new exhibit based on a two-story model of a working computer, now total over $400,000.

This takes the Museum well beyond the halfway point in its $750,000 development effort for the exhibit, which is scheduled to open in May, 1990. Promises of in-kind donations of equipment and services are also coming in at an encouraging rate.

With the scheduled opening only eight months away, the search for the right mix of manufacturers, foundations, and interested individuals continues.

There is a particular interest in finding sponsors for the large-screen projection system, the video input stations, the laser printers, and several key interactives (including the frame-grabber board, the disk drives, and the CPU).

### Kapor Family Foundation Donates $250,000

Mitchell Kapor, acting as treasurer of the Kapor Family Foundation, recently presented the Computer Museum with a check for $250,000, earmarked for the Walk-Through Computer and associated educational activities.

The original developer of Lotus 1-2-3, Kapor is currently the president of ON Technology, of Cambridge, Massachusetts. He is a founding member of The Computer Museum and has long been a supporter and key benefactor.

Kapor has expressed a special interest in the development of the Walk-Through Computer, and says he looks forward to its speedy completion. His gift takes us a long way toward making the exhibit possible.

### DEC Grants $150,000 for Walk-Through Computer

Digital Equipment Corporation has recently announced a grant of $150,000 to The Computer Museum, to be used for the Walk-Through Computer. In addition, the company has donated equipment for the exhibit and operations.

The donation is part of a three-year sponsorship plan. Details of the plan will be announced shortly. The grant shows Digital's strong commitment to the success of The Computer Museum. It is and an enthusiastic endorsement of the Museum's exhibit development plans.

**The Walk-Through Computer**

The Computer Museum

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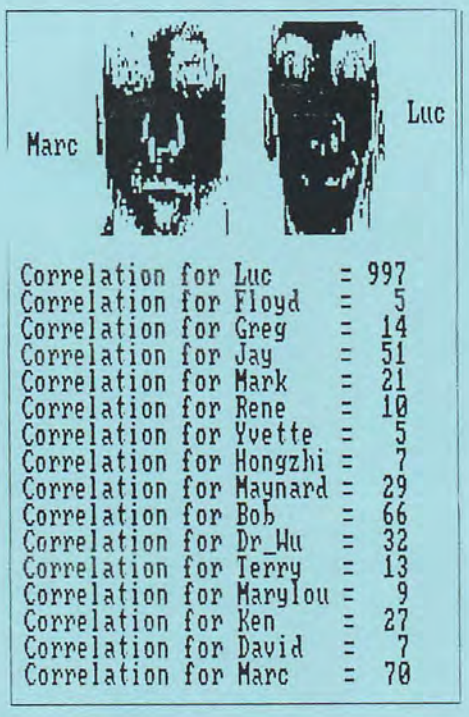
# Update on WTC "Face-Matching"

As previously announced, visitors who enter the Walk-Through Computer exhibit area will be invited to pose for a video snapshot. The Walk-Through Computer will then search its database of existing faces (including faces of both previous visitors and celebrities) for "resemblances." The closest matches, along with the original, will be displayed on the computer's giant monitor.




### Digital's New Ventures Gets Involved

Digital Equipment Corporation's New Ventures organization, based in Stow, Massachusetts, has agreed to provide technical advice and software support for the image-matching task. Dr. Terry Potter, New Ventures Manager, and Matt Jaffe, Business Manager for Machine Learning and Artificial Intelligence Services, will oversee Digital's involvement.

The group's experience in high-speed pattern recognition and learning algorithms puts them in an excellent position to assist the Museum with this aspect of the exhibit.

### Tufts University Team to Give Software Assistance

A team of graduate students headed by Dr. Robert Gonsalves, professor of Electrical Engineering and director of the school's Electro-Optics Technology Center, will assist the Digital engineers in developing the face-matching program. Dr. Gonsalves has considerable experience as a consultant to industry. His areas of interest include digital image processing, phase retrieval, robotics, and detection theory.

The Tufts team will have primary responsibility for conducting feasibility studies and prototyping the user interface. A prototype "face-matching" exhibit will be tested in The Computer Museum beginning in late October or early November.

## F.W. Dixon Selected as Exhibit Fabricator

F.W. Dixon, of Woburn, Massachusetts, has been awarded the main contract for the fabrication of the Walk-Through Computer. George Vanikiotis, Exhibits Division Manager, will lead a team of skilled craftsmen including model makers, cabinet makers, pattern makers, sculptors, auto-CAD designers, and lighting experts.

F.W. Dixon's Exhibits and Display Division has considerable experience in museum exhibit construction, having built and installed displays in Boston's historic Old South Meeting Hall, the Omni wing of Boston's Museum of Science, and the Digital Historical Collection, an in-house museum of computer technology. They also have extensive experience in industrial prototyping and architectural modeling.

Founded in 1899, the company has a reputation for quality craftsmanship and attention to detail. The Computer Museum is pleased to have F.W. Dixon on the team, and looks forward to working with them on the Walk-Through Computer.

## David Macaulay Signs on as WTC Exhibits Illustrator

The Computer Museum is proud to announce that David Macaulay, the prize-winning author, illustrator, and television producer, has agreed to act as Exhibit Illustrator for the Walk-Through Computer.

Macaulay will create a series of panels for display around the inside of the Walk-Through Computer that will serve to tie the many facets of the exhibit together with a coherent set of graphical explanations.

Macaulay, who has been serving on the Walk-Through Computer Advisory Group, is the author of the popular series of highly imaginative books on architecture that includes *Cathedral, City, Pyramid, Castle*, and *Unbuilding* (the imaginary dismantling of the Empire State Building).

His most recent book, *The Way Things Work*, is an entertaining and informative guide to the workings of over 250 different machines, from the zipper to the photocopier, and includes a major section on computers.

With his special talent for making complex mechanisms understandable to the non-technical person, Macaulay is a welcome addition to the exhibit team.

# The Walk-Through Computer

## MINUTES of 10/4/89 Meeting of the WTC Advisory Group

Compiled by Natalie Rusk

Present: Art Bardige, Gwen Bell, Dan Dennett, Richard Fowler, Dan Griscom, Mattie Jaffe, Chip Morrison, David Patterson, Jonathan Rotenburg, Dick Rubinstein, Natalie Rusk, Oliver Strimpel.

### Update

Oliver opened the meeting with news of the $250,000 grant from Sloan Foundation. He pointed out that this is a prestigious award and an unusually large gift for Sloan to make. We are still awaiting decisions from several other potential funding sources.

The contractors anticipate completing work by May, as previously scheduled.

### Timetable for Exhibit

Richard Fowler presented the Master Work Plan, a month-by-month timetable which indicates when each stage of the exhibit needs to be completed.

Oliver reviewed which elements of the exhibit have been decided and which are still open for suggestions. Two areas which need more attention are the specific locations on the motherboard and the learning stations.

Dan Griscom and Oliver suggested adding a line to the Master Work Plan to indicate the timetable for interactive stations on the motherboard.

### Application

Several members emphasized the necessity of having a backup application.

Dan Griscom described the main backup application currently under consideration -- the face-blending software. The main advantage of the face-blending software is it was developed for museums and is known to work. The caricature application is another possibility, but may not be feasible.

Dick Rubinstein recommended carrying two applications as if they will be the final application.

Mattie announced that DEC should have the Excalibar face-matching software ready for evaluation by next week.

Dave Patterson outlined three main testing points for the application --

1) Will the computer be too slow?

2) Will the application work?

3) What will be the audience's reaction?

## Interactivity within the Walk-Through Computer

Art Bardige raised a concern about the lack of interactivity in the face-matching application. He brought up the idea of a database application which would allow visitors to make selections on a microlevel within the computer.

Dick pointed out there is no user-interface in a real computer, and interacting with the computer from the inside may be confusing for visitors. However, he did like the idea of being able to see what is happening on the outside of the computer while inside.

Oliver explained the concept of having the interactive stations on the motherboard be like probes, or "unreality spectacles." These probes would allow a different perspective on what is happening at each of the computer components. For example, at the disk drive probe a visitor might be allowed a glimpse of what is stored on the disk -- such as an encyclopedia entry or a face.

## Video as Input Device

Jonathan said learning five main concepts -- input, output, storage, memory and processor -- is very empowering for people trying to understand computers. He expressed concern about using video as an input device because it might confuse visitors. There was then general debate about whether video should be used for input.

## CPU Theater Script

Dan Griscom presented the proposed layout of the CPU theater screen and explained how the show could run. He also handed out a copy of the program code that would be explained in the proposed script.

The proposed layout of the CPU theater screen brought on debate about whether or not there should be two separate RAM locations for instructions and data. Dan Dennett endorsed the idea of having one RAM location and a common bus, and felt that colored lights could adequately distinguish instructions from data. After some discussion, most members seemed to be in favor of the von Neumann, single RAM location layout.

Dan Dennett suggested having one of the interactive probes allow visitors to see what is stored in RAM -- they would see that some RAM stores instructions and some stores data, such as faces.

## Working Groups

Oliver proposed the formation of three working groups made up of members of the Advisory Group and of the people who will actually be working on the exhibit. The three working groups would be the motherboard group, the CPU theater group, and the application group.

Jonathan suggested having five groups and possibly five theaters and five shows.

There was more debate about what would happen on the motherboard. Oliver suggested that the motherboard group explore these issues and questions.

Before adjourning, the following Advisory Group members agreed to be on a working group:

Dan Dennett, CPU theater group

Dave would be willing to be on the CPU theater or the motherboard group

Matt will send a representative to the application group

Dick, application group

Art, application group

Jonathan abstained and Gwen will come when she can.

The time, date and location of the working group meetings will be arranged later.

The Computer Museum

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

29 September 1989

Gardner Hendrie
342 Green Street
Northboro MA 01532

Dear Gardner,

This is just to remind you of our Walk-Through Advisory Group Meeting on Wednesday the 4th, at 6:30 pm, in the Smart Machines gallery.

The proposed agenda is as follows:

1. General progress report
2. Specifications for face-matching program
3. Back-up application
4. CPU Theater script

I am enclosing two documents: a first crack at a script for the CPU Theater, and a document titled Face Matcher Specifications.

We look forward to seeing you at the meeting.

Sincerely yours,

Chip Morrison

Donald M. Morrison
Exhibit Developer

## CPU Theater Script

*This is an early version of a script for the CPU theater. It envisions three back-projection display surfaces. In the center is the CPU itself, with pins coming out of the sides. The pins are sculptural features, lighted from within. Pulses of light of light represent the flow of data between the chip and other parts of the computer. The main part of the chip is represented as a giant transparency of a real microprocessor. From time to time other images (numbers, labels, faces or bits of faces) are projected onto the same surfaces. The flow of data along buses is represented by pulsing lights. Small cartoon characters (angels, people with dogs, etc.) mill about the scene as added interest. To the left and right are two other smaller screens for displaying scrolled program code.*

Welcome to the Walk-Through Computer's central processing unit (CPU).

This is where the computer carries out the instructions a programmer has written for it.

It could be carrying out instructions from any other program—for example, a spreadsheet program or a word processing program.

The instructions the computer is carrying out *now* are some instructions from the program Face Matcher. You probably saw the output from this program displayed on the Walk-Through Computer's giant monitor.

The program has been loaded into the computer's main memory banks from a floppy disk inserted in the disk drive. You may have seen some of these same instructions in the RAM chips out on the motherboard.

Over to your left you see what this program might look like to a programmer. It is written in Pascal, a so-called "higher-level language," one that a human can understand.

As you can see, the instructions are presented in a series of steps. A serial computer like the Walk-Through Computer carries out these steps one at a time.

The instructions in Face Matcher are telling the computer to compare a series of images— a target image (a face...it could be yours) and a set of faces in a database stored on the computer's hard disk drive.

The program tells the computer to read the images from the disk drive, one after the other. As each image is read, it is compared against the target image. If the stored image resembles the target image more than any other one so far, this new image is displayed on the screen, next to the target face.

This program has a loop in it. The loop structure makes the computer repeat these basic instructions until it has searched through all the images in its database. Then it pops out of the loop, goes back to the top of the program, grabs another target face and repeats the process.

That's how the face matching program looks to a programmer. Now let's see what it looks like from the computer's point of view.

Over to your right, you can see the same program in machine language. The 1s and 0s represent the pulses of electricity (changes in voltage) that force the computer to perform operations such as reading data from the disk or comparing two numbers.

A few lines of instructions in a higher-level language like Pascal are represented at the machine by large numbers of 1s and 0s. For example, here are the instructions that tell the computer to read some data from a file stored on disk.

Here on the microprocessor is where the instructions are actually carried out. The processor in a real personal computer is very tiny. You can hold one on your fingertip. Here you see the chip magnified 500 times. The surface of the chip is embedded with hundreds of thousands of tiny circuits.

The circuits represent logic gates and storage cells that the CPU uses for manipulating and storing data. Everything that the programmer calls for in the higher-level language happens here on the surface of the chip. We've magnified parts of the chip to give you a better view.

This part of the chip is the program counter. Information stored in the the program counter tells which instruction in the program should be carried out next. As in most other parts of the computer, information in the program counter is stored as a pattern of electrical charges in tiny memory cells made of silicon. As the instructions in the program are executed, these electrical charges change constantly.

A modern computer carries out instructions very rapidly, as many as a million per second, in time with the beat of the system clock, which acts as a kind of metronome. Let's slow the clock down so we can see what's happening.

The electronic charges in the memory cells that make up the program counter represent numbers. These numbers refer to locations of the instructions in the computer's main memory: RAM. For example, 1 might be the address of the first instruction 2 might be the address of the next instruction, and so on.

Every few beats of the system clock [?], a copy of the instruction stored in the location specified by the program counter is fetched from RAM and stored in the instruction decoder. At the same time, the program counter is advanced one step, so that it points to the next instruction.

Meanwhile, the instruction decoder interprets the instructions for the processor. For example, this bit of data might mean something like "Read some data from the disk drive"

Let's slow the clock down so we see focus on a single instruction.

Each instruction has two parts: the operation part, shown here in the instruction decoder, tells the CPU what to do. For example, this instruction tells the CPU to "**Load**" something.

Load what? The other part of the instruction is stored in a part of the CPU called the address decoder.

If we look inside the address decoder, we see that it too consists of some electronic circuitry in the form of a memory cell. The electrical charges stored in this cell represent a pointer to an address in memory. This particular pointer has a name —**newFace** the name of the image most recently"grabbed" from the video camera by the Walk-Through Computer's framegrabber board.

Together, the two parts of the instruction say **Load newFace**. Following this instruction, the CPU sends out a request along the instruction bus for data from the framegrabber board. Several clock cycles later, back comes the data from the framegrabber board, along the data bus.

There it is, sitting in a temporary storage area, called a register. This data could represent anything— a word in a word processing document, a number in a spreadsheet, or a line in a drawing. Here it represents a face.

(In a real computer, there probably wouldn't be enough room on the CPU to store the data for an image this big.)

Let's look at the next instruction.

**store targetFace**

This instruction tells the CPU to store the data in main memory, at an address represented by the name **targetFace**. A copy of the data is also placed in an area of the CPU called a RAM cache, where it can be accessed quickly.

The CPU sends the data out along the data bus to the bank of memory chips out on the motherboard, at an address specified by

the name **targetFace**. The address decoder works out the actual location.

**display targetFace**

The next instruction tells the CPU to display the image at the address referenced by the name **targetface** on the screen.A copy of the image called **targetFace** is sent out along the data bus to the printer driver, which sends to data to the screen.

Now the CPU has a copy of the target face stored in a RAM cache and also on the screen. The next step is to start comparing faces stored in the database with the "target face."

Lets move the clock ahead another beat and look at the next instruction.

**read nextface**

This instruction tells the CPU to read an image from the database of faces stored on the hard disk drive. The CPU sends an instruction out along the instruction bus requesting the data from the disk drive controller. After a few more clock beats, the data comes back along the data bus.

**store testFace**

The next instruction is fetched from memory and loaded into the instruction decoder. This tells the CPU to store the data currently in the register in an area of RAM with the address **testFace**. A copy of the data is also stored in a RAM cache on the chip for easy access.

Now the CPU has data for two images: the "target face" and the "test face". The next step is to compare them.

Let's look back at the Pascal program. We're now at this line

**testMatch := Compare(targetFace, testFace)**

Compare is a high-level subroutine called a function. It consists of a quite a large number of complicated instructions that are used for comparing the two images. At the machine level, the comparison instructions would be almost impossibly complicated. The result, however, is simple— an integer between 0 and 100 that represents the program's estimate of how closely the two image resemble each other.

If the resemblance is very poor, the compare function would yield a small number like 3 or 5. If the program thinks the resemblance is strong, it might yield a number like 78 or 85. A perfect resemblance would be represented by 100.

Looking back at the chip itself, the result of the comparison routine is placed in a register. We'll assume the location is labelled with the same name as in the Pascal version— **testMatch**.

If we look at the contents of the register, we see that the number is somewhere in the middle of the range— 47.

The next step for the program is to see whether this number is bigger than the value of the best match so far. The CPU checks by subtracting the value of **testMatch** from the value of **bestMatch** using another register called the accumulator.

If the result is less than zero, it means that the test image, the one that was just read from the disk drive, is a better match than any so far.

If so, the program does two things. First, the value of testMatch is stored at the address for **bestMatch**.

Second, a copy of the image called **testFace** is sent out to the printer driver for display on the monitor.

This process continues until all of the images in the database have been compared against the target face.

Let's speed up the clock and see how fast the instructions are carried out in real time. There are over a 500 images stored on the disk, and it takes the computer about 1/30th of a second to load an image from the disk and compare it against the target face. That's pretty fast!

When the process is complete, the face remaining in the right half of the screen is the best match. The program is now ready to grab another face.

```
Program FaceMatcher
var
        thisMatch, bestMatch: integer;
begin
        repeat
                GrabFace (targetFace);
                Display (targetFace, leftWindow);
                bestMatch := 0;
                Open(faceFile, hardDisk);
                repeat
                        Read(thisFace, faceFile);
                        testMatch:= Compare(targetFace,testFace);
                        if testMatch > bestMatch then
                                begin
                                        Display(testFace,rightWindow);
                                        bestMatch:=testMatch;
                                end;
                until endOfFile;
                Close (faceFile);
        until endOfDay;
end.
```

# Face Matcher Specifications

The success of the Walk-Through Computer exhibit will depend in large part on the suitability of the computer program shown to be running. The leading candidate as of late September 1989 is a program with the working title "Face Matcher." The program compares a target face (usually a visitor's face) with a database of faces, then displays a subset of faces, consisting of those that most closely "resemble" the target face.

## Purpose

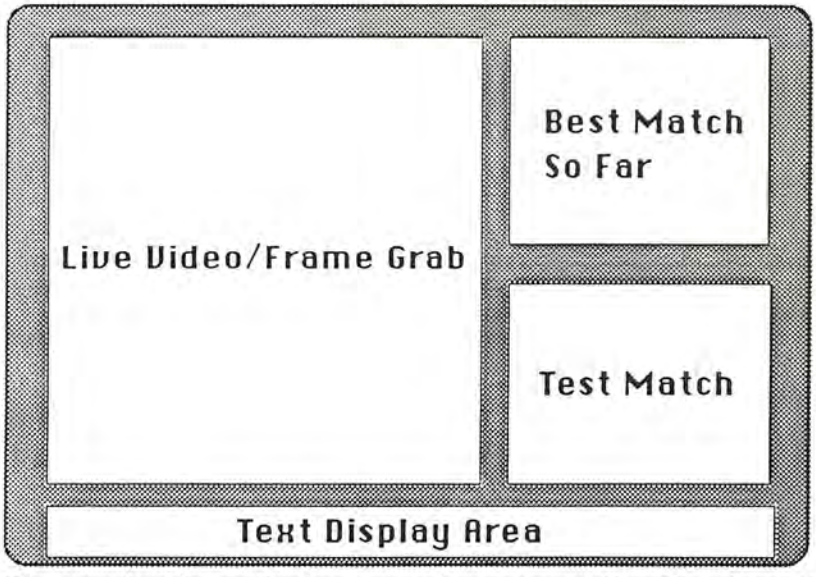
The face-matching program has two main purposes:

- To engage visitors; to "bond" them to the exhibit.
- To provide an easily-remembered task that visitors can relate to the various activities within the exhibit.

The program will have additional beneficial side effects. For example, it may raise interesting questions about differences in the ways humans and computer programs "think," provide rich promotional opportunities, link with other galleries (e.g. Smart Machines, Graphics), etc.

## Screen Design

The screen will look something like this:




We may decide to display a number representing the strength of correlation (possibly represented as a percentage) beneath the current best match.

The live video and still frame should be in color. The matches may be black and white. The background should be colored.

## Function

Current plans call for three modes of operation:

- In *attract mode*, the program will randomly select a face from its database as the target face, then run a matching algorithm, displaying the best matches in windows to the right of the target face.

- In *fixed target mode*, the visitor will manually select a target face from the database using function keys on the keyboard. The program will then run the match algorithm against the selected target face.
- In *face-grab mode*, visitors will be able to make their own faces the target, then watch as the program selects matches.

Our current plan is that face-grab mode will be available only at the "input stations" (see floor plan). Fixed target mode will be available at giant screen, and possibly also at the input stations. In attract mode, a title screen for the Walk-Through Computer and other messages may periodically replace the main screen. The program will go into attract mode if no one has used the keyboard during the past 60 seconds.

We are also going to need a maintenance program that performs a small number of system functions, including the ability to add to or delete faces from the database and the ability to scan the database.

## Evaluation Criteria

Since the program is looking for resemblances, not identifications, there will be no such thing as a "correct" match. A visitor's judgements about the strength of the resemblance will therefore be subjective. Our expectations are not high. Although it is desirable that the resemblances be from time to time striking, the following will be sufficient:

- At least 8 out of 10 visitors will be convinced that the program is exhibiting *some* sort of intelligence in its selections, even if they don't agree with the matches. In other words, only 2 out of 10 visitors will think that the program is doing no better than a random selection. (At least some of the visitors who are initially skeptical about the goodness of fit will be won over by other strengths of the exhibit.)
- At least 9 out of 10 visitors will react neutrally to favorably to the matches (e.g. feel that the matches are fun, amusing, intriguing, etc.). Less than 10 visitors *per year* will report being "offended" by matches the program makes.

The strength of the apparent resemblances will be a function of the range of faces in the database, the extent to which the images are "standardized" (same lighting, same distance from lens, no rotation, etc.), the image processing and pattern-matching algorithms, and the visitor's willingness to suspend disbelief.

Of these three factors, the hardest to optimize is probably going to be the program itself. From this it follows that we should concentrate on building a large and varied database of standardized images. We also need to develop, through prototyping, ways of presenting the exhibit that encourage a positive response.

Over the life of the exhibit, minor improvements in the algorithms, the quality of the database, and the means of presentation may lead to improved effects. For example, we may be able to have a system whereby target faces that correlate poorly with the existing database are flagged as candidates for adding to the database.

## Contents of Database

The database will consist primarily of faces of visitors to the Museum, used with their written permission, and gathered during the prototyping phase. As much as possible the faces will be standardized in terms of lighting and registration;

i.e. they will be facing the camera straight on, at the same distance from the lens, and with eyes at the same level.

If possible, the database will be spiced with a few celebrity faces, preferably those who have actually visited the Museum and had their faces grabbed under the same conditions (maybe we can get some local celebrities).

## Speed and Database Size

The database should be large enough to produce the effects described above, and need not be larger. At this point, we do not know how large the database will need to be. Our first-cut estimate is that we need somewhere between 100 and 1000 faces.

- In face-grab mode, it should take no longer than 10 seconds to grab and process the visitor's face.
- Total time for scanning the entire database and displaying best matches should not exceed 30 seconds. In other words, our current estimate is that the program should be able to perform comparisons at the rate of about 30 faces per second.

Since the display will be constantly changing as better matches are found and displayed, visitors will probably be able to tolerate a longer wait than if the display were static during the search. Ultimately questions concerning speed and database size are empirical questions, and can be answered during the prototyping phase.

## Prototyping

We plan to have a crude prototype version of Face Matcher out on the floor of the Computer Museum by November 30th, 1989. If all goes well, this prototype, or a cousin, will grow into the program used in the exhibit. In addition to providing a means of collecting a large and varied database of faces, this prototyping exercise will tell us when we have attained an effect that is "good enough" in terms of the criteria discussed above.

# WALK-THROUGH COMPUTER

## MINUTES of 9/13/89 Meeting of the WTC Advisory Group

Compiled by Chip Morrison

Present: Art Bardige, Gwen Bell, Dan Dennett, Richard Fowler, Robert Gonsalves, Dan Griscom, Signe Hanson, Chip Morrison, Philip Morrison, Philys Morrison, Mark Paquin, David Patterson, Jonathan Rotenburg, Natalie Rusk, Oliver Strimpel.

### Progress to Date

Oliver opened the meeting with a review of recent progress on several fronts. On the funding side, we now have Mitch Kapor's $250,000 check in the door, a commitment from DEC for $150,000 plus equipment, which brings us to $400,000 out of $750,000.

F.W. Dixon has been selected as contractor. They have good museum experience (Science Museum, DEC's in-house museum) and have an excellent reputation for craftsmanship and attention to detail. The Museum is pleased with this selection.

David Macaulay has agreed to provide illustrations for the exhibit. He will do a set of explanatory drawings that will form a sort of frieze around the inside of the chassis of the Walk-Through. He is also working up a logo for us. Everyone feels David's involvement will help enormously.

Richard Fowler showed us his most recent drawings (enclosed). The pieces are really starting to come together. While there is still flexibility in the design, we need to be making some basic decisions soon so that Dixons can get going with their drawings.

### Parallel Processing?

Mattie Jaffe raised the issue of parallel processing. Future computers will have parallel architectures. What about the Walk-Through?

Jonathan Rotenberg recommended that we have an expansion slot. Later on we could add a parallel processor.

Richard pointed out that the WTC has two slots, one for the frame-grabber board one for the screen driver. An additional expansion slot could be provided, but there is a question about whether there would be enough space.

There seemed to be a consensus that we are doing a circa 1990 computer— a parallel architecture is therefore not necessary.

### Transition to CPU Theater

Jonathan raised a concern about the transition from the CPU on the motherboard to the CPU in the CPU theater. Art suggested that we could have a sort of moving walkway into the CPU theater. You're standing near the motherboard CPU, then get transported into the theater.

### Small Model Computer Microcosm

Phylis Morrison suggested that we have a real microcomputer in a clear plastic case on view as visitors approach the exhibit. This will help visitors orient themselves once they get inside the Walk-Through. Signe endorsed this idea. She said we should be "up front" about what the exhibit is about. Here's this little computer here, and over there we've blown it up into a giant computer.

Jonathan also like the idea of a small model computer. It could be accompanied by a video or slide show. He described an exhibit at Disneyland in which you get a ride into a giant snowflake.

### Color Coding

As a way of modelling the flow of data, Art suggested that people could be given colored cards as they enter the exhibit. Different people would get different cards, and instructions about where to go.

At a later point, Dan Dennett talked about the possibility of color-coding the different components of the computer. The same color-coding scheme could be used in other exhibits.

### CPU Subject Matter

Oliver asked what people would like to see as subject matter for the show in the CPU Theater. Should there be a kind of voyage of discovery of the different parts of the processor, or should the treatment be more mathematical.

Dan Dennett talked about having a pseudo-code instruction cycle. Instructions are brought one by one into the instruction register. You could start slow, then speed up.

Philip Morrison agreed, but suggested that you could also start fast, then slow down.

Dan Griscom suggested that changes in speed could be accompanied by lighting and sound effects. For example, going to red lighting and a deep sound for a slower clock speed.

Jonathan talked about the advantage of using a RISC processor. It would be easier to explain.

Philip said that authenticity was our hardest design goal. He talked about having a sort of "stratified" authenticity. Real on the surface, then more symbolic as you go deeper.

Dan Dennett talked about showing the bit stream in the instruction register.

Phylis suggested that we shouldn't be afraid to be playful. It will be impossible to pin down all of the logic.

David Patterson endorsed the idea of showing pixel by pixel comparison as a way of illustrating basic computation. He also talked about the important role of the clock in establishing the basic "drum beat." Phylis suggested that this could be accompanied by light and sound effects.

Philip suggested we could exploit the clock beat by having it stop from time to time. When the beat stops, it signals that something else is being talked about.

### Concerns with Face Grabbing

Art expressed a concern that frame-grabbers are not familiar components. He suggested we use a scanner instead. He also had an idea about having lots of little monitors. One for each pixel.

Phylis Morrison said she thought the face-matching task was "just the right thing"— an appropriate vehicle for modelling basic computational procedures. She suggested we might want to link the matching concept with bar codes and spell checking, which are the same thing, but which people are more familiar with.

Jonathan said he liked the face-matching idea at first, but after some thought now has four major concerns. First, he's afraid visitors will come away from the exhibit

with the idea that computers are about image-processing, or at least they will think they've learned about image-processing, but not about computers. Also, face-matching is not a daily-life sort of application. Third, it's hard for him to think of a suitable role for the keyboard. Finally, there's the problem of the video camera.

In place of the face-matching, Jonathan recommended a simple Macintosh-like interface with pull-down menus. There could be three simple applications: a word processor, a spreadsheet, and some sort of graphics application. Visitors could select the application they wanted to work with from the menu. The tour of the Walk-Through would not have to be strongly linked to the task. Rather, one could look at the disk drive, RAM, ROM, etc., as components that can be used for any number of tasks. Not just face matching.

Picking up on the paint program idea, Art suggested that the application could be a sort of giant weaving machine or kaleidoscope. Visitors could create a giant tapestry. This would be more interactive than the face-matching task.

Dan Dennett suggested that there could be two windows. One window would be for the face-matching application. The other would be the "garbage" window. Anyone could type anything in the garbage window. Dan also suggested that there could be a period of "free play" on the keyboard.

Phylis expressed a concern that the exhibit would work least well with high school students.

Again the question was raised as to whether we really need a single task to teach with. Most of the group seemed to agree that the task was an important vehicle for explaining the workings of the computer.

### Cariacture Program

Dan Dennett described a program he saw described in a Scientific American article that generates caricatures of faces. It compares a person's face against a normed face, then exaggerates the features that depart from the norm.

Bob Gonsalves suggested it might be possible to have both applications.

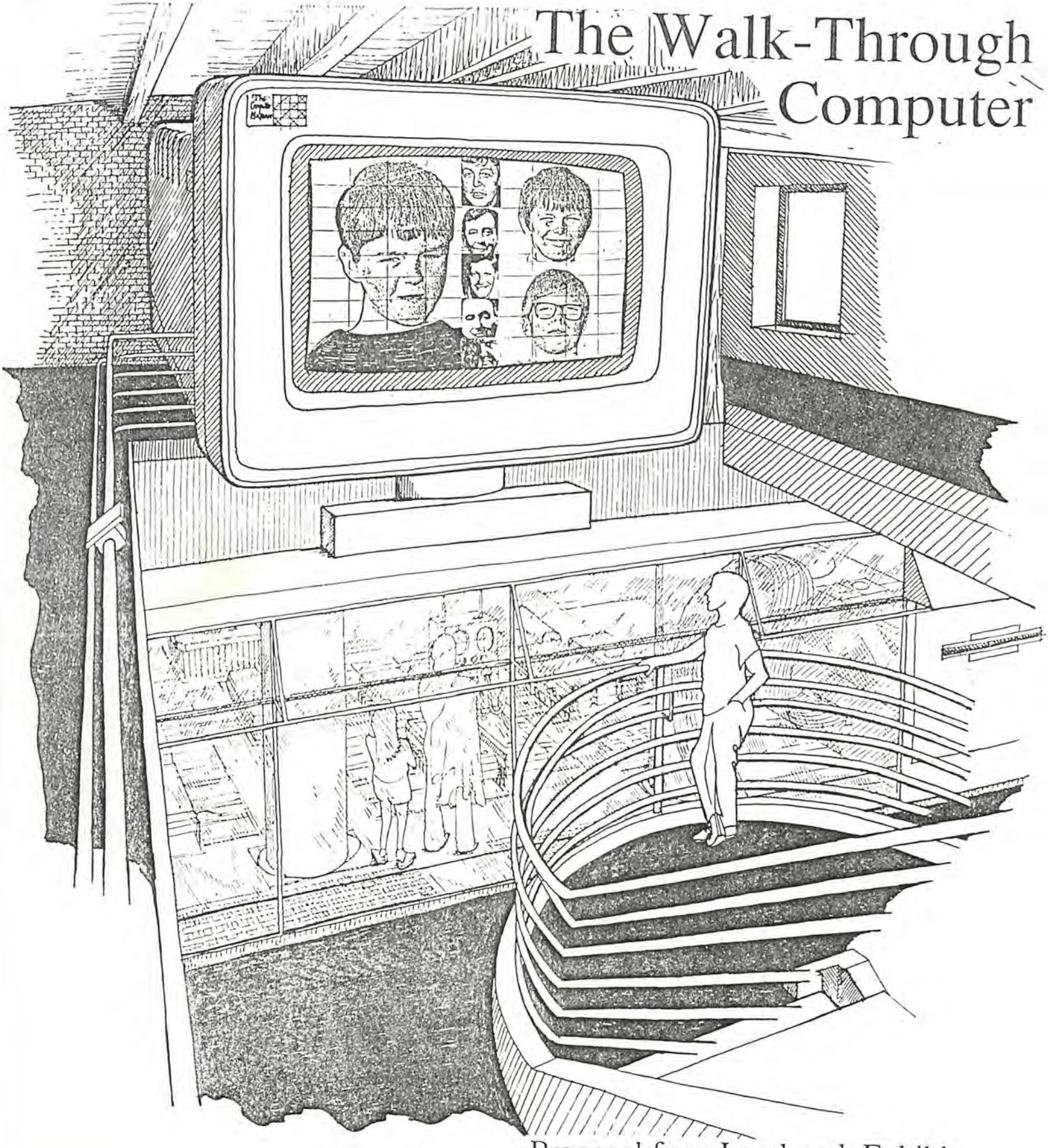
### Protyping

Phylis Morrison stressed the need to find out how visitors will interact with the exhibit. She suggested that we might get children to build a giant model of a computer using cardboard boxes and other such materials. We might learn a lot from observing how they interact with the model.

### Next Meeting

It was agreed that the next meeting would be Wednesday, October 4th, at 6.30 pm in The Computer Museum.

# The Walk-Through Computer



Proposal for a Landmark Exhibit
at the Computer Museum

# THE WALK-THROUGH COMPUTER

## "You Remind me of Someone..."

## A Proposal for a Landmark Exhibit at The Computer Museum

Imagine a computer so large that you can dance across its keyboard, ride atop its mouse and explore its microprocessor and memory chips on a human scale. The Computer Museum is now planning to develop and construct such a giant 3,500-square-foot walk-through computer, about 20 times its actual size. The exhibit will meet a growing and increasingly urgent need for a new way of teaching large numbers of people how computers work.

## Project Summary

The rapid emergence of the computer as a central tool in society has left many members of the public without a basic understanding of computers. Whereas existing or planned exhibits at The Computer Museum and other institutions address computer history and applications, no significant project at a public institution has tackled the most fundamental topic—how computers work—in a way that overcomes the fear and inadequacy much of the public feels about understanding technology.

The Walk-Through Computer will help to meet this need. The exhibit will consist of a large-scale, functioning computer, complete with giant keyboard, mouse, monitor, circuit boards with processor and memory chips, interface boards, disk drives, and printer. The scale of magnification will range from 20 times actual size for the keyboard and monitor to 1000 times or more for components such as the memory chips.

The Walk-Through Computer will be running a specially written image-matching program designed to engage the visitor on a personal level. On entering the exhibit area, visitors may pose for a video snapshot. The computer will add the snapshot to its database (including both previous visitors and celebrities), then search through its existing store of snapshots for resemblances. The closest matches, along with the original, will be displayed as output on the giant monitor.

Walking through the computer, visitors will be able to observe how the different parts of the computer are brought into play as it performs the matching task. Visitors will be able to peer inside random-access memory chips (where they may see a fleeting video image of their own face!), watch the disk drives storing and retrieving data, and study instructions being executed one step at a time inside the CPU. As they leave the exhibit area, visitors will be able to obtain a printed copy of the output.

By producing a theatrical effect similar to that of the elaborate coal mine at the Deutshes Museum, Munich, and the giant walk-through heart, on display at both The Chicago Museum of Science and Industry, and The Franklin Institute, Philadelphia, The Walk-Through Computer will provide a stimulating, entertaining environment in which to learn how computers process information, from the level of the flow of electrons in transistors up through the algorithms of a computer program. It will also serve to showcase cutting-edge technologies, including high- definition large-screen displays, an optical disk drive, and image- recognition software.

The Walk-Through Computer will occupy a central, 3,500-square-foot gallery in the museum, with the potential to become both the hallmark of The Computer Museum and an international tourist attraction. Along with another major exhibit scheduled to open in Fall, 1990, it is expected to significantly boost the number of visitors to the museum, currently approaching 100,000 per year. It is our intention eventually to encourage its replication by museums of science and technology throughout the world. Our estimated development costs total $700,000 in cash and $260,000 in in-kind donation of services and equipment.

## Why a Walk-Through Computer?

The rapid onset of the computer revolution has left people bewildered and confused on many fronts— our experience with museum visitors and the general public points to three general questions:

1. Where did computers come from?
2. What can computers do?
3. How do computers work?

Thematic exhibits at The Computer Museum and in many science and technology centers around the world are beginning to explain what computers can do by demonstrating applications such as simulation, robotics, and expert systems. Other exhibits planned at The Computer Museum and at the Smithsonian Institution's National Museum of American History will deal with the history of computing.

To our knowledge no other public institution has serious plans to address what is arguably the most important question of all— "How do computers work?" Because computers are such complicated machines, the task is a challenging one, involving the explanation of phenomena on disparate scales of size and time. Also, until recently, having a good sense of how computers work was not regarded as a fundamental part of technological literacy. As computers take on an ever-expanding role in the world, however, this attitude is changing rapidly. As a result, it is becoming increasingly important that institutions such as The Computer Museum come to grips with the problem of how to create public places in which the average person can come to gain a deeper understanding of computer technology. This is why we are building the Walk-Through Computer.

## Walking Through The Walk-Through Computer

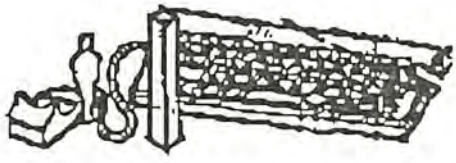
As you approach the Walk-Through Computer, you will see a giant monitor, keyboard, and mouse— all scaled up to twenty times normal size. Some visitors are pushing the mouse around the floor; others are typing at the giant keyboard; others seem to be having their pictures taken at booths that ring the exhibit; still others are walking through the computer itself— you can see them through the transparent front wall. What's going on here?

### The Monitor

On the giant monitor overhead, you notice a constantly changing set of images— the face of someone vaguely familiar is displayed on one side of the screen while the other side presents a constantly changing set of faces, some of other visitors, some of celebrities. Some visitors are peering inside the monitor housing from an opening on its side. The tube, deflection coils, shadow mask, and other parts are visible, together with a short piece of animation (perhaps computer-generated) showing the operation of a raster color display.

### The Mouse

The mouse, an actual working tool, about three feet high, stands to one side. Looking through the transparent casing you can see the roller ball, wheels, light-emitting and photo diodes. As you move the mouse, lights shoot down the cable that connects the mouse with the computer, while a pointing arrow moves across the face of the monitor. Point to one of the matching faces and click the mouse button. The face you clicked on moves to the left side of the screen, while the computer starts to search for matches. Does Queen Elizabeth really look like Elizabeth Taylor? The computer seems to think so...



### Keyboard

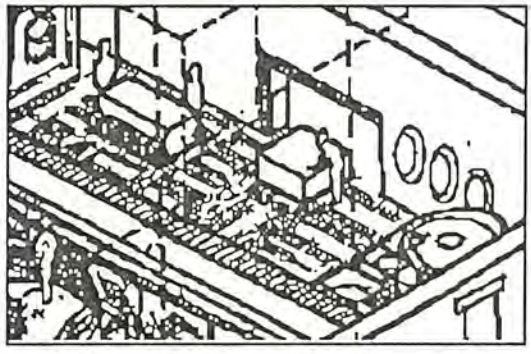
To the right of the mouse sits a giant keyboard. Use the cursor keys to change the menu selection to FIND, then type in a name— C-H-A-P-L-I-N. As you type, pulses of light flash down the cable into the computer. A cutaway view shows the keys making contact with a grid of wires underneath. Soon, a picture of Charlie Chaplin appears at the left of the screen, and a changing set of dark-haired men with mustaches appears to the right. Wait a minute, there's a familiar face... didn't that man come up in the elevator with you? How did *he* get in there?

### Input Station

You can be in the database too. Walk up to one of several input stations arranged along a side wall. A voice invites you to pose for a video portrait. Type in your name, then press Enter when you're ready. A light flashes down a cable connecting the input station to the chassis of the giant computer. A voice says, "You remind me of someone... come inside and watch me try to remember who."

## Inside the Computer

By now you're curious about what's going on inside. Walking through a doorway into the chassis, you're greeted by a landscape of giant printed-circuit cards, disk drives (floppy and hard-disk), and drooping ribbon cables. Walking across the motherboard, you can step onto any of the integrated circuits and pass through the rows of RAM. Vertical cards slotted into the horizontal, floor-level motherboard form walls that approach shoulder height. The power supply stands out as a large, sculptural feature, complete with its huge smoothing capacitors. A disembodied electronic voice calls out instructions. "Get next face...store in RAM...get next face from disk...compare...that's a good match!"

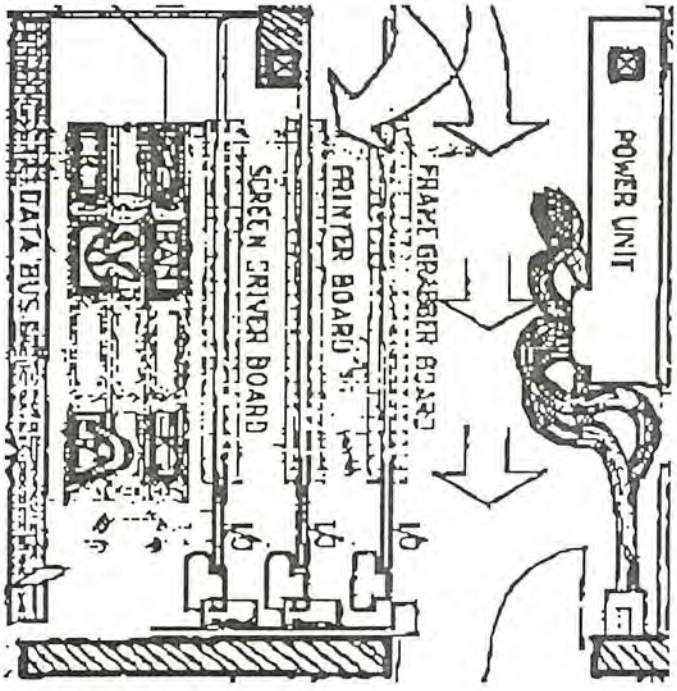


Video and pulsing light fibers simulate the flow of information throughout the computer and its peripherals. Your tour is guided by spoken explanations, special effects, and video animation, which you activate by touching the appropriate component or walking by sensors that detect your presence.

Now that you're inside, you can see how the giant computer executes its program, learning how all parts of the computer act as a coordinated whole, synchronized by a clock, and calling the memory and peripherals into play as needed. When visitors using the mouse and keyboard enter commands to store or match an image, you witness the flow of information to the RAM and disk. Pathways of flashing lights and video images simulate the flow of information from one component to another.

## Peripheral Boards

As you first walk into the computer, you see a set of three peripheral boards, large printed-circuit cards plugged into the motherboard. A frame-grabber board converts analog signals from the video camera to digitized images and stores them in RAM. A screen-driver board sends output to the monitor on the floor above. A printer board sends output to the printer that stands by the exit to the exhibit. Interactive stations at each board let you study these operations in detail.




## The Clock

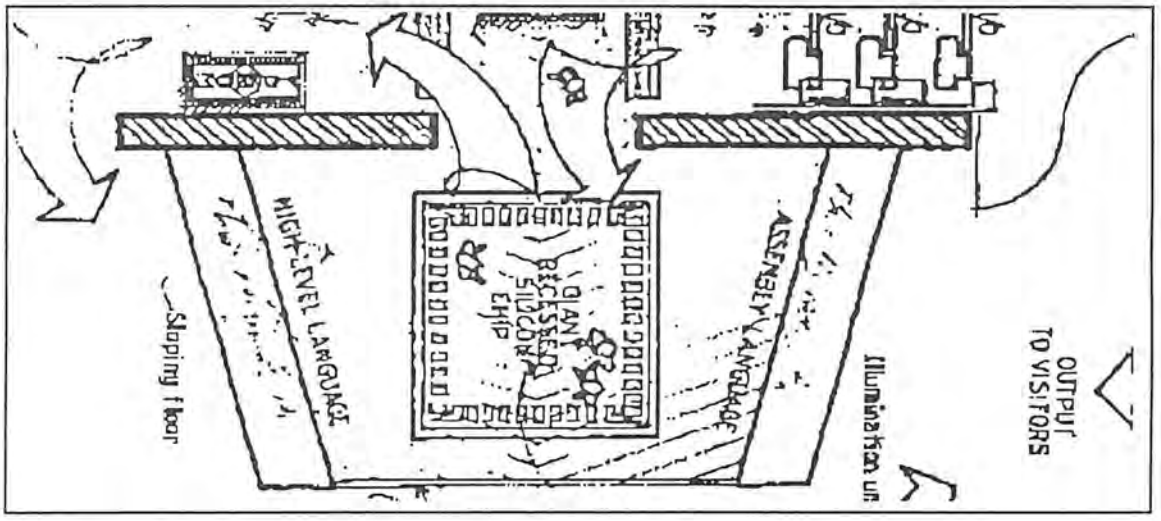
Stooping under some ribbon cables you come out into the center of the mother board. Here you find the clock— peering into a sort of microscope, you see an oscillating quartz crystal sending out pulses of electricity to other components, setting the rhythm for all their operations. Turning a dial, you can slow down the oscillations; as you do so, the lights travelling along their pathways slow down and the voice announcing the instructions speaks more slowly, at a lower pitch.

## The Microprocessor (CPU)

The microprocessor, perhaps the most important of the stations, is housed in its own room at the back of the exhibit. Walking inside, you seem to have entered another world. Your shirt is glowing strangely and

dancing images play around the room. On one wall you see a series of 1s and 0s streaming by, so rapidly you can hardly read them— these are the computer's machine-language instructions. What do they mean? At the other end of the room you see recognizable, English-like instructions scrolling by, accompanied by a disembodied voice (the same voice you heard outside while you were exploring the mother board) "Get next face...store in RAM...get next face from disk...compare...that's a good match!... store in RAM...";

At your feet is the microprocessor itself, enlarged a thousandfold. An outline map shows the the location of the different components, the ALU, instruction register, instruction counter, address register, etc. Color-coded light paths illustrate the flow of information from one part of the CPU to another.



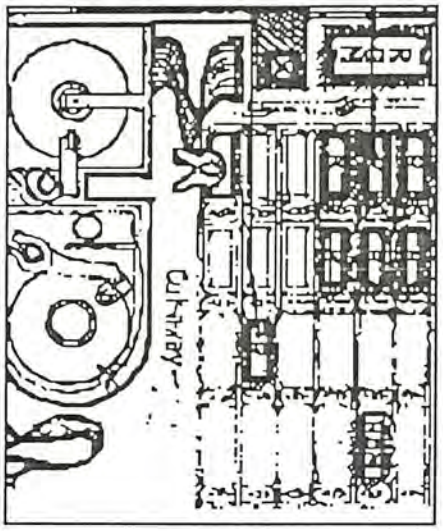

Turn a dial to slow the passage of time down a millionfold and watch the behavior of key parts of the microprocessor. By varying the speed of execution, you see how useful behavior emerges when many millions of elemental operations at the machine level are executed. You have an opportunity to discover the distinction between instructions and data and see how a simple set of registers and instructions enables the computer to become a general-purpose information-handling machine.

Finally, you will be able to choose the level of abstraction in the magnified, slowed-down processor to explore the giant gulf between the

low-level operations carried out by the computer's processor, and the high-level instructions given to it by the programmer.

### The Main Memory (RAM)

Walking back out onto the motherboard, you have a chance to examine how the RAM chips work. At another microscope housed among rows of RAM chips, you encounter a simulated active portion of memory. By varying the scale from a bit up to a megabyte, you can watch patterns of ones and zeros change before your eyes. Here you will see the connection between individual bits of information and the macroscopic "knowledge" stored within a computer's memory. One of the most readily interpreted chunks will be the segment of RAM devoted to the bit-map that represents a human face. In addition, you will have a chance to peer at real RAM chips under microscopes, and see the detailed workings of an individual memory cell explained.



### Floppy Disk Drive

Of course you will have noticed the Walk-Through Computer making periodic use of its disk drives. One drive, the floppy drive, holds a giant floppy disk. This contains the computer program the computer is running, the instructions that tell it how to store, find, and match faces. From time to time, as the computer needs new instructions, you see the head assembly moving rapidly back and forth across the six-foot-diameter spinning platter. A special "probe" assembly under your control lets you explore the disk yourself and see where different

instructions are stored. You notice that some of them are the same ones you encountered inside the CPU.

### Optical Disk

A second giant disk drive, an optical storage device, is used for recording and retrieving the video images that make up the computer's database of faces. Looking up from underneath, you see a tiny red beam of light moving across the face of the rapidly spinning disk and reflected back into the beam splitters and detectors that read the stored data.

Here you can learn how pulses of electricity representing video images are translated into beams of light and recorded on the disk as tiny spots of magnetization. Here you can also type in your own name, and watch the drive retrieve your own face from the disk.

### Printed Output

As you leave exhibit area, you pass a station with a laser printer. Type in your name, and the printer gives you your output— your own face, together with the faces of the six other previous visitors, and celebrities, the Walk-Through Computer has decided you resemble, the people you "reminded" it of. Do you agree with its conclusion?

## Who is The Walk-Through Computer For?

We are confident that a large-scale, landmark exhibit of this type will attract new audiences to The Computer Museum. The exhibit will attract more school groups from low income urban and rural areas in the immediate vicinity—where there is still a lack of computer equipment for students—as well as providing an enriching experience for moderate-income school districts from Rhode Island, Connecticut, New Hampshire, Vermont, Maine, and New York, as well as Massachusetts. Pre-visit materials will help prepare teachers and students.

As the only institution of its kind in the world, The Computer Museum currently attracts a large number of American and foreign tourists, especially during the summer months. The Walk-Through Computer will attract an even greater proportion of Boston's tourists, as it will appeal to people even if they are not particularly interested in computers. Families with young children will especially enjoy the Walk-Through Computer, with children exploring the unusual and

unexpected spaces within the exhibit, while parents investigate the exhibit at the same or a more detailed level. Visitors of all ages will be intrigued by the computer's attempts to find matching faces.

The Walk-Through Computer will also provide a valuable experience for computer-knowledgeable visitors. Though many of them will already be familiar with the material being presented, they will be intrigued by the exhibit's unique character, and will want to visit the exhibit and share it with their friends and relatives. We have frequently observed that even technologically sophisticated visitors learn something new in the Museum.

## What Will Visitors Learn from the Walk-Through Computer?

As the Walk-Through Computer will address a diverse audience, the main educational goals of the exhibit will be to convey only a few important concepts. However, a rich array of further information will be available for those who seek it, without distracting them from the primary educational concepts of the exhibit. This will be implemented, in part, through interactive, computer-based stations that use animation and sound.

The important concepts will include:

### 1. Computer Programs (Software)

A working computer follows a program, a series of instructions that have already been stored inside the computer. The program determines what the computer does. One can change the same computer from doing one job to doing another simply by changing the program.

### 2. Instructions

A computer obeys instructions, usually one at a time, using a device called a processor. The instructions "understood" by the processor are drawn from a repertoire of a few dozen commands. Individual instructions retrieve or send out information, carry out very simple arithmetic or logical operations, or cause the processor to execute another instruction. Each instruction that passes through the processor does very little, but computers execute instructions at an unimaginably rapid rate, so a lot gets done.

### 3. Programming a Computer

People write programs in languages that look a little like English. Other programs (also written by people) are used to translate these languages into myriads of detailed instructions that the processor can "understand." These translation programs include programming languages (compilers and interpreters) and operating systems.

### 4. Memory

The computer has physical memory that stores instructions (programs) and data (text, numbers, images). Fast memory uses silicon chips, and slower, (but more capacious) memory uses magnetic and optical disks. Disks are used to archive and distribute computer programs and data.

### 5. Input and Output

Devices are needed to convert information that people use into the form handled by computers (electric charges, magnetic fields, and microscopic pits that represent ones and zeros). Input devices, such as keyboards and mice, convert hand and finger movements into computer-recognizable form. Output devices, such as printers and displays, reverse the process and produce information people can use readily.

## Developing the Walk-Through Computer

The Walk-Through Computer will require careful planning, design, and fabrication to ensure that all its educational goals are met. The ambitious nature of the project will necessitate a major collective effort, combining the resources the Museum with a team of outside consultants, developers, and manufacturers.

### Advisory Group

The Computer Museum has already convened an advisory group composed of some of the world's leading experts in educational psychology, educational software, exhibit design, computer science, and classroom teaching. This group will provide a range of input that will help the Museum implement the concept accurately and effectively. The members of the committee are as follows:

Art Bardige, Learningways, former classroom teacher now director of an educational software-development company

Daniel C. Dennett, Tufts University, Professor of Cognitive Science and co-author of *The Mind's I*

Signe Hanson, Boston Children's Museum, Director of Exhibit Design

Gardner Hendrie, Sigma Partners, former computer architect and designer of minicomputers and fault-tolerant computers

Danny Hillis, Thinking Machines Corporation, computer architect, designer of the novel, massively parallel Connection Machine

David Macaulay, author and illustrator of a series of best-selling educational books including *The Way Things Work*

Philip Morrison, MIT, Institute Professor and co-creator of many popular films, articles, and programs on science, including the PBS series *The Ring of Truth*

Phylis Morrison, former teacher, curriculum developer, and co-author and producer with Philip Morrison of science materials and programs

Jonathan Rotenberg, founder and president of The Boston Computer Society, the world's largest society of computer users

## Museum Staff

The project will be directed by The Computer Museum's Curator, Dr. Oliver Strimpel. Dr. Strimpel has directed exhibit development at The Computer Museum since 1984. He was responsible for "The Computer and the Image" and "Smart Machines," two 4,000-square-foot galleries with highly interactive exhibits, which are the most successful exhibit areas in The Computer Museum. Prior to joining The Computer Museum, Dr. Strimpel was curator for Mathematics and Computing at The Science Museum, London, where he developed major interactive exhibits on information technology, and electronic imaging.

Adeline Naiman, Director of Education at The Computer Museum will take a lead role in the determination of the exhibit's content and will work to maximize its educational impact on Museum visitors. She has written extensively on the use of computers in education, is a former Managing Director of Technical Education Research Centers, Director of HRM Software, and Editor of the Elementary Science Study. She is currently Vice-chair of the Educational Technology Advisory Council of the State of Massachusetts and author of "The Learning Curve" column in Computer Update.

The Walk-Through Computer will be designed by Richard Fowler, visiting exhibit designer at The Computer Museum, on loan from Britain's award-winning and highly popular new National Museum of Photography, Film and Television, where he is head of design. Formerly senior designer at The Science Museum, London, he has designed numerous highly acclaimed exhibitions. He is particularly known for his designs of three-dimensional exhibit environments, including a nuclear power reactor and a television studio. He is uniquely qualified for the challenge of designing the Walk-Through Computer.

Donald M. Morrison, the Exhibit Developer, will assume day-to-day responsibility for advancing the project and locating external resources of expertise and equipment. His varied background in computers and education includes educational research, software development, and teaching.

### Manufacturers, Donors, and Volunteers

In the past, The Computer Museum has been very successful in securing in-kind donations of equipment and services for new exhibits. The Walk-Through Computer will be no exception. It is expected that at least $260,000 of in-kind contributions will be raised. This is expected to be mainly in the area of programming and special effects in the exhibit, as well as in video equipment (such as a projection display for the giant monitor) and computers, peripherals, and software for the interactive stations. The Museum will draw on its sizable pool of skilled volunteer professionals to help with the implementation of the working elements and will vigorously seek new volunteers as needed.

## Reaching the Market

As the opening date approaches, the Museum's Director of Marketing, Mark Hunt, will convene an advisory committee for public relations to create a publicity and promotion campaign for the exhibit. This committee will ensure that the opening and launch of the exhibit achieve maximum media impact. The campaign will make use of the Museum's established relationships with New England print and television media and national magazines and writers on science and technology. All publicity will recognize significant supporters of the exhibit.

## Budget

The cash cost of developing the Walk-Through Computer will be an additional $700,000. As the budget below indicates, the bulk of the funds will be required to fabricate the exhibit. The development cycle will last approximately one year, from initial funding to the opening of the exhibit. The cash requirements can be approximated on a quarterly basis starting from the initial go-ahead:

| 1st quarter | 2nd quarter | 3rd quarter | 4th quarter | TOTAL |
|---|---|---|---|---|
| $50,000 | $100,000 | $150,000 | $400,000 | $700,000 |

An estimated line budget for the project is as follows.

| Item | Cash Cost | In-kind |
|---|---|---|
| concept development | $80,000 | |
| exhibit design | $50,000 | |
| three-dimensional fabrication | $350,000 | $20,000 |
| graphic & photographic production | $65,000 | |
| computer & video hardware | $30,000 | $130,000 |
| working models & effects | $85,000 | $65,000 |
| promotion, marketing | $25,000 | $10,000 |
| educational materials | $15,000 | |
| administrative support | | $35,000 |
| **TOTAL** | **$700,000** | **$260,000** |

The Computer Museum

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

March 29 1989

TO: Art Bardige, Gwen Bell, Dan Dennett, Allison Druin, Gardner Hendrie, Signe Hanson, Danny Hillis, Dan Griscom, David Macaulay, Philip Morrison, Phylis Morrison, Adeline Naiman, Jonathan Rotenberg

**THIRD MEETING OF THE WALK-THROUGH COMPUTER ADVISORY GROUP**

This is to confirm that the next meeting will take place from 6-9pm on **Monday May 15** at The Computer Museum. As before, enter via the Children's Museum. We shall provide dinner.

I think we covered a lot of ground and made good progress in the last two meetings. I have not had time to put together minutes of the last meeting—they will have to wait till I return. I will send them out to you towards the end of April.

I propose the agenda for the next meeting be:

- **Software: how should it be treated?**
- **Preparation of the major points of content that the exhibit should cover.** This will provide a basis for the exhibit designer, Richard Fowler, who arrives June 1.

Thank you all for your enthusiastic involvement!

Oliver Strimpel

The Computer Museum

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

March 29 1989

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**WALK-THROUGH COMPUTER**

To: Art Bardige, Gwen Bell, Daniel Dennett, Allison Druin, Dan Griscom, Signe Hanson, Gardner Hendrie, Danny Hillis, David Macaulay, Philip Morrison, Phylis Morrison, Adeline Naiman

Thank you all for making it such an exciting session! I enclose a somewhat selective summary of the ground we covered. Please let me know if you feel something has been inappropriately omitted.

The next meeting will take place from 6 to 9pm at The Computer Museum next Monday, March 27th. As before, you can park in front of the building and enter through the "Staff Only" door of the Children's Museum. We'll meet (and dine) in the Image gallery—at the Congress Street end of the 5th floor.

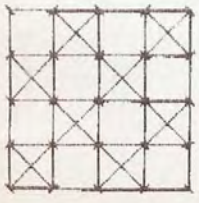
I think we need to get a better model of our visitors, and, in particular, what they might be able to learn from such the exhibit. I also propose that each of us try and make our vision of the Walk-through Computer (or other exhibit) as concrete as possible. Perhaps, after presenting and discussing the visions, a favorite model will emerge. The attached summary of the last meeting lists most of the models mentioned so far. Thus the proposed agenda is:

- **Definition of target audience**
- **Discussion of Walk-through Computer models (see summary of March 13 meeting):**

  1. realistic models
  2. "Alice" models
  3. abstract models
  4. others

We look forward to seeing you!

Oliver Strimpel
3/20/89



# WALK-THROUGH COMPUTER

## SUMMARY OF 3/14/89 MEETING OF THE ADVISORY GROUP

Compiled by Oliver Strimpel & Allison Druin

Present: Art Bardige, Gwen Bell, Daniel Dennett, Allison Druin, Dan Griscom, Signe Hanson, Danny Hillis, Patty Hillis, Adeline Naiman, David Macaulay, Philip Morrison, Phylis Morrison, Oliver Strimpel

## Models for Walk-through Computer

1. Realistic (as described in the proposal)

   Inside and outside based on physical hardware. Hardware details treated by cutaways and insets, as well as by mechanical, computer-based, video-animated, or other stations placed at the appropriate places in the exhibit.

   Cutaways & insets:
   keyboard, mouse, monitor, printer

   Interactive stations at:
   microprocessor, RAM, bus, floppy disk, hard disk

   Software is treated primarily at the microprocessor, but also at the RAM & bus.

   Good points: Builds on an image people are familiar with. Offers exciting view of a computer without its skin. Good context for understanding hardware.
   Problem: software is hard to visualize and will need the help of a compelling, perhaps large-scale, metaphor.

2. Alice in Wonderland

   The giant computer's exterior is as in 1. above, but doorways open into unexpected spaces. Several varieties:

   a. Two doorways, one for software and one for hardware. The software one may be a doorway through the monitor (looking-glass!), the hardware a doorway into the computer's chassis.

   b. One doorway into the computer chassis, but at unexpected places within the computer, a "rabbit hole" into a new space that represents the realm of software.

   Good points: As in Alice, the unexpected spaces make for a sense of adventure and fun. Software can have its own treatment without being constrained by spaces determined by hardware layout.
   Problem: This appears to sever the link between hardware and software.

3. Whirling ping-pong balls

A class of models with no realistic modeling of a computer, outside or inside. Several varieties:

a. blocks machine
b. sorcerer's apprentice
c. golf-balls in a shoebox

Good points: Allows visitors to focus on the essence of computing without distraction by arbitrary implementations of computers.
Bad points: Might be hard to match the visual excitement of a giant computer. Abstract models don't build on people's pre-existing imagery. Might be hard to connect to real computers.

## What the Computer Might Do

arithmetic (caution here—people are scared of maths)
graphics, paint program
word-wrapping
sorting
matching

## Important ideas to communicate with this exhibit:

Computers offer people new ways of thinking (interactive, dynamic).

Computer basics, comparable to automobile common knowledge. (Are some of these on page 4 of proposal?)

First came the capturing of mechanical force (industrial revolution); computers (unlike any other machine) capture mind in mechanism by being able to process information.

Layers of abstraction.

Emergent behavior arises from huge numbers of simple processes. The connection between the reductionist and wholistic view of the computer.

The capabilities and limitations of computing (some of this might be dealt with elsewhere in the Museum in application-oriented exhibits).

Allow visitors to visualize the connection between hardware and software.

The connection between computers and the social world; could be universally available. Though concrete objects (like a television), computers can perform multitudes of tasks (as a television can show any program).

Scales of size and time (radically beyond our experience) in a computer.

It's done by means of tricks. For example, people are tricked into seeing moving animated objects by the changing pattern of colored pixels on a screen.

## Other Remarks

1. Visitors do not come with preset questions. Inspire them and they'll learn.
2. Understand what it is that people mean when they wonder "How does a computer work?", so as not to miss out types of explanations visitors really seek.
3. Expect different visitors to have different ways of learning.
4. Let people interact as much as possible, provided groups can still enjoy themselves collectively.
5. Don't try to pack in too much.
6. Perhaps use a sectioning approach showing half from outside, half from inside; half solid, half transparent.
7. Large things in museums have a tendency to become ugly and shabby.
8. The computer should be demystified; this will not make it any the less amazing.

END
3/20/89

WALK-THROUGH COMPUTER

Advisory Group Meeting 3/27/89

AGENDA

- Definition of target audience

- Elaboration of specific models for Walk-through Computer

  1. realistic models
  2. "Alice" models
  3. abstract models
  4. others

CM: Walk Thru

WALK-THROUGH COMPUTER

MINUTES OF 5/15/89 MEETING OF THE ADVISORY GROUP
Compiled by Oliver Strimpel

Present: Art Bardige, Gwen Bell, Michael Chertok, Daniel Dennett, Allison Druin, Dan Griscom, Signe Hanson, Phil Morrison, Phylis Morrison, Adeline Naiman, Jonathan Rotenberg, Dick Rubinstein, Rob Semper, Oliver Strimpel

## What Should the Walk-through Computer be Doing?

Phylis suggested that keystrokes on the large keyboard could cause different characters, strings, or instructions to appear on the large screen. Severing the notion of a one-to-one connection between the keys and screen would show how software controls the computer and introduce the idea of coding. Art thought the point would be made even more effectively if the keystrokes caused animation or other graphical results.

Dan D. suggested a choice of 3 simple interactive programs such as

1. display visitor's name (visitors enter name & choose fonts)
2. draw a house
3. alter colors

If 1. was selected, the corresponding program would be displayed, perhaps on a display of the type used in airports, in a BASIC-like programming language. Though simple, the program would have loops and conditional instructions. The bit map for the large screen could also be shown on the mechanical airport-style display.

Phil thought the computer should run a database or word-processor, as this was more concrete than a numerical computation.

Dick suggested a simple paint program using the mouse with the left button painting a black pixel and the right one a white pixel.

Signe wanted visitors to learn something that could readily be followed up at home.

## Presenting software

Dick wanted to convey the notion of hierarchies of instructions. Phylis thought we should reveal the "bag of tricks" that is software. Oliver wanted visitors to see that software was a detailed list of instructions. Michael thought visitors should get a feel for the human effort involved in writing software. Dan D. suggested a display showing source code for some well-known programs such as Wordstar or Zork, with the opportunity to browse and see extensive commentary.

Phylis said we should make special "big" software suitable for the big computer. Also, it should be pointed out that it does not affect the algorithms whether the computer is built of silicon or cobblestones.

Phil likened software to a book. Each letter or word is simple, but the whole is arbitrarily complex. In software the individual elements are also simple. Take the American Airlines SABRE system for example. The whole program is very complicated, but the basic idea—that of matching requests to available seats on airplanes—is simple.

Jonathan wondered if the exhibit could use an analogy with the human body. The hardware corresponds to anatomy. Software might correspond to the function of the brain. Just as visitors know that consciousness arises out of the brain and not the heart, so too they should be shown where software resides and that it takes the form of a program, executed in simple successive steps.

Rob felt that it might be better if the large computer was clearly not meant to be a blow-up of a real computer, but something else. For example, by using a large digital board of an airport-style display (it even makes a clicking noise when it changes) it would be clear to visitors that they were not looking at a computer, but at something built specifically to tell them how computers work. Maybe a large computer will not serve the need. One must be careful not to talk down to visitors. An important message is that data and instructions are one and the same.

Dick suggested tackling the following questions for visitors: If computers are so fast, why are they often slow? Why do they get the wrong answers sometimes even if the computer is functioning correctly? Gwen added: Why do computers need so much memory?

Oliver made the analogy with a car: the software can be compared to driving; both involve a list of simple actions, conventions, and serve to cause hardware to perform a task. Adeline thought we might develop some conventions for the purpose of the exhibit that would enable the essence of software to be shown simply.

Oliver wondered if human-like agents might populate the computer, making the exhibit feel more approachable. The agents might adorn the machine, as in some of David Macaulay's illustrations, or might actually carry out some of the tasks. Phil thought this might become contrived and old-fashioned.

Dan D. and Art thought bugs and debugging could be used to help present programming.

<u>How would visitors interact with a large computer?</u>

When the Museum is busy, lots of people will be interacting with the computer at once. How can visitors learn under these circumstances?

Phylis wanted to restrict interaction to one person at a time. Dick imagined several people doing different things. For example, there might be periscopes for visitors still outside the computer to watch effects of keyboard or mouse

commands. Allison favored group experiences, with visitors cooperating to get things done on the big computer. The important part was to create an environment. Phil was skeptical, fearing a noisy, chaotic environment, especially if people using the computer didn't know each other. Phylis thought one group might put another off. Careful thought needs to be given to the question of who this exhibit is for. Art wanted it to be primarily targeted to kids. Phylis wanted it to enchant people on their first visit. Dan D. suggested allowing visitors to fiddle with and break the computer. They need to see the physical connection between the keyboard, processor, screen, etc.

Signe said that a straight-forward message is needed. It is not clear how the big computer can do this.

## Concluding Remarks

Allison wanted the exhibit to be playful, inviting. The relation between hardware & software and the path information takes between input and output must be shown.

Rob pointed out that a large-scale exhibit provides drama and interest, but not necessarily ideas. Maybe non-technically oriented artists could be involved in the creation of the exhibit to bring a new perspective. Some ideas:

1. Scaling: computers are very fast and very small. This makes them useful, and also makes them harder to understand.
2. Simple things done many times become important. There are many examples of this, one being letters & words building up any message that can be expressed in language.
3. Codes can do strange things. They can cause a screen to turn red, create a sound, or anything else a computer can do.
4. Peripherals are bridges into computers.

Michael thought the large scale was important. The spaces should be designed with the needs of a young audience. Many will visit in groups and it will be helpful to have distinct spaces where different parts of the computer can be explained. This is how the present SAGE exhibit is used by the Museum's interpreters to explain computer basics to visiting groups.

Philip encouraged us to look outside the computer to find an analogy, perhaps with a machine such as a typewriter. The typist is partially replaced by software, and partially by the author.

Jonathan wanted to show the public that computers are not a mystery. They should be able to learn what software is and what the difference between hardware & software is. The basic messages should be clear and there should be an opportunity to delve quite deeply into each of the computer's aspects.

Dan G. hoped the exhibit would establish an anchor that would start by explaining high-level software and hardware. This could be added onto in three directions: peripherals, downwards towards lower layers of software, and spreading out to give more details of the hardware components, such as an accumulator.

Dan D. thought visitors might be able to change programs, perhaps by inserting different disks. The program should be shown stored on the disk, the instructions should be seen and heard as they get executed, and followed through the instruction register, adder, right through to the print head of a matrix printer. Peripherals should also be enlarged as they can help bridge the million-fold scale change from people to computers.

Art wanted to make sure the exhibit was well integrated and told a story. A theme or focus was needed. Some "wildness" might be needed to motivate a child to learn.

Signe said that the content and format needed to be integrated. A walk-in exhibit is like a vessel, and the content has to fit elegantly and simply. A lot of resources should go into creating one experience, and doing that well. The messages might be lost if there are a lot of different agenda. This one exhibit cannot cover everything, nor serve all audiences optimally, but it needs to convey, say, three simple ideas. Iterative testing of ideas on visitors could prove helpful.

Dick wanted to convey the levels of abstraction, from individual hardware components, to registers, chips, and software. Also, the computer shouldn't be too clean and wonderful as in reality computers often have bugs, are slow, and may not solve people's problems.

Gwen wanted the direct impact and simplicity of concept embodied in the film Powers of Ten. Scale changes can be very effective, and visitors might be transported from times 20 on the outside of the computer to times 1000 on the microprocessor and beyond.

Phylis pointed out that with a big, grand exhibit one felt required to put a lot into it. Maybe the large computer should be a starting point from which to visit the rest of the Museum. The big computer should not try to take visitors too far, but should stop at a highly introductory level. However, it should perform this introductory function extremely well, and make all visitors feel very good about what they've experienced there. Such a positive experience can color visitors' attitude to the rest of the Museum.

Oliver said that part of computing is engineering, which involves arbitrary decisions about how to build things. We should show people how engineers have chosen to build computers today. Also, we should ensure that visitors realize that computers are special because they are general purpose machines and, as such, are quite different from all other single purpose machines.

## What Next?

It was agreed that the Museum will absorb and digest the ideas to date and come up with some incarnations of the exhibit. When some ideas had been developed, the group would reconvene.

END 6/14/89

# The Walk-Through Computer

*A Landmark Exhibit at The Computer Museum, Boston, Massachusetts, USA*

**Insider's Report #3***

**The Walk-Through Computer*

**The information in this newsletter is pre-release material. Please contact the Museum Development Office for further information.*

## WTC Construction Gets Under Way

A giant keyboard, monitor, and chassis front are now taking shape at F.W. Dixon Company, exhibit fabrication contractor, in the company's Woburn, Massachusetts, workshops. This marks a major milestone in the transition from concept to reality for the Walk-Through Computer, the next major permanent exhibit at The Computer Museum.

The huge components, built at twenty times scale, will fill a 55-foot-wide exhibit space and tower two full stories when the exhibit opens.

Construction began in mid-October, just four months after exhibit design was initiated in July. "Four months from concept to construction is phenomenally fast," acknowledges Richard Fowler, exhibit designer. "In my entire design career, I've never seen an exhibit project move forward so quickly."

The Walk-Through Computer is now scheduled to open to the public in June 1990. To meet this ambitious goal, museum staff arereleasing components for fabrication in stages, as parts of the exhibit are refined and finalized (see keyboard story, back page).

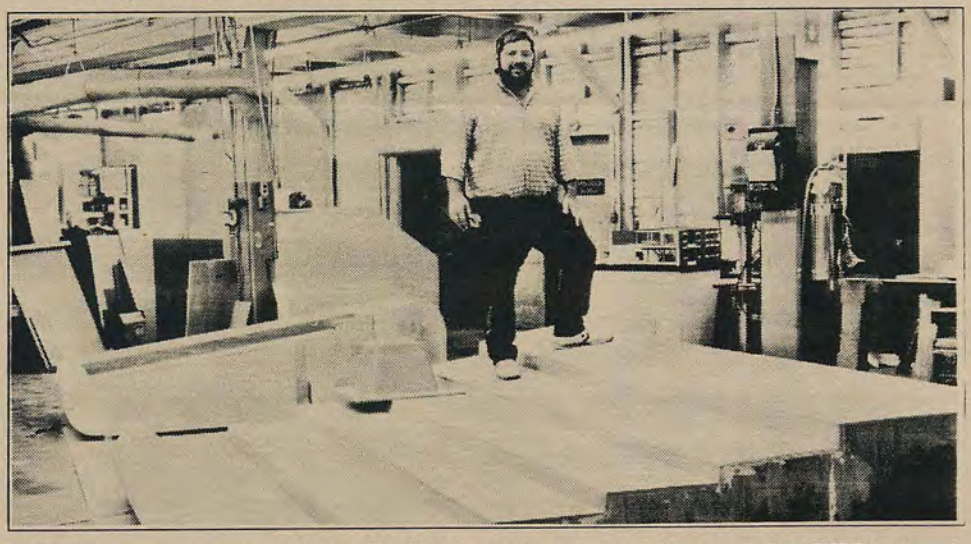
The keyboard, monitor, and chassis front will be completed in December, though a sponsor is still being sought for the large-screen projection system that will be housed inside the monitor shell.

In January, construction will begin on the disk drives, power supply, and motherboard. Once the separate components are completed in early spring, the entire Walk-Through Computer will be assembled at a Dixon warehouse in Wilmington, Massachusetts. Installation of electronics and special effects will take place at that facility.

After final testing, the exhibit will be disassembled, trucked to The Computer Museum, and reassembled in its permanent home, a 3,500-foot gallery in the center of the Museum.

## Sloan Foundation Grants $250,000

In support of its mission to increase public understanding of technology, the Sloan Foundation has presented The Computer Museum with a $250,000 grant, earmarked for the Walk-Through Computer. Added to previous donations, this brings the project well along towards the $750,000 development goal.



*F.W. Dixon project manager George Vanikiotis stands atop partially-constructed WTC keyboard*



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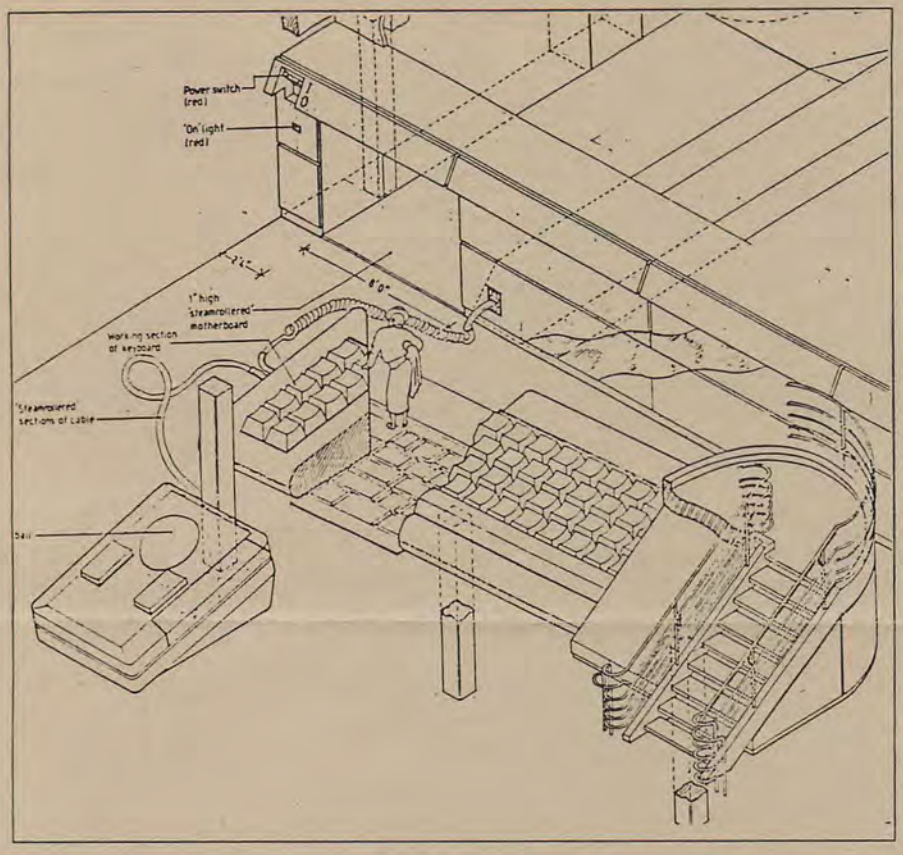



# "Steamrollering" the Keyboard

Each component of the Walk-Through Computer poses specific design challenges that must be solved before manufacture can begin. The giant keyboard is a case in point.

As recently as October, plans called for a twenty-foot keyboard with more than fifty operational keys. The keys were to be non-mechanical, using a system of optical switches to detect keypresses.

Although this design promised to give good reliability while keeping costs down, it raised several problems. For one thing, most computer keyboards have mechnical keys. The optical keyboard thus violated one of the team's main design principles: realism. There were also concerns about traffic flow on the exhibit floor. The keyboard would block direct access from the stairs to the entrance into the computer's chassis. And functionality. How would a visitor, especially a small child, be able to reach all the keys?

One morning in late October, Richard Fowler, the Exhibit Designer, came up with an answer. His solution, shown in the sketch above, was to make a flattened section in the middle of the keyboard that would serve as a walkway to the chassis entrance.

To the left of the walkway, visitors will press fully operational function keys to make selections. These operational keys, one of which will be shown in full cutaway view, are to be controlled by sturdy gas pistons. The pistons will give the right tactile feel and ensure a high degree of reliability. Connectors will send input to the exhibit software. To the right of the walkway, keys will be cosmetically accurate but not operational.

The "walk-through" keyboard solved all the problems in one stroke. Cutting down on the number of functioning keys left more money for the remaining keys, thus making mechanical keys feasible. The walkway also makes it easy to reach the remaining keys and at the same time, improves traffic flow.

Finally, the device of flattening three-dimensional objects into two dimensions ( "steamrollering," as it is called by members of the design team) will be repeated at various places in the exhibit to improve access without eliminating components essential to the modeling of a working computer. Having a steamrollered section at the entrance to the exhibit serves as a convenient introduction to this technique.

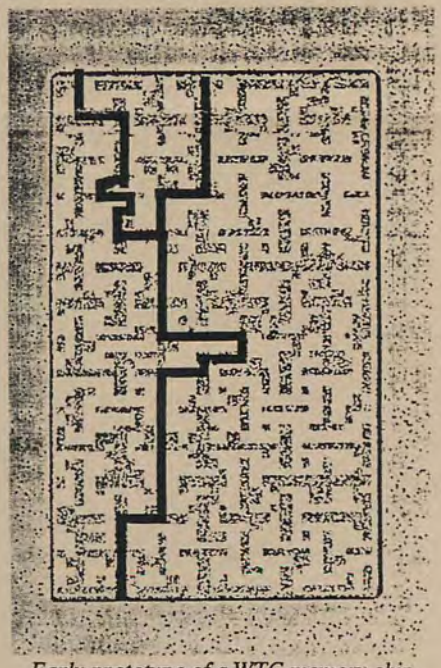
# Alan Symonds MadeTechnical Director

Alan Symonds, an experienced electrical engineer and lighting designer, has recently been appointed Technical Director for the Walk-Through Computer.

On leave from Ripman Lighting of Lexington, Massachusetts, where he serves as Project Manager, Symonds will assume primary responsibility for special effects in the exhibit, including lighting for the Walk-Through Computer Theater and design and implementation of the "viewports," the interactive stations that visitors will manipulate to explore highly magnified views of the Walk-Through Computer's electronic circuitry.

One of his first jobs will be the design of an actual PC board that will serve as the basis for motherboard layout. He has also recently begun work on a prototype viewport that will simulate a magnified view of the computer's random access memory (RAM) chips.

Symonds has extensive experience in museum exhibit work, having worked on the Smart Machines Robot Theater, the Computer Museum's exhibit on artificial intelligence, for which he won an award from the Illuminating Engineering Society of North America. He also designed lighting for the forthcoming renovation of Faneuil Hall and the Old State House. He is an experienced theatrical lighting designer, with over 200 credits on professional, academic, and community productions, including the Hasty Pudding Theatricals, the Boston Ballet, and this year's James Taylor Small World Tour.



*Early prototype of a WTC memory chip*

# The Walk-Through Computer

*A Landmark Exhibit at The Computer Museum, Boston, Massachusetts, USA*

**Insider's Report #4***

**The Walk-Through Computer**

**The information in this newsletter is pre-release material. Please contact the Museum Development Office for further information.*

## An International Look for the WTC

A new demonstration program has been chosen for the Walk-Through Computer. Provisionally titled "World Traveler," the program will combine a simple route-finding application with a database of pictures and maps from around the world.

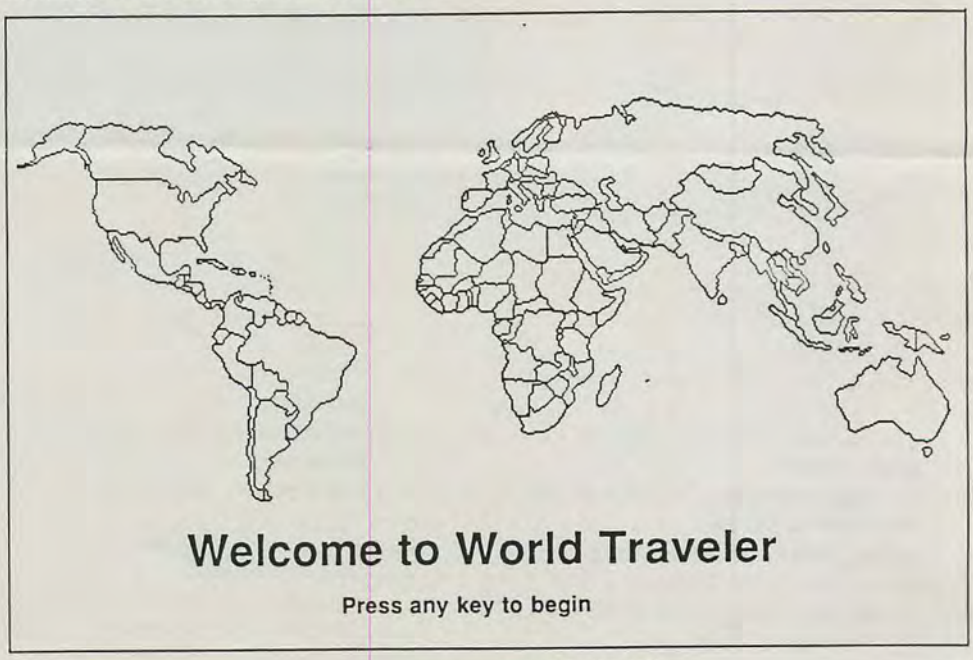
Using a giant trackball as a pointing device, visitors will first select a continent, then a starting city and a destination city. The program will find the shortest land route between the two points, then play an on-screen computer-based slide show of sights one might see along the way.

All major world cities will be represented, for a total of some seven hundred possible destinations. Photographs of famous landmarks in each city will be digitized and stored on a hard disk in the 200-megabyte class.

World Traveler replaces "Face Matcher," an idea that had received serious and active consideration as a demo program for several months. Although work on a prototype had been under way since September, by early November members of the development team had become increasingly concerned about the practicality of a face-matching application as a demonstration program for the Walk-Through Computer.

Concerns included the feasibility of developing a working program in time for the exhibit opening, and questions about how visitors would react to having their faces matched with members of a different race, gender, or age group. Another problem was the fact that video cameras are somewhat unusual input devices for personal computers. As a result of these growing concerns, face matching was finally removed from consideration.

The map application quickly moved into first place. It was found to have good graphics and a simple user interface, and to make appropriate use of all major components, including the disk drives and trackball. World Traveler will appeal to the large number of international tourists who visit the Museum each year, and may even help broaden horizons for local school children. The concept has been enthusiastically endorsed by all members of the design team and work on a prototype is well under way.

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# West Coast Companies Join WTC Sponsors

West Coast companies Apple Computer, Incorporated, and Intel Corporation have agreed to become corporate sponsors of the Walk-Through Computer, The Computer Museum's new permanent exhibit scheduled to open in June 1990. Combined with major contributions from the Kapor Family Foundation, the Sloan Foundation, and Digital Equipment Corporation, cash donations for the Walk-Through Computer now total more than $750,000.

"The Walk-Through Computer is the most ambitious single exhibit ever undertaken by The Computer Museum, so we tried to be modest in our initial funding requirements," says Oliver Strimpel, Curator and Acting Executive Director. "We have many ideas of how the exhibit could be even more effective. All indications are that we'll be able to achieve financial support for these goals."

Response to the exhibit has been so enthusiastic, in fact, that development of a national outreach program, based on the Walk-Through Computer, is now in the works.

### Apple Computer Donates Equipment Plus $50,000

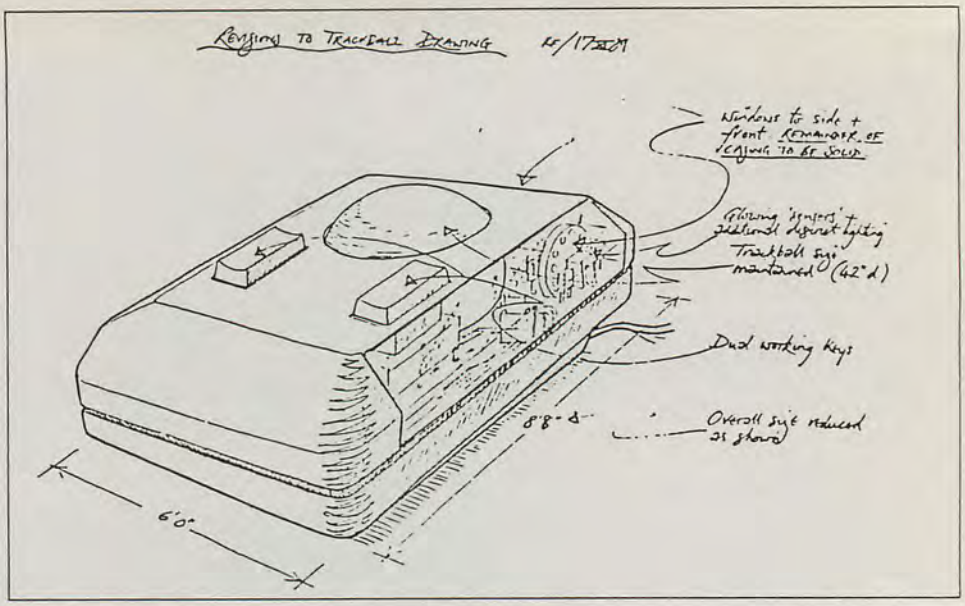
Apple Computer has donated eight Macintosh II systems to the Walk-Through Computer effort, plus a cash grant of $50,000. The contribution was made by Apple's Advanced Technology Group, headed by Vice President Larry Tesler.

The Macintosh systems will be used as "learning stations" within the exhibit and for developing software. The learning stations, to be located adjacent to the exhibit, will allow visitors to explore computer concepts at their own pace and at a greater level of detail than in the exhibit itself.

### Intel Corporporation Contributes $50,000

Intel Corporation recently announced a grant of $50,000 to the exhibit through its 80386 and 80486 End-User Marketing Group, managed by Dennis Carter. In addition, the company agreed to provide technical support and advice on the design of the giant microprocessor.

The Computer Museum is proud to welcome Intel and Apple to the growing group of corporate, foundation, and individual sponsors of the Walk-Through Computer.




# Walk-Through Gets a Trackball

Although early plans for the Walk-Through Computer called for a "bumper-car-sized" giant mouse, the mouse has recently been scrapped in favor of a trackball. Six feet wide and over eight feet long, the trackball will stand to the left of the giant keyboard. It will be fully functional—used to select starting and destination cities for the route-finding application (see front-page story). A cutaway view will reveal the rollers, the slotted wheels, photo diodes, and light sensors.

The trackball will have two buttons, one on either side, both with the same assigned function. This will make it easy for visitors to operate the device from either side.

The choice of a trackball over a mouse was purely a practical matter. An analysis of the sightlines from the exhibit floor showed that visitors would not be able to push a mouse around the floor and still maintain a view of the giant monitor overhead. A giant trackball was also judged to be simpler to construct and manipulate.

## Insider's Grapevine

Here are some of the developments you should be hearing about in future *Insider's Reports*:

- The Computer Museum has been speaking with a well-known educational television producer about doing the theater show. Look for an announcement in the next issue.
- Members of the WTC development team are working on the design and fabrication of a prototype printed circuit board, populated with real components, for use in fabricating and interpreting the exhibit. DGA Associates, of Wilmington, Massachusetts, will be assisting with this portion of the project.
- Members of The Computer Museum's Education Committee met recently with Adeline Naimain, the Museum's Director of Education, to discuss a Walk-Through Computer National Outreach Program. Look for more information in a forthcoming issue.

# The Walk-Through Computer

*A Landmark Exhibit at The Computer Museum, Boston, Massachusetts, USA*

**Insider's Report #5**

*The information in this newsletter is pre-release material. Please contact the Museum Development Office for further information.*

# World's First Walk-Through Computer to Open June 23rd!

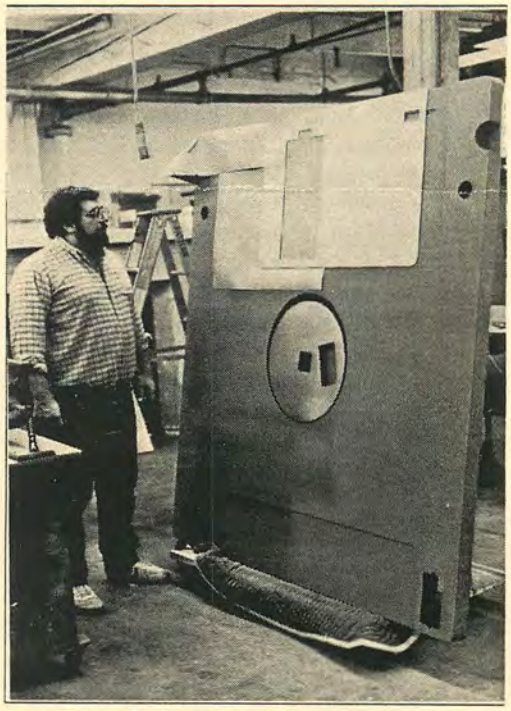
The Walk-Through Computer, the world's only two-story working model of a desktop computer, will open at The Computer Museum on Saturday, June 23rd, at 10 am. The public opening will be preceded by a series of special events for sponsors, Museum members and supporters, and other VIPs.

Several of the major components are nearly complete, including the 25-foot-long keyboard, the power supply unit (complete with working fan and 60-cycle hum), the trackball, the giant floppy disk, and the monitor. Work has also started on the hard disk, and the "motherboard," the giant printed circuit board. According to Richard Fowler, the Exhibit Designer, the motherboard is proving to be the most difficult part of the exhibit to fabricate. "On the one hand, it's got to look right. That means it's got to be a nice translucent green. At the same time, it's got to stand ten years of wear and tear as a floor...and that's proving to be a very difficult combination."

Present plans call for a translucent plastic subfloor with embedded neon tubing (to show data flow), covered by a transparent capping layer made of a durable resin material. The search for just the right material continues. Researchers at F.W. Dixon, the exhibit fabricators, have tested samples from literally dozens of different manufacturers.

To ensure that the exhibit is completed on time, Dixon workers are already putting in twelve-hour days, and six-day weeks.

More than one 100 individuals, representing some 25 different corporations and institutions, are now involved in some way in the design and construction of The Walk-Through Computer. This includes a staff of thirteen full-time carpenters, model-makers and electricians at F.W. Dixon, ten Computer Museum employees working at least half-time on the project, a ten-member Advisory Committee, and numerous outside consultants, contractors, and volunteers. Technical contacts at companies sponsoring the exhibit are also giving important advice, including engineers at Digital Equipment Corporation, and Intel Corporation.



*George Vanikiotis, Jr., Project Manager at F.W. Dixon, stands next to the completed floppy disk.*

**The Walk-Through Computer**

The Computer Museum

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## WTC Donations Pass $1 Million!

The Computer Museum has now raised $867,500 in cash for construction of The Walk-Through Computer, plus more than $200,000 in equipment and services. This brings the total within $150,000 of the $1.2 million originally budgeted for the exhibit. "With several proposals and equipment requests outstanding, I am optimistic we will be able to meet our development goals," says Oliver Strimpel, the Museum's new Executive Director.

### Maxell Sponsors Floppy Disk

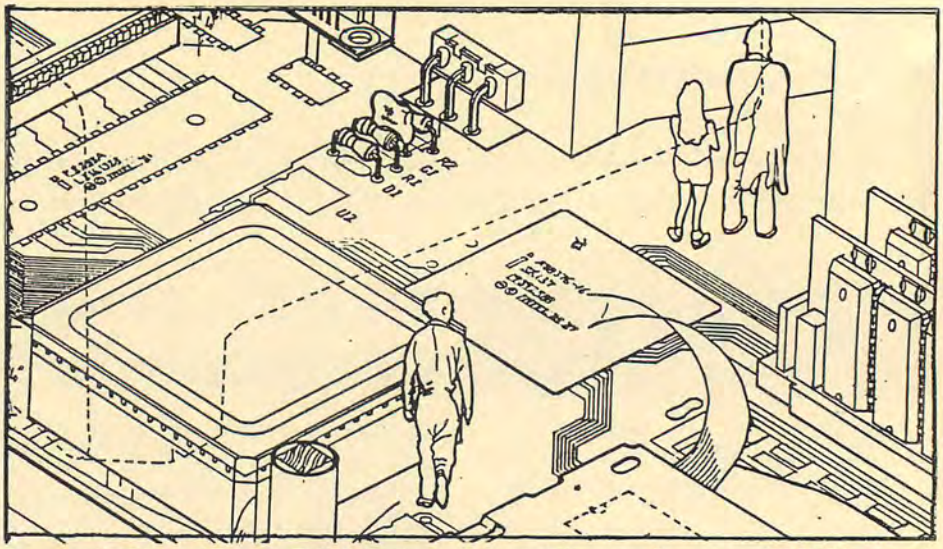
Maxell Corporation of North America has donated $25,000 to The Walk-Through Computer. Combined with a $12,500 seed grant given in 1989, this brings Maxell's total involvement to $37,500. Part of the gift will go towards fabrication of the six-foot-high floppy disk, which will be shown standing near the front of the computer. The jacket has a sliding access door, revealing the disk itself, and a functional write-protect tab. The donation was arranged by Leesa Young, Computer Products manager.

### Kensington Donates $25K

Kensington Microware Ltd., of New York City, a major manufacturer of computer peripherals, has donated $25,000 towards construction of The Walk-Through Computer. Part of the donation, which was arranged by Pam Miller, President of Kensington, will be used to cover the cost of fabricating a giant trackball, the WTC's pointing device (see *Insider's Report No. 4* "Walk-Through Computer Gets a Trackball"). "The Walk-Through Computer," she says, "shows users how our mouse actually works. And the scale of the model allows visitors to see aspects of the technology we employ far more readily than they ever could in a traditional exhibit. This kind of hands-on use does not exist anywhere else."

### Cirrus Logic Gives $10K

Cirrus Logic, the California-based manufacturer of integrated circuits, has donated $10,000 towards construction of The Walk-Through Computer. The donation was arranged by Dr. Suhas Patil, Chairman of the Board and Vice President of Research and Development, and Mike Hackworth, President and CEO. Cirrus products include devices for mass storage control, display and print graphics, and data communications.



*Drawing by Richard Fowler, Exhibit Designer, shows visitor standing next to CPU "viewport."*

## Paracomp to Help with WTC Computer Animation

Paracomp, Inc., of San Francisco, a developer and publisher of 3D software applications for the Macintosh, has agreed to provide assistance in developing computer animation for use in The Walk-Through Computer.

Sean McKenna, 3D Product Line Manager, has arranged for donation of the company's Swivel 3D software to the project. Paracomp has also agreed to donate 6 to 8 weeks of an animator's time to develop computer animation for showing in The Walk-Through Computer's "viewports." These are stations on the giant motherboard that will allow visitors to see highly magnified views of the inner workings of the computer. At the hard disk, the viewport will allow visitors to take a computer-animated "ride" on a read-write head as it flies over the surface of the disk, much like a fighter jet hurtling just a few feet above the surface of a hilly terrain. Other animations will include close-up views of RAM chips and the CPU.

Source and research material for the hard disk "flyover" is being provided by Len Daugherty, Principal Mechanical Engineer at Digital's Low End Disk Systems.

Drew Huffman, the Paracomp animator, is the creator of several successful demonstration programs, including 3D animation for the Macintosh IIcx introduction.

## Insider's Grapevine

Here are some of the developments you'll be hearing about in future *Insider's Reports*:

- A prototype PCB (printed circuit baord) is now complete and in the hands of the exhibit contractor for use in modeling the giant motherboard. The board was designed and fabricated by a consortium of Massachusetts companies.
- John Palfreman and Nancy Linde, producers of the PBS series, *The Information Age*, have agreed to produce a film for showing in the WTC Software Theater. Dean Winkler, Vice President of Post-Perfect, a New York animation house, will create the computer animation and provide post-production facilities.
- David Macaulay, author of *The Way Things Work* and Exhibit Illustrator for The Walk-Through Computer, is working on a large introductory panel for the Walk-Through called "The Information Machine."

# The Walk-Through Computer™

*A Landmark Exhibit at The Computer Museum, Boston, Massachusetts, USA*

**Insider's Report #7**

*The information in this newsletter is pre-release material. Please contact the Museum Development Office for further information.*

## Walk -Through Computer™ Arrives

*Riggers carefully ease the giant monitor into place in the new gallery. Photo by Richard Fowler.*

Components of The Walk-Through Computer™, the world's only two-story model of a desktop computer, have now been moved to The Computer Museum from workshops at F.W. Dixon, the exhibit fabricator. It took a full day of work by a five-man rigging team to hoist the computer's giant monitor into place on the sixth floor of the Museum, overlooking the new Walk-Through Computer gallery. The giant keyboard, power supply, hard disk, and chassis front are also now on the exhibit floor, with the trackball soon to follow. A team of Dixon workers has set up shop in the gallery and is hard at work fabricating the remaining portions of the exhibit.

Originally, The Walk-Through Computer was to have been assembled in a warehouse in Wilmington, Massachusetts, then disassembled and brought to the Museum just a few weeks before the exhibit opening. The new plan saves precious time, and has the added advantage of giving visitors a sneak preview.

### AT&T Donates $50K

AT&T recently pledged $10,000 toward construction of The Walk-Through Computer. Combined with a donation last year of $40,000, this brings AT&T's total sponsorship to $50,000, and makes the company an official exhibit Sponsor. "AT&T Computer Systems is proud to be a participant in The Walk-Through Computer," says Paul A. O'Brien, AT&T Data Area Manager-New England. "It's a wonderful resource for the Musem's mission of helping people understand these things called computers."

### SuperMac Gives Hardware

SuperMac Technology, of Sunnyvale, California, has donated two Spectrum/8 Series III color monitors with 8-bit video boards and two DataFrame XP100 hard disks for use in Walk-Through Computer software development. The donation was arranged by company president Michael McConnell.

Other West Coast companies that have contributed to the development of the exhibit include Apple Computer Corporation, Macromind, Paracomp, Intel, Claris, Cirrus Logic, and Silicon Beach.

**The Walk-Through Computer**

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## Media Interest Grows

According to Gail Jennes, The Computer Museum's Public Relations Manager, more than 16 million people will have read about The Walk-Through Computer before formal promotional efforts even begin.

### International Highlights

News of The Walk-Through Computer has already spanned the globe with a half-page piece in the March 26 *London Daily Telegraph* and a *Jerusalem Post* feature on the Museum last December.

The *Telegraph* story prompted a stream of inquiries from the British media including the *London Times*, *New Computer Express*, *Electronic Times*, the BBC prime-time science program *Tomorrow's World* and the BBC's *Search Out Science* show for children. In addition, the West German *Siemens Review* (read by 40,000 of the world's opinion leaders) will publish a feature on The Walk-Through in its May/June issue. Germany's *Der Spiegel* is also interested in doing a piece.

### National Highlights

Columnist Alex Beam broke the story in *The Boston Globe* last December. In March, *The Sunday New York Times* highlighted the new exhibit in a piece on the Museum that has been reprinted across the country and in Canada. The April issue of *Compute!* featured a photograph and description of The Walk-Through Computer as part of an extensive feature about the Museum.

Look for stories on April 16th in *Business Week*, April 18th in the *North Shore Weekly* chain distributed to 110,000 people in Massachusetts, and in the May issue of *Popular Mechanics*. On May 20th, *The New York Times Sunday Magazine* will feature The Walk-Through Computer as its "Works in Progress" piece. And in June, *Family Circle*, *The Boston Sunday Globe*, *Personal Computing*, and *CHILDSPLAY Magazine* are highlighting the exhibit with features or other coverage. Also coming up this summer is a story in *Results Magazine* (read by 25,000 top management executives in the US).

To top it off: *Good Morning America* is interested in greeting the country one morning in June from inside The Walk-Through Computer!

*Workers from F.W. Dixon bring part of the giant keyboard into the Museum. Photo by R. Fowler.*

## Marketing The Walk-Through Computer™

Noel Ward, The Computer Museum's newly appointed Director of Marketing, is working with Commonwealth Creative Group of Natick, Massachusetts, to develop an advertising campaign designed to ensure that The Walk-Through Computer gets the audience it deserves when it opens on June 23rd.

High visibility advertising aimed at building public anticipation will begin three to five weeks before the opening. In the weeks following, advertising efforts will focus on maintaining awareness of The Walk-Through Computer and attracting visitors.

Media under consideration for the advertising campaign include: local and regional newspapers; billboards along major highways approaching Boston; transit cards on subway cars and buses; posters in train stations, airports, computer stores, tourism centers, public libraries, and community recreation centers.

"In the history of The Computer Museum," says Ward, "no other exhibit has had the potential to capture the imagination of as broad an audience as The Walk-Through Computer. A landmark exhibit, it presents us with a larger-than-life opportunity to promote the museum regionally, nationally and even worldwide." Ward feels The Walk-Through Computer has the potential to double the number of visitors to the Museum, currently running at about 100,000 annually.

## Insider's Grapevine

Here are some of the developments you'll be reading about in future *Insider's Reports*.

- Intel Corporation has contributed $115,000 for use in the production of a video that will take viewers on a "walk" through The Walk-Through Computer.
- Testing and formative evaluation of the various Walk-Through Computer exhibit components is now underway. School children, visitors, and industry consultants are getting involved.
- Lotus Development Corporation has donated $25K towards construction of The Walk-Through Computer Software Theater.
- The Information Machine, the large introductory panel being created by David Macaulay, will incorporate six different interactive stations.