

# *The Computer Clubhouse*

**A Proposal for a Model Learning Center**

by

The Computer Museum

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## Executive Summary

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The Computer Museum plans to open The Computer Clubhouse, an innovative learning center targeted to serve youth from underserved communities. In The Computer Clubhouse, youth, ages 10 to 15, will be able to use computers to work on projects related to their interests, concerns, and experience. Professionals and graduate students from diverse fields and cultural backgrounds will serve as Mentors, helping participating youth design their own computer-based projects. Five young people skilled with computers will also serve as Mentors to newcomers to the Clubhouse.

The Computer Clubhouse has three major goals:

- Provide youth from underserved communities access to computers for use in empowering and creative new ways
- Inspire young people to become more interested and confident in science, mathematics, and technology
- Provide educators nationwide with a working model and educational materials to help them take advantage of powerful computer tools in the teaching of science, mathematics, and technology

Unlike a standard computer classroom laboratory (equipped only with desks and computers), The Computer Clubhouse will be a vibrant environment, containing ingredients of an artist's studio, biology laboratory, television newsroom, architects' office, and a robotics workshop. The Clubhouse will provide sixteen computers and a variety of software and technological tools for participants to use in developing projects. Projects will focus on five cutting-edge areas of computer applications: scientific simulations, electronic publishing, computer-controlled devices, computer games, and "Virtual Reality" design.

The Computer Clubhouse project consists of two components: the Afterschool Program and the School Program. The Clubhouse Afterschool Program will reach 2,500 youth per year, including approximately 2,000 from low-income communities, at an average of 6 three-hour visits each. The School Program will reach an additional 7,500 youth per year, including 3,000 underserved youth, at an average of one three-hour visit per youth. Museum staff will develop a video (2,500 copies) and printed guide (5,000 copies) for educators seeking to begin or enhance youth programs that make use of computers. Through the dissemination of Starter Software Packages developed in the Clubhouse, the project will indirectly serve an estimated 50,000 youth nationwide by the year 1997. Future programs in the Clubhouse will include workshops for teachers and families.

Professor Seymour Papert, Ph.D., and Professor Mitchel Resnick, Ph.D. from the Epistemology and Learning Group at the world-famous MIT Media Lab, will serve as active advisors to the Clubhouse project. The Museum staff will also assemble an Education Advisory Board and Youth Advisory Team to assist in planning, implementation, and evaluation of The Computer Clubhouse project.

Locally, The Computer Clubhouse will provide youth access to resources they need to excel in today's technological society. On a national scale, the Clubhouse project will provide teachers and other educators a state-of-the-art vision and practical approach for making use of the power of computers to improve math and science education.

## **Background—Crisis in Education**

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The number of young people interested in pursuing careers in science, mathematics, and technology is at a critical low. Women and people-of-color, an ever-growing proportion of the nation's work force, have particularly low participation rates in these fields. New approaches to science and mathematics education are needed to attract a broader population of students.

Young people *are* interested in and attracted to computers. However, the potential of computers to stimulate students' involvement in scientific and technical fields has not been tapped effectively. The average school has only one computer for every 30 students, so students typically spend very little time using a computer.<sup>1</sup> Even when students do have access to computers in school, they have almost no freedom to use computers to pursue topics they find of interest.

The situation is worst for those students who could benefit the most—students from low-income communities. These children rarely have computers at home,<sup>2</sup> and they attend schools where computer access is particularly limited, or non-existent.<sup>3</sup>

## **The Computer Museum's Unique Role**

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The Computer Museum is uniquely positioned to address these problems. The two components of our name reflect the two areas of expertise needed to address the problem of limited computer use in education: expertise in computer technology and expertise in informal, museum-style education.

The Computer Museum staff, in conjunction with volunteer experts, have built exhibits that feature cutting-edge computer technologies and applications in areas such as robotics, artificial intelligence, computer graphics, and personal computing. The Museum has also developed engaging educational materials on the history, technology, and application of technology, including the video "How Computers Work," based on *The Walk-Through Computer*<sup>TM</sup> exhibit, and the Educational Activities Packet, a set of materials that help teachers across the country involve students in the study of computers.

In addition to its expertise in educating *about* computers, the Museum is a leader in educating *with* computers. The Computer Museum's interactive computer exhibits are made available through the Exhibit Kits Program.<sup>4</sup> Six museums, ranging from The St. Louis Science Center to England's new Eureka Children's Museum, have purchased exhibits since the program's inception in 1991.

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<sup>1</sup> Figures from *Power On!: New Tools for Teaching and Learning*, Congress of the United States, Office of Technology Assessment, September 1988.

<sup>2</sup> According to a 1991 study by the Department of Commerce, 15 percent of all households in the U.S. have computers, but 63 percent of children from high-income families (with incomes more than \$75,000) have access to computers at home.

<sup>3</sup> *Power On!: New Tools for Teaching and Learning*, Congress of the United States, Office of Technology Assessment, September 1988.

<sup>4</sup> Supported by funding from the National Science Foundation.

The Computer Museum's grounding in the world of museum education differentiates it from almost all other providers of computer education, including schools, computer learning centers, and afterschool clubs. The non-threatening, informal education approach of museums supports learning through curiosity, exploration, social interaction, play, and multi-sensory experiences.<sup>5</sup> Leaders of the nationwide school reform effort are looking at museums as models for new approaches to education. For example, the National Council on Science and Technology Education<sup>6</sup>, in its recommendations for comprehensive educational reform, proposes many museum-style approaches, including placing a premium on students' curiosity and creativity, engaging students actively in the exploration of phenomena, and providing students hands-on experience with technological tools.

The Computer Museum currently serves more than 60,000 students per year through its informal educational programs, including special educational events and museum visits. Although it serves a large number of young people, the Museum's educational impact has been limited by the nature of the museum visit. Exhibits are designed for simple interactions ranging from 30 seconds to 10 minutes. The Computer Clubhouse will allow students to use computers to follow up on their interests and explore subjects in greater depth.

### **Goals of The Computer Clubhouse**

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- 1) To provide youth from underserved communities access to computers for use in empowering and creative new ways
- 2) To inspire young people to become more interested and confident in science, mathematics, and technology
- 3) To provide educators nationwide with a working model and educational materials to help them take advantage of powerful computer tools in the teaching of science, mathematics, and technology

### **Clubhouse Description**

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The Computer Clubhouse will be a rich learning environment where young people ages 10 to 15 can use computers to build their own computer-based projects. Computer-using professionals and graduate students from a variety of cultural backgrounds will serve as Mentors, offering educational guidance and inspiration to participating youth.

#### **Educational Approach**

The Computer Clubhouse will give participants the opportunity to become designers and creators—not just passive consumers—of computer-based products. The Clubhouse will be equipped for young people to develop projects in the following areas:

- scientific computer simulations

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<sup>5</sup> See "Science Museums as Environments for Learning" in *Physics Today*, November 1990.

<sup>6</sup> Appointed by the American Association for the Advancement of Science

- electronic publishing
- computer-controlled devices
- “Virtual Reality” design
- computer games

Activities in The Computer Clubhouse will be guided by current educational research which shows that children learn most effectively when they are engaged in open-ended projects that build upon their interests, concerns, and personal experiences.

### **The Clubhouse Environment**

The Computer Clubhouse will be located in a 1,000 square-foot dedicated space on the ground floor of The Computer Museum. The Computer Museum, which shares a building with The Children’s Museum, is readily accessible by public transportation.

Unlike a standard computer classroom laboratory (equipped only with desks and computers), The Computer Clubhouse will be a vibrant environment, containing ingredients of an artist’s studio, biology laboratory, television newsroom, architects’ office, and a robotics workshop.

### **Tools and Technologies**

The Clubhouse will provide a variety of software and technological tools for participants to use in developing projects. Sixteen computers will be set up at stations distributed throughout the Clubhouse.

The Clubhouse will provide both commercially available software packages and prototype educational tools developed at MIT’s Media Laboratory, a world leader in the development of innovative interactive environments. The tools and technologies will include: LEGO/Logo, a computer-controlled construction set; digital video editing and production tools; simulation tools for exploring biology, ecology, math, and physics (including \*Logo, developed at MIT); digital music recording, editing, and mixing tools; new programming tools, such as advanced versions of Logo, particularly for developing games and computer animation; Virtual Reality tools, for developing three-dimensional computer worlds; desktop publishing tools; and Programmable Bricks (developed at MIT) for sensor and robotic activities.

To help participants learn how to use these powerful tools, the Museum Exhibit staff will develop Starter Software Packages. The Starter Software Packages will demonstrate elementary applications of the tools, and will allow learners to extend or create variations on these applications. For example, the Starter Software Package for simulation projects will be a simple simulation of ants foraging for food, programmed in the latest version of the Logo programming language. After trying this introductory program, participants will be able to adapt and add on to the program to make their own simulations (for example, adding on additional ant behaviors, or adapting the program to study the behavior of other forms of life).

### **Mentors from Diverse Backgrounds**

Many computer-using adults would be interested in using their computer skills and experience to help underserved youth, if only there were organized ways for them to do so. The Clubhouse aims to take advantage of this largely untapped resource, by

recruiting professionals and graduate students from a variety of disciplines (including engineering, music, environmental science, art, journalism, and architecture) to serve as Mentors. The team of 20 adult Mentors (a combination of paid, work-study, and volunteer part-time staff) will represent a diversity of cultural and ethnic backgrounds.

The main role of the Mentors is to coach and inspire Clubhouse participants to pursue science, mathematics, and technology. For example, a local architect has already volunteered to develop a database of Boston architecture at the Clubhouse. He will also work with students to help them add information on architecture in their own neighborhoods to the existing database. By sharing their experience and enthusiasm, Mentors will serve as influential role models and help broaden students' interests and knowledge about science, mathematics, technology, and the world.

In addition to the 20 adult Mentors, the Museum will recruit five young people who are skilled with computers to serve as Youth Mentors to newcomers to the Clubhouse. The Youth Mentors will gain job experience and will provide other participants peer support as they work on their projects.

#### **An Example of a Computer Clubhouse Experience**

A group of 18 boys and girls from a local (Roxbury, MA) Boys and Girls Club arrive at The Computer Clubhouse for the first time. Noah, a professional musician and a Mentor at the Clubhouse, welcomes the group and shows them around the Clubhouse, demonstrating completed projects and works-in-progress by other participants.

"Check this out," says Izzy, one of the new students, as he spots a bridge made out of LEGO bricks that is attached with wires to a computer. Rose (another in the group) points out the window to the drawbridge which they walked over on their way to the Clubhouse. "Hey, look, the LEGO bridge is just like that bridge out there!" Giselle, a local high school student and one of five Clubhouse Youth Mentors, is working nearby, using LEGO bricks and motors to create a kinetic sculpture garden. She stops to show Izzy, Rose, and the others how they can control the movement of the LEGO bridge by typing commands into a computer.

Noah then shows the group a video presentation about robots and artificial intelligence, which a school group made at the Clubhouse. The robot video is accompanied by music that Noah helped create using digital audio equipment at the Clubhouse's Music Station. Afterwards, Noah leads the group to the Plant Station, where electronic sensors are used to monitor the light, temperature, and humidity around a row of pea plants. Noah explains an on-going experiment by Clubhouse members testing how different water sources (Boston Harbor water, filtered water, and tap water from different parts of the city) affect the growth of the plants. At the Simulation Station, Noah demonstrates a computer simulation of the spread of the AIDS virus, which three Clubhouse members programmed with assistance from a computer professional at a local software company.

Next, the students break into small groups and begin working at the computer stations. They begin by exploring one of five introductory Starter Software Packages: an interactive story game, a computer ant simulation, an electronic newspaper about jobs for young people, a remote control animal robot, or a three-dimensional virtual-reality model of The White House.

The students return once a week for the next four weeks. The first day back, Izzy, Rose, and their friend Shawn, decide to build four cars and a boat out of LEGO bricks to accompany the model of the bridge. During the next two visits, with help from Giselle, the team finishes building the cars and the boat. The next time they come, they learn how to program the bridge, boat, and car setup. They write a program so that when the boat approaches the bridge, a safety bar lowers, the cars stop, the bridge lifts, and the boat goes by. On their fifth visit, Noah shows them how they can program a song into the computer. Now, each time the bridge lifts, the computer plays "Like a Bridge Over Troubled Water."

Charisse and Shani, who particularly enjoyed the computer model of The White House, work together to build a three-dimensional computer model of Boston's historic African Meeting House, the oldest standing African-American church in the United States. Another group develops a computer game that involves exploration of the streets of Roxbury, while five others design flyers and a newsletter to let more children know about programs at the Boys and Girls Club. The staff from the Boys and Girls Club are amazed to see how quickly and eagerly the youth learn how to use the computers and other technology, and ask the Clubhouse staff for information on ways they can make better use of the two computers they have back at their site.

## **Afterschool and School Programs**

### **Afterschool Program**

The Afterschool Program is targeted to young people with the greatest need: those who would not otherwise have access to the help and resources they need to thrive in today's technological society. The Afterschool Program will reach local youth in two ways: through scheduled visits by afterschool clubs and by individual drop-in visits. A total of 2,500 youth will be served by the Clubhouse Afterschool Program, with approximately 75 percent of the participants coming from low-income communities or being identified as at-risk youth.

Three afternoons per week, plus one weekend morning, will be reserved for group visits by afterschool groups serving young people in low-income areas, such as the Boys and Girls Clubs of Boston, Girls Incorporated, and the Salvation Army Kids Club. (These groups are among those that have already expressed interest in making use of the planned center. See appendices.) Clubs which reserve space for 15 or fewer students will be paired with other afterschool groups of a similar size.

On three other afternoons, the Clubhouse will hold drop-in hours for youth from local communities. Young people interested in participating in the drop-in program will fill out an application to receive a membership worth 10 visits to the Clubhouse. Applicants from low-income areas will receive memberships free of charge. Those from families living in middle-income and high-income areas will be charged a minimal fee (about \$30) for 10-visit memberships.<sup>7</sup> Subsidized memberships will also be made available to

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<sup>7</sup> Income area (low, medium, and high) determined on the basis of zip code using information provided by the state government. This information is used by the Massachusetts Cultural Council

"youth-at-risk" who are referred by teachers, social workers, or other service professionals—and who would otherwise be unable to take advantage of the program.

### **School Programs**

A total of 7,500 students per year will be served by The Computer Clubhouse School Programs, including 3,000 youth from low-income communities.<sup>8</sup> The School Programs will accommodate school groups during morning hours for special activities related to the Museum's exhibits. Some school activities, such as "Robot Design Lab," will involve multiple visits to the Museum: a first visit using the exhibits to gather ideas and plan one's design, a second visit to build the robot using LEGO bricks and motors, and a final visit for using computers to program the robots to move. Other activities, such as "Computer Times," will involve a single visit to the Museum. (The "Computer Times" activity will involve students in a jointly-written electronic newspaper, with articles based on information and images gathered in the Museum's exhibits.)

In addition to providing an unique educational experience for participating students, School Programs at The Computer Clubhouse will provide local teachers with examples of activities and approaches they can adapt for use in their classroom. The Museum will be working with local school teachers to develop activities for school groups that allow students' creativity in designing computer-based products, while complementing the school curriculum.

### **Reaching Underserved Youth**

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The Clubhouse Afterschool Program is targeted for youth, ages 10 to 15, from low-income and underserved communities. The Afterschool Program will reach approximately 2,500 youth from low-income neighborhoods per year, at an average of 6 three-hour visits each. The School Program will reach an additional 3,000 underserved youth per year, at an average of one three-hour visit per youth.

Youth from low-income areas will be recruited by several means. More than 5,000 students from low-income areas currently visit The Computer Museum free of charge each year through the Museum's Ticket Subsidy Program. Beginning January 1, 1993, students ages 10 to 15 visiting the Museum through the Ticket Subsidy Program will receive a pass worth three visits to The Computer Clubhouse to be used during any of the drop-in hours. Upon the second or third visit to the Clubhouse, the student can choose to apply for a full 10-visit Clubhouse membership. Young people will also be recruited through local schools, parent groups, churches, temples, and social service agencies.

The membership application process will allow Clubhouse staff to monitor the use of the Afterschool Program drop-in visits. Information on memberships and visits by school and afterschool groups will be collected on a computer database. This information will be used by Clubhouse staff and evaluators to track which children are

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(a state agency) for determining the eligibility of school groups for participating in museums' Reduced Admission programs.

<sup>8</sup> Based on FY'91 school visit figures, with 40 per cent of total visiting students coming from low-income communities.

making the most use of the Clubhouse program. Corrective measures will be taken to ensure maximum retention in the programs, and to protect against bias towards involvement by a particular gender, race, or ability level.

### **Creating a National Model**

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One of the major goals of the project is to help educators take advantage of the power of computer tools in the teaching of science, mathematics, and technology. As part of this effort, in the third year of the project, the Museum will disseminate the Starter Software Packages for use on standard computers in schools, museum computer labs, afterschool clubs, and homes across the country. Through the dissemination of software developed in the Clubhouse, the project will indirectly serve an estimated 50,000 youth nationwide by the year 1997.<sup>9</sup>

To provide educators with an understanding of how to help young people use computers for pursuing in-depth projects, the Clubhouse staff will produce a 10-minute video (2,500 copies) showing examples of young people working with Mentors on projects at the Clubhouse. The Clubhouse staff will also produce a short printed guide (5,000 copies) describing the philosophy, setup, and activities at the Clubhouse. Researchers from the Epistemology and Learning Group at MIT (see Project Staff, page 10) will document findings from their investigations at the site for inclusion into journals and/or presentations at national conferences on education (such as American Educational Research Association and the National Educational Computing Conference).

### **Evaluation**

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#### **Formative Evaluation**

A full-time Museum staff member will oversee the formative evaluation process, performing observations and interviews with participating youth, Mentors, teachers, and youth program leaders. The formative evaluation period will involve the Clubhouse Advisory Board and Youth Advisory Team (described below), leaders of model programs serving adolescents from low-income neighborhoods, and educational specialists in the areas of adolescent development and the use of computers in education.

Twelve young people from the target audience for the Clubhouse will be recruited to serve as the Youth Advisory Team for the Clubhouse. This group will participate in shaping the design of The Computer Clubhouse. The Team will meet to look over the initial Clubhouse plans, express their reactions, and discuss with Museum staff ways the space and activities could be designed to best serve their needs. The Youth Advisory Team will also play a central role in the design of the Starter Software Packages.

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<sup>9</sup> Calculated based on 1,000 copies distributed, with each copy being used by an average of 50 students (two school years per copy, 25 students per class).

Members of the Team will come to the Museum to test out and critique early prototypes, suggest ideas, and help guide the revision process.<sup>10</sup>

Benchmarks for attaining the program goals (outlined on page 2) include youth interest (measured by interviews, observation, and repeat visits in the Afterschool Program) and self-reports of changing attitudes towards science, technology, and mathematic fields by interviews with participants. Evaluation will include examination of the participation of Mentors, interest level in various project areas and activities, use of software tools and Starter Software Packages, and response to the Clubhouse environment (including materials, layout, and design issues). Staff will also examine what type of transportation participants are using to reach the site and how often they are able to attend, in an effort to ensure that the youth who would most benefit from the program have access to it.

### **Summative Evaluation**

For summative evaluation, the Museum will hire an outside evaluation team to determine whether the project is meeting its goals (outlined on page 2). The evaluation team will conduct interviews of participants, group leaders, and teachers (upon arriving at the Clubhouse and after multiple visits) to determine the influence of the Afterschool and School programs upon participating youth, Mentors, and afterschool leaders and teachers bringing groups. The evaluation team will also help assess the effectiveness of the Starter Software Packages, initially within the Clubhouse environment, and ultimately within other museum, school, and home environments. The outside evaluation team will visit one year into the project and again at the end of the third year, producing written reports at both of these intervals.

### **Ongoing Evaluation**

Museum staff will continue to perform ongoing evaluation of The Computer Clubhouse programs beyond the initial intensive evaluation period by means of surveys and observations. The Museum has an excellent record for continuing improvements to its exhibits and educational programs, and The Clubhouse will also undergo continuing refinements as the result of this process.

### **Funding Sources**

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Over the last two years, the Museum has received first-time grants from the National Science Foundation, the National Endowment for the Humanities, NYNEX Corporation, and the Sloan and Hearst Foundations. Additionally, last year the Museum was able to secure exhibit, operating and in-kind support from more than 150 corporations and foundations. The Museum's ability to significantly increase its support over the last few years indicates that it will be successful in securing matching support for The Computer Clubhouse.

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<sup>10</sup> The Computer Museum has used this "Participatory Design" approach with great success in the development of a major, permanent exhibit called *Tools and Toys: The Amazing Personal Computer*. A class of 22 eighth grade students from the Martin Luther King School in Dorchester have visited the Museum several times and made numerous suggestions that have been incorporated into the design of the exhibit, due to open June 13, 1992.

The initial three years of funding will support the development and implementation of The Computer Clubhouse Afterschool and School Programs. Additionally, initial funding will be used to develop and disseminate educational materials developed in the Clubhouse, including the Clubhouse video, Starter Software Packages, and printed guide. Plans for long-term funding include: income from the sale of educational materials; fees paid by participating groups and individuals from non-disadvantaged communities, and continuing support from corporations, foundations, and government agencies.

## **Future Programs**

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Once the Afterschool and School Programs have been underway for one year, the Museum plans to add Clubhouse activities for two other audiences that have a profound influence on young people: teachers and families. The Teacher and Family Programs will increase the impact of the Clubhouse and generate income to help sustain the project beyond the three-year start-up period.

Although there are classrooms without computers, there are possibly more classrooms with computers that go *unused* or are poorly used because of the teacher's lack of confidence with computers. One of the primary reasons teachers fail to use computers in their classrooms is because they feel unprepared to do so.<sup>11</sup> Even those teachers who do use computers often avoid using the most powerful and exciting tools because they seem the most difficult. A three-week summer workshop at The Computer Clubhouse will provide teachers (grades 4 through 12) the time they need to experiment with tools in the Clubhouse and create their own computer-based projects. Museum staff also plan to hold teacher mini-workshops once a month, to help teachers learn about high-quality software appropriate for classroom use.

The Computer Clubhouse project will also be expanded to serve families. The Family Program will bring parents and children together to work on projects similar to those in both the Afterschool and School Programs. Mentors will not only help participating families build their projects, but they will also model for parents constructive ways to encourage their children's interests in computers and other areas.

## **Project Staff**

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### **Lead Staff from The Computer Museum**

Natalie Rusk, Ed.M., Director of Education at The Computer Museum, will serve as *Project Director* of The Computer Clubhouse. As Project Director, she will guide both the organization and the direction of The Computer Clubhouse programs.

David Greschler, Exhibit Developer for The Computer Museum, will guide the development of software for The Computer Clubhouse project. As *Software Development Director*, he will manage two other Exhibit staff members (and work with education staff, evaluators, the advisory boards, Mentors, and Clubhouse participants) in

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<sup>11</sup> *Power On!: New Tools for Teaching and Learning*, Congress of the United States, Office of Technology Assessment, September 1988.

the development of the Starter Software Packages and general preparation of software tools for use in the Clubhouse.

### **Clubhouse Core Staff**

The Museum will recruit a *Clubhouse Coordinator* to oversee the day-to-day operation of The Computer Clubhouse. The Museum will seek an educator with experience working with adolescents from underserved communities, as well as familiarity and interest in innovative uses of computers.

The *Clubhouse Assistant* will assist the Clubhouse Coordinator in carrying out the Afterschool and School Programs. The Assistant will schedule Mentor staffing, administer the drop-in membership program, and work with the Museum Group Visits Coordinator to schedule school and afterschool visits. The *Evaluator* will oversee the formative evaluation of the project.

### **Mentors**

A team of 20 *Mentors* will serve as consultants and role models to Clubhouse participants (see page 4 for further description of the Mentors' role). Approximately half of the Mentors will be volunteer staff; the other 10 will be compensated through hourly wages or work-study program reimbursement. The Mentors will be selected to represent a diversity of cultural and ethnic backgrounds. Museum staff will recruit the Mentors through volunteer coordinators at corporations and professional organizations (such as the National Action Council for Minorities in Engineering), and by contacting clubs and work-study offices at MIT, Harvard, Northeastern, and other local universities.

Five *Youth Mentors*, ages 10 to 15, will be recruited through participation in the Clubhouse and other local youth programs. Youth Mentors will be selected at the beginning of each year following an application and interview process.

### **MIT Media Lab Epistemology and Learning Group**

The project involves collaboration with the Epistemology and Learning (E&L) Group in the MIT Media Lab. Seymour Papert, Ph.D., Professor and Director of the Epistemology and Learning Group (and developer of Logo) and Mitchel Resnick, Ph.D., Assistant Professor (developer of LEGO/Logo and \*Logo) will serve as active advisors to the Clubhouse project.

The E&L Group has been responsible for several major educational-technology innovations, including Logo (a programming language for children) and LEGO/Logo (a computer-controlled construction set). The E&L Group is currently developing a new set of educational technologies (including the Programmable Brick and a massively-parallel version of Logo), with research funding from the National Science Foundation. Researchers from the E&L Group will make these new technologies available and research their use within the Clubhouse.

### **Consultants**

Planning will involve consultations with Alan Cohen, Director of Adolescent Programs at The Children's Museum and head of the "Studio 1015" project, and other experienced programming staff at The Children's Museum. In addition, Alan Cohen and other Children's Museum staff will lead staff development sessions for Clubhouse Mentors once every three months. Topics will include basic developmental theory, reviews of

current research on adolescence (such as the recent Carnegie Foundation report on adolescents), multicultural awareness, and how to handle difficult topics or dangerous situations (such as suspected drug abuse, talking about AIDS, and potentially volatile conflicts).

### **Advisory Boards**

The Clubhouse Education Advisory Board will include a total of 10 representatives from the following sources:

- local afterschool organizations serving low-income communities (such as the Boys and Girls Club of Greater Boston and local Girls Incorporated)
- parent organizations
- experts on involving youth-of-color in science, mathematics, and technology
- professionals and graduate students serving as mentors in existing programs
- educational software developers

The Museum staff will also assemble a Youth Advisory Team (mentioned in Evaluation section, above) to assist in planning of the Clubhouse. The Team will include youth representatives from clubs and schools in low-income communities. Youth Advisors will be selected with the assistance of leaders from local afterschool clubs and teachers from area schools. Youth Advisors should show interest in the Clubhouse project, yet reflect a diverse set of interests and concerns.

## Schedule

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### **July 1992-December 1992 Preparation**

- Recruit and meet with Clubhouse Education Advisory Board and Youth Advisory Team
- Develop Starter Software Packages
- Set up Clubhouse (computers and other equipment, materials, furniture, signs)
- Recruit Clubhouse Coordinator and Mentor staff
- Initial Mentor development workshop and preparation sessions
- Initial publicity campaign and direct mailing to schools and afterschool groups
- Create membership and reservation systems to handle Clubhouse Programs
- Schedule initial visits for youth from afterschool groups
- Arrange for initial drop-in memberships for individual youth through local schools

### **January 1993-June 1993: Opening and Intensive Formative Evaluation**

- Official Clubhouse opening (January 1993)
- School and Afterschool Programs begin
- Observations of Clubhouse participants by Museum staff evaluator
- Individual interviews and focus group sessions with participants, group leaders, teachers, and Mentors
- Evaluation meetings with Education Advisory Board and Youth Advisory Team
- Improvements of Clubhouse setup and activities based on formative evaluation
- Improvements to Starter Software Packages based on formative evaluation
- Continue to build adult Mentor pool
- MIT researchers begin research projects

### **July 1993-June 1994: Refinements and Off-Site Testing of Starter Software Packages**

- Initial evaluation and report by outside evaluation team
- Surveys of participants, Mentors, group leaders, and teachers measuring steps toward project goals (surveys on first visit, with follow-up survey after two months)
- Refine Starter Software Packages based on observations and survey results
- Refine School and Afterschool Programs and activities based on observations and survey results
- Direct mailing to additional afterschool groups and school groups (September 1993)
- Starter Software Packages evaluated in ten afterschool and school sites

### **July 1994-June 1995: Dissemination and Expansion**

- Finalize Starter Software Packages for dissemination
- Develop guide and video documenting Clubhouse program
- Market and distribute Starter Software Packages, guide, and video to educators nationwide
- Publicity on release of Starter Software Packages, Clubhouse guide, and video
- Develop Teacher and Family Programs
- Final evaluation and report by outside evaluation team

## **Sponsorship**

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The Computer Museum's Computer Clubhouse offers a unique opportunity for corporate and individual sponsors to be associated with a ground-breaking and highly visible program designed to serve the needs of underserved youth. The Computer Clubhouse project will educate and inspire young people about science, mathematics, and technology by providing access to innovative applications of computer technology. Not only will sponsors be part of a unique and important local public education project, they will help educators nationwide incorporate powerful computer tools into their educational programs.

Sponsors of The Computer Clubhouse will achieve local and national recognition through four major venues: educational materials developed at the Clubhouse, credit panels, national press releases, and marketing materials.

Funders' names will appear on the Clubhouse booklet, video, and Project Starter Software, which will reach a total of approximately 10,000 educators nationally. Sponsors will also be named on a credit panel at the entrance to the Clubhouse, which will be visible to participants as well as foot traffic passing along Museum Wharf.

The Computer Museum's Public Relations staff will undertake a publicity campaign on The Computer Clubhouse project. The Public Relations staff has had marked success in gaining local, national, and international media coverage for previous Museum exhibits and programs (including coverage in The Boston Globe, The Boston Herald, The Bay State Banner, Newsweek, The New York Times, The Today Show, The Christian Science Monitor, Business Week, San Jose Mercury News, and Popular Science). Major sponsors will be named in publicity releases on the opening of the Clubhouse as well as press releases on the publication of the booklet, video, and Starter Software Packages.

Sponsors' names will appear on advertisements and other marketing materials designed to inform residents in local communities of The Computer Clubhouse afterschool and school programs. The marketing campaign will be designed to capture the attention of youth, families, and teachers from diverse communities.

The Computer Clubhouse Budget

The Computer Clubhouse Budget

Total Project Cost: **\$545,596**

	Year 1 9/92-8/93	Year 2 9/93-8/94	Year 3 9/94-8/95	Project Total	Comments
<b>Staff</b>					
Director of Education	\$21,000	\$16,800	\$8,400	\$46,200	All salary figures incorporate benefits N. Rusk 50% Year 1, 40% Year 2, 20% Year 3
Clubhouse Coordinator	\$36,000	\$36,000	\$36,000	\$108,000	100% each year
Clubhouse Assistant	\$10,800	\$21,600	\$21,600	\$54,000	6 mos. Year 1, 100% Years 2, 3
Mentors (Adult)	\$17,441	\$29,068	\$29,068	\$75,577	Av.\$6.50/hr,43 hrs./wk.,2 Ment./hr.,52 wks./yr. 60% Year 1, 100% Years 2,3
Youth Mentors	\$4,212	\$7,020	\$7,020	\$18,252	Av.\$4.50/hr,6 hrs./wk.,5 Ment.,52 wks./yr. 60% Year 1, 100% Years 2,3
Software Dev. Dir.	\$31,500	\$10,500	\$10,500	\$52,500	D. Greschler 75% Year1, 25% Years 2 and 3
In-house Evaluator	\$30,000	-	-	\$30,000	100% Year 1
Hardware Engineer	\$2,600	\$1,300	\$1,300	\$5,200	S. Snow 1 mo. Year 1, 2 week Years 2,3
Graphic/Exhibit Designer	\$3,800	\$950	\$1,900	\$6,650	T. Groves 1 month Year1, 1 week Year 2, 2 weeks Year 3
Carpenter	\$5,600			\$5,600	D. Green 2 mos. Year 1
<b>Subtotal</b>	<b>\$162,953</b>	<b>\$123,238</b>	<b>\$115,788</b>	<b>\$401,979</b>	
<b>Consultants</b>					
Outside Evaluation Team	\$3,600		\$3,600	\$7,200	120 hours @ \$30 Years 2,3
Children's Museum staff	\$200	\$400	\$400	\$1,000	
<b>Subtotal</b>	<b>\$3,800</b>	<b>\$400</b>	<b>\$4,000</b>	<b>\$8,200</b>	
<b>Clubhouse Equipment</b>					
Computer Hardware	\$119,340			\$119,340	Seeking hardware donations (See attached budget)
Other Electronic Equip.	\$5,000	\$300	\$300	\$5,600	MIDI instruments, microscope, sensors
Computer Software	\$2,000	\$100	\$100	\$2,200	Seeking software donations
A/V	\$3,500			\$3,500	Monitors, VCR, video camera, audio equipment
Misc. Materials	\$6,000	\$1,000	\$1,000	\$8,000	LEGO Technic, aquarium, plants, animals, books, supplies
Maintenance contracts	\$2,500	\$2,500	\$2,500	\$7,500	
<b>Subtotal</b>	<b>\$138,340</b>	<b>\$3,900</b>	<b>\$3,900</b>	<b>\$146,140</b>	
<b>Clubhouse Renovation</b>					
Materials	\$10,000			\$10,000	Materials for building shelving, painting supplies
Carpeting	\$3,920			\$3,920	112 sq. yrds @ \$35
Electrical/lighting	\$5,000			\$5,000	
Furniture	\$7,000			\$7,000	15 tables @\$250 + 30 chairs @\$50 + 4 filing cabinet @\$250
<b>Subtotal</b>	<b>\$25,920</b>			<b>\$25,920</b>	
<b>Other Direct Costs</b>					
Educational Materials	\$3,000	\$1,000	\$1,000	\$5,000	
Direct Mailing	\$10,000	\$10,000		\$20,000	Notices sent to afterschool groups, schools re: programs
Telephone & Postage	\$100	\$100	\$100	\$300	
<b>Subtotal</b>	<b>\$13,100</b>	<b>\$11,100</b>	<b>\$1,100</b>	<b>\$25,300</b>	
<b>Dissemination Materials</b>					
Video			\$15,000	\$15,000	
Software Starter Packages			\$5,000	\$5,000	
Printed Guide			\$18,500	\$18,500	
<b>Subtotal</b>			<b>\$38,500</b>	<b>\$38,500</b>	
<b>TOTAL EXPENSES</b>	<b>\$344,113</b>	<b>\$138,638</b>	<b>\$124,788</b>	<b>\$607,539</b>	
<b>Income</b>					
Afterschool Program	\$5,625	\$11,250	\$11,250	\$28,125	25% of participants (non-disadvantaged) \$3/visit
School Program	\$6,764	\$13,527	\$13,527	\$33,818	60% of participants (non-disadvantaged) \$3/visit
<b>TOTAL INCOME</b>	<b>\$12,389</b>	<b>\$24,777</b>	<b>\$24,777</b>	<b>\$61,943</b>	
<b>TOTAL PROJECT COST</b>	<b>\$331,724</b>	<b>\$113,861</b>	<b>\$100,011</b>	<b>\$545,596</b>	

## The Computer Clubhouse Budget

### Attachment

### Clubhouse Computer Hardware

	Quantity	Cost	Total Cost	
Personal Computers	11	\$2,500	\$27,500	Seeking donations
486-based 50mz PCs for VR	4	\$3,000	\$12,000	Seeking donations
Virtual Reality equipment	1	\$56,000	\$56,000	Seeking donations
Workstation	1	\$10,000	\$10,000	Seeking donations
CD-ROM players	2	\$500	\$1,000	Seeking donations
Network modems	2	\$300	\$600	Seeking donations
Network nodes	17	\$500	\$8,500	Seeking donations
LEGO/Logo interface	4	\$310	\$1,240	
Programmable Bricks	5	\$500	\$2,500	MIT experimental technology (will be produced at cost)
<b>Total hardware cost</b>			<b>\$119,340</b>	

## ABOUT THE EDUCATIONAL ACTIVITIES PACKET

This Educational Activities Packet contains information and activities about computers. You can use sections of the Packet before, during, and after your visit to The Computer Museum. Even if you cannot visit the Museum, the Packet can help you learn more about computers.

Feel free to photocopy all or any of the pages in the Packet for your students or other teachers to use!

The Packet contains four major themes, each based on a major exhibit gallery in The Computer Museum. Concentrate on one theme per visit. The four themes are:

- **Can Machines Think?**  
(*Smart Machines: Robotics and Artificial Intelligence*)
- **What Can You Do With A Personal Computer?**  
(*Tools and Toys: The AMAZING Personal Computer*)
- **How Do Computers Work?**  
(*The Walk-Through Computer*)
- **Computer History**  
(*People and Computers: Milestones of a Revolution*)

For each topic, there are three sections: Background Information Sheets, Classroom Activities, and Museum Activity Circuits.

### Background Information

The Background Information Sheets explain the basic information and issues related to each exhibit topic. You can use this background information to introduce students to major computer topics. For classes planning to visit the museum, the experience will be enhanced if you prepare your students beforehand with the information in these sections.

### Classroom Activities

The Classroom Activities suggest projects or other activities that students can do to get hands-on experience with computer topics. They can be used as pre-visit or post-visit activities. These activities are easy to implement and give students the chance to explore the subject area covered in the Background Information Sheets.

### Museum Activity Circuits

The Museum Activity Circuits are designed to be used *during* a visit to The Computer Museum. Plan to use only one Activity Circuit during your visit so students have time to explore the rest of the museum. Copy enough Activity Circuits for students to work individually, with partners, or in small groups. Visitor Assistants will be available in the exhibit galleries to help you and your class with the exhibits.

There is an additional information sheet with the theme *The Computer And The Image* at the end of the Activities Packet.

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**The Educational Activities Packet is made possible by support from NYNEX.**

# **Teacher's Key**

**All of the Background Information sheets can be adapted for students to use at all age levels.**

**Use the following key as a guide to find out which activities we suggest using with different grade levels:**



**= Students in grades 3 through 5**



**= Students in grades 6 through 9**



**= Students in grades 10 through 12**

# Background Information

## Can Machines Think? - Smart Machines



Robots in films usually look, move, and even speak like people. But real robots behave very differently. A look at where real robots came from, what they are designed to do, and how they look will help you answer these questions:

**What are machines capable of? Can they think? Will they ever be able to?**

### The First Robots In Literature

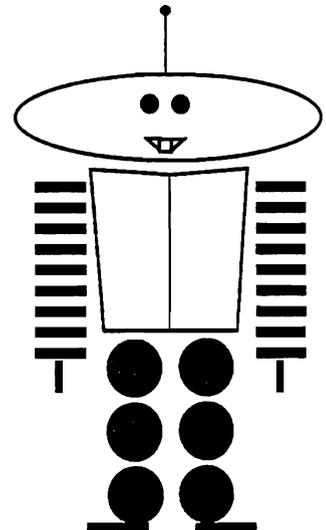
The idea of artificial life has been around for hundreds of years. But until the late 1950s, smart machines were only imaginary.

- In the early 1800s, Mary Shelley wrote the book *Frankenstein*. The being Dr. Frankenstein created turned into a frightening monster.

- In 1920, Karel Capek wrote a play called *R.U.R.* (Rossum's Universal Robots). In the play, a man named Rossum makes robots. "Robot" comes from the Slovak word meaning "worker." Capek's play started the use of the word "robot" to mean a human-like machine.

- In 1942, Isaac Asimov wrote a story about robots called *Runaround*. In the story, he listed three rules robots should be made to obey:

- 1 A robot may not harm a human, or allow a human to come to harm through inaction.
- 2 A robot must obey a human's orders unless they conflict with the first law.
- 3 A robot must protect itself unless this conflicts with the first or second law.



### Artificial Intelligence

The invention of computers in the early 1940s made robots a real possibility.

In 1949, only two years after the first electronic computer was invented, the debate about whether machines could think began. Some people, such as Dr. Geoffrey Jefferson, a British brain surgeon, said that machines would never be able to equal the human brain. Dr. Jefferson said that computers would never have feelings so they could never think like a person.

Alan Turing, a mathematician, wrote that he could see no reason why machines would not be able to eventually equal human intelligence in *any* field. He believed it would be possible someday for machines to think. He developed the idea of a test, which is called The Turing Test. This test requires a computer to act like a person in a written conversation so well that it fools people into thinking its responses are coming from a person.



## **Background Information – Smart Machines**

### **Robot History**

The first computer-controlled robots were made only about 30 years ago—in the early 1960s. Since the 1960s, computers—and robots—have become smaller, cheaper, and more powerful. The early robots were made by researchers in laboratories. For example, the Rancho Arm was designed at Rancho Los Amigos Hospital in 1963 to aid a paralyzed person.

Most robots used today are actually robot arms. Robot arms do factory jobs that require doing the same task over and over. They weld parts of cars together, put together plastic toys, package bread, and many other repetitive tasks.

### **What Else Do Robots Do?**

A spill occurs at a nuclear waste site. Who will clean it up? Perhaps a robot can. Scientists are developing robots that can work in situations that would be dangerous or impossible for human workers. Robots can work with harmful chemicals, explore the ocean floor, and travel into space.

### **Intelligent Machines**

Robots have computers for brains. People write the computer programs, or instructions, that tell robots what to do. Computer programs that attempt to make machines think are called Artificial Intelligence (AI) programs. For example, the computer program, Haymarket is an Artificial Intelligence program that lets you bargain for a box of strawberries.

### **What's Hard For Robots?**

Computers are good at some things that are difficult for people, but what a three-year old can easily do, no robot has yet to accomplish. Walking is a good example of this. It's very difficult to build and program a real robot that can balance when walking.

Having a simple conversation is another example. It takes a lot of instructions to program a robot to understand what people are saying. Computer programmers write *voice recognition* programs that people use to talk to a computer instead of typing in words. People who have disabilities with their hands benefit from this, as well as surgeons or pilots who need to keep their hands free for other purposes.

### **What Would You Want A Robot For?**

If you built a robot, what would it be able to do? In the Smart Machines exhibit, you can see robots with different abilities. Robots and other computer-controlled machines have the potential to help with daily tasks. Some people only want robots for entertainment. Would you like a robot to clean your house? Cook your food and bring it to you? Accompany you on the piano?

# Classroom Activities

## Design Your Own Robot - Smart Machines



### What Kind Of Work Will Your Robot Do?

(Check all that apply)

- Work that is dangerous or difficult for people
- Provide entertainment
- Provide companionship
- Repetitive, dull tasks
- Help people with disabilities
- Other type of work:



Which senses would you use to do these things? (Check)

- |                                  |                                |
|----------------------------------|--------------------------------|
| <input type="checkbox"/> Hearing | <input type="checkbox"/> Smell |
| <input type="checkbox"/> Sight   | <input type="checkbox"/> Taste |
| <input type="checkbox"/> Touch   |                                |

Robots use *sensors* to gather information that we use our senses for.

### What Type Of Sensors Will Your Robot Need?

- |  |                                       |
|--|---------------------------------------|
| <input type="checkbox"/> Sonar (measures distance) | <input type="checkbox"/> Touch        |
| <input type="checkbox"/> Sound                     | <input type="checkbox"/> Smell        |
| <input type="checkbox"/> Optical (sight)           | <input type="checkbox"/> Other: _____ |

### What Physical Features Will Your Robot Need?

- Arms
- Wheels
- Legs
- Other features: \_\_\_\_\_

# **What Will Your Robot Look Like?**

***Draw A Design Of Your Robot:***

## ***Extra Challenge!***



### **Build A Model Robot**

Build a model robot based on your design. If you have a robot construction kit like **LEGO/Logo**, you can use that. Otherwise, you can use scrap materials (such as cardboard boxes, tin cans, buttons, pipe cleaners, aluminum foil), and use duct tape, glue and/or wire to hold it together.



# Activities For The Senses



Our five senses give us information about the world, and our brain makes us react. Most robots have sensors to tell them what is going on around them. A robot's computer interprets the signals from the sensors.

You can program a robot to move forward for 10 seconds. But what if a wall is in the way? Unless the robot has sensors, it will crash into the wall. If the robot has touch sensors, you can program it to move forward until it touches the wall, and then turn right.

## Compare Your Senses To A Robot's:

### How Do You Sense This?

Trace letters in the palm of your partner's hand. Can s/he guess the letters? \_\_\_\_\_

**Touch**

Pick an object in the room without letting your partner know what it is. Now describe it, as if s/he had never seen one like it. Can s/he guess what it is? \_\_\_\_\_

**Vision**

Ask someone to say a word or sentence in a different language. Could you hear the sounds they were making? \_\_\_\_\_  
Could you understand them? \_\_\_\_\_  
Your ears hear the sounds, but your brain makes sense of those sounds.

**Sound**

Smell is the most primitive sense. People often connect certain smells to memories. Can you think of a smell that reminds you of something?

**Smell**

What is the smell? \_\_\_\_\_  
What does it remind you of? \_\_\_\_\_

Often when you think you are using your sense of taste, you are really using your sense of smell. Close your eyes and hold your nose tightly. Ask your partner to give you a piece of either apple or potato. Can you guess which one s(he) gave you?

**Taste**

### How Does A Robot Sense This?

A robot with touch sensors can be programmed to sense when something touches it. Feeling things with a thick glove on is somewhat similar to how well a robot can feel. Have your partner put on the glove. Can s/he guess the letters?

Some robots can identify some objects, but most cannot. No robot today could look around your room and describe everything that is there.

Ultrasonic sensors let robots hear sounds we can't. But robots can't necessarily understand what they hear. It takes complicated computer programs to make a robot understand even just a few spoken words or phrases.

Smells are just chemicals. Robots can sense a smell if they have a material that reacts to the chemicals that make up the smell. These robots could be used in chemical labs to detect dangerous leaks.

Robots aren't built to sense taste. Most don't really need this sense. Can you think of when they might?

# Museum Activity Circuit

## Can Machines Think? - Smart Machines

①

②

### Robot Theater

This 10-minute show brings to life 25 historic robots.

Which robot in the show do you find most interesting?

Check off what this robot uses:

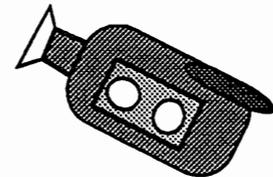
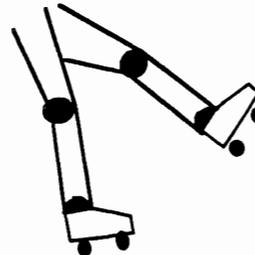
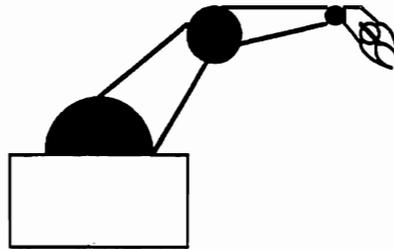
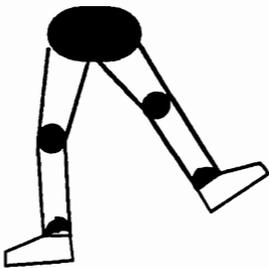
arms  fingers  legs  wheels  camera

other: \_\_\_\_\_

What do you like about this robot?

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### Haymarket

Try bargaining with an artificially-intelligent strawberry vendor.

Which storekeeper did you choose?

Nora Logical (more than 100 rules)

Ho Nin (30 rules)

Noah Budge (8 rules)

What was the original price of the strawberries? \$ \_\_\_\_\_

How much did you pay for them? \$ \_\_\_\_\_

What was the difference? \$ \_\_\_\_\_

**Extra Challenge:** Can you bargain with the storekeeper and buy the crate of strawberries for less than \$5?



## Museum Activity Circuit - Smart Machines

### LEGO/Logo

You can see three LEGO machines in this glass case. They are hooked up to this computer .

Try this activity using simple instructions to make the machines move:

Type in: **FD 3**

What happened? \_\_\_\_\_

Type in: **BK 5**

Did another machine move when the robot moved backward? \_\_\_\_\_

Which one? \_\_\_\_\_

If you built a machine out of LEGO, sketch what it would look like:

*What would you program your machine to do?*

---

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### Color the States

You use your voice instead of typing on a keyboard to play this game.

Does the computer have any trouble understanding what you are saying?

Yes

No

Does the computer understand if you speak....

**YES**

**NO**

slowly.....

\_\_\_\_\_

\_\_\_\_\_

using a very high voice.....

\_\_\_\_\_

\_\_\_\_\_

using a very low voice.....

\_\_\_\_\_

\_\_\_\_\_

with a different accent.....

\_\_\_\_\_

\_\_\_\_\_

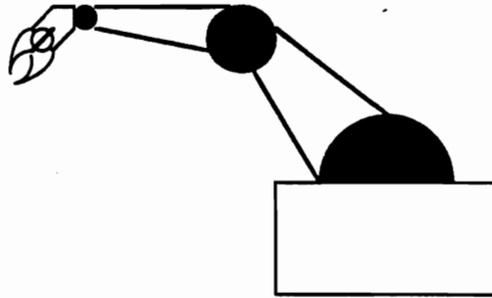
# Museum Activity Circuit - Smart Machines



## Vanna: The Robot Arm

This robot arm can arrange alphabet blocks to spell names and other words.

Try typing your name in the computer and see how the robot arm picks up the blocks.



How do you think the robot arm knows where each block is?

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## Aaron - The Computer Artist

Aaron is a computer programmed to draw pictures of plants and people. Aaron draws a different picture each time.

What do you think of Aaron's latest drawing? It is \_\_\_\_\_

Do you think the computer is being creative?

- Yes
- No
- Not sure

## Height Sensor

The computer Height Sensor uses sonar to measure people's height.

The sonar sensor the Height Sensor uses is the same sensor that measures distance on a Polaroid camera.

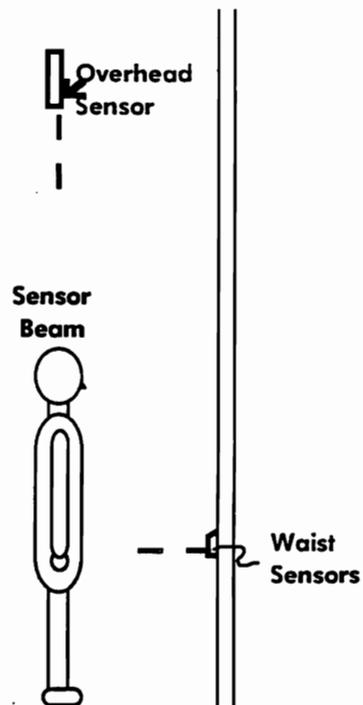
Can you trick the Height Sensor?

- Yes
- No

If so, how did you do it?

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# Background Information

## Tools & Toys



### What Can You Do With A Personal Computer ?

Here are some of the many amazing things you can do with a personal computer:

#### Write

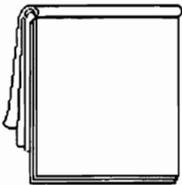
Using a **word processing** program to write allows you to experiment with your ideas easily. Editing documents is very simple using the *cut* and *paste* features. With these, you can easily move text around and experiment with the changes.



Besides helping you to follow your creative impulses, word processing programs do some tedious tasks, like proofreading, almost instantly. A computer **Spellchecker** uses a dictionary of stored words to check the words you've written. If it locates a misspelling, you can ask for a suggestion to correct it. You can use a **grammar checker** to help locate errors. Correcting grammar is more difficult for a computer than correcting spelling because there are a lot of rules and exceptions, but can be useful as a proofreading aid.

#### Create Art

A **paint program** lets you create and experiment with graphic images. With some computer programs, you can even attach sound to your image! **Desktop publishing** programs let you move graphics and text around the screen and create newsletters, postcards and books.

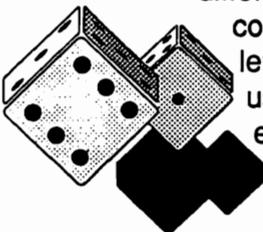


Using **computer animation**, you can create 3-D objects that look realistic, and make them do unrealistic movements. Science fiction films, like *The Abyss* often use computer animation for creating unique special effects.

Designers use **computer-aided design** (CAD) to create 3-D models that they can examine from any angle. **Virtual Reality** lets you become part of an artificial or "virtual" world on a computer. For example, if a computer has a virtual building, you could walk inside it and explore the rooms. Or, in another virtual world, you could take a trip through the human body, exploring blood vessels, lungs, and the brain.

#### Play Games

Although you may have played some type of computer game, are you aware that there are many different kinds? Some computer games are **simulations**, programs that let you control a system or an object in a system. For example, a flight simulator program lets you feel like you are flying an airplane. People training to be pilots actually use flight simulators to learn how to fly. You can learn about how ants live by exploring a simulation of an ant farm. You can explore the simulation as an ant, or you can change characteristics in the ant farm and see the results.

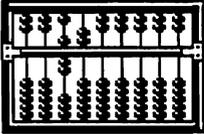




## Background Information - Tools & Toys

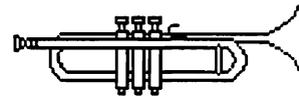
### Do Math

You can use a computer to create visual models based on mathematical equations. You can also make changes to the dimensions of your model and see how your changes affect the shape and size of the model.



Computers are quick at making calculations. If you just won a million dollars, you could use a **spreadsheet** program to help you budget your money for expenses like a house or car. If you wanted to see how your budget would look if you bought a more expensive car and took a trip to Hawaii, you would enter these new costs and the spreadsheet program would calculate the changes in seconds.

### Make Sound



You can use a computer to compose and edit music. **MIDI** (Musical Instrument Digital Interface) is a common language used for making music with computers. MIDI records information about a note you play on an instrument, such as how long, at what pitch, and how hard you play it. You can then assign these MIDI notes to any instrument sound that you want. So you can take a series of notes you've played, or a track using the piano sound on a synthesizer, and change it instantly to a drum, violin, or trumpet track.



You can make songs using a computer and a **sampler**. Pop musicians and rappers use short, digital samples (pieces) of songs to add to their own songs. For example, MC Hammer sampled from the song "Superfreak" to create his hit song, "Can't Touch This". Sampling is also a way to reproduce instruments and voice recordings for playing on a keyboard.

### Share Ideas

Communicating through electronic mail allows people to send and receive messages to someone at a computer at another location. This useful way of exchanging information with other computer users is called **networking**. Connecting a modem to your computer and a phone line connects, or networks, you with others also using a modem. This enables you to communicate with more than one person at a time and work cooperatively on a project. In the future, more and more computer networks will connect computers at school, home, and work so you can communicate and do work with others using computers even if they are in a different country! Imagine a videophone which you can use to call up and see the person you are talking to!

### Get Information

There are many different **databases**, or sources of information, that are accessible with personal computers. An **online** database is continually being updated with current information, such as news, weather information, and sports scores. A large quantity of data doesn't have to be written in text or lists. For example, a database on the human anatomy might have a picture of a human body on the screen. You would use a mouse to click on areas of the body where you would like more information. By clicking on simple tools, you could focus your research very quickly to find the information you are looking for, without having to read through a lot of text.

## Classroom Activities - Tools & Toys

2  
3

### Write A Software Review!

Tried any good computer programs lately? Any not so good ones? Try writing a software review and let others know about it. Spend time using the computer program you want to review. First, pick a software program to review. For example, you could try out a program used for:

*Writing*  
*Playing Games*  
*Solving Math Problems*  
*Editing Music*  
*Organizing Information*

After using the program, jot answers to the questions below. This will help you outline the important points. Then write a brief review of the program. It can be positive or negative, but you also want to hold the reader's interest, so be creative!

**What program did you use?**

**What is the program designed to help you do?**

**Did you like using this program?**

**Was it easy or difficult to use?**

**Did it have graphics or just text?**

**How was the speed of the program?**

**What types of computers can you use it on?**

**Do you consider this software program to be a *tool* or *toy*?**

**How do you rate this program: overall? (Circle)**  
**excellent   good   average   poor**

**Whom would you recommend this program to?**

## Classroom Activities - Tools & Toys

### Where Are Computers Used?

You can do this activity alone or with others. Find five different places in your town where computers are used. Write down where you saw the computers and what they were being used for in the log below.

You might not have to go out of your way to find the computers. If you ever do the following, you have a good chance of seeing and/or using a computer...

- ... **Look for a book in a library**
- ... **Go out to eat in a restaurant**
- ... **Shop**
- ... **Rent a movie**

### Computer Log

Where did you find computers?	How were they used here?	Did the people like using the computers? (Workers or customers)	Did you use one here?

## **Classroom Activities - Tools & Toys**



### ***Debate Issues About Computers***

Choose one debate topic each week for students to consider and discuss.

***Do Computers Improve Your Writing?***

***Should Students Use Computers To Do Their Math Homework?***

***Are Computer Games Educational Or Are They Just A Waste Of Time?***

***Do You Think Computers Will Someday Replace Books?***

***Do Computers Save You Time?***

# Museum Activity Circuit

## Tools & Toys



### What Can You Do With A Personal Computer?

(Find the following exhibits with a partner and try doing these activities in any order.)

#### You Can...

##### ... Create an ant colony using *SimAnt*:

Try Using *SimAnt* to explore life as an ant in an ant colony. The way ants behave on the screen is based on the way real ants behave.

*Can you make your yellow ant...*

- Pick up a piece of food and bring it back to the nest?*
- Dig a tunnel?*
- Eat?*

Do the ants in this computer simulation seem to move around the way the real ants do? (Circle one)

Yes      Sometimes      Not really      *Explain:* \_\_\_\_\_

Circle the tasks you find the real ants in the ant farm doing:

Digging      Eating      Carrying Food

##### ... Use the *SampleStick* to make rap music:

*Sound samples*, or pieces of songs, have been stored in the computer's memory. Move the joystick around to try out different samples and create an original rap.

- Did you work with other people to make up your rap?
- How many samples did you use in your rap?
- If you were in a rap group, what songs would you take samples of?
- What would you call your band? \_\_\_\_\_

## Museum Activity Circuit - Tools & Toys



### ... Use digital video to *Make Your Own Commercial*:

Try this out with a couple of other people. You can record yourself on the video camera and watch it played back on the computer. Try editing your commercial by filming something you do and adding it in the commercial.

- What did your group do in the commercial?
- Did you talk or sing on your video?
- If you could make a movie, circle what kind it would be:

Adventure      Horror      Documentary      Comedy      Romance

Other: \_\_\_\_\_

### .....**NOISE-MAKING MACHINES**.....

*Find a computer that makes some kind of noise when you use it.*

What noise does it make?

Does it have different sounds or just one?

How do you think the computer makes the noise?



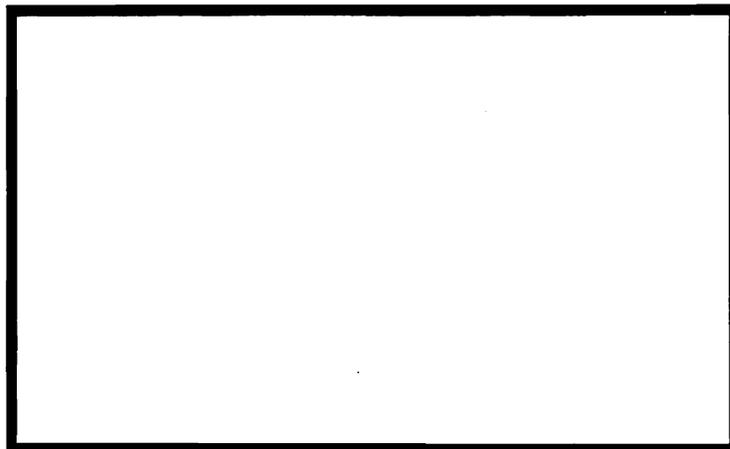
### ... Move around in *Virtual Reality*:

With virtual reality, you feel like you are moving through a place on the computer screen in three dimensions!

Try finding the room in the virtual house you think was designed to be the kitchen.

Can you find different areas to move around in?

Draw a place you would like to explore using virtual reality:



## Museum Activity Circuit - Tools & Toys



### ... Be a mad scientist and do **Explosive Experiments:**

Two great things about doing these experiments on a computer are: one, you don't need goggles, and two, you can perform chemical reactions that are dangerous to do in a lab if you don't have a lot of experience.

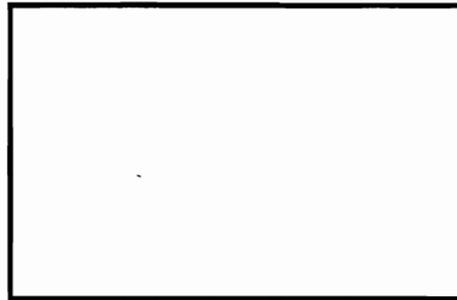
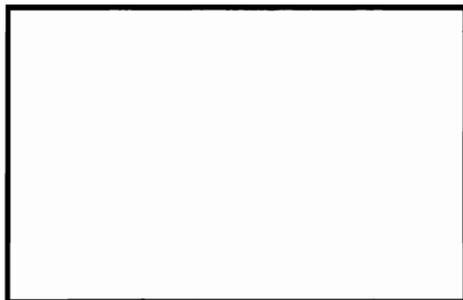
*Jot down notes in this log about an experiment you find interesting:*

<b>Experiment Log</b>
<b>What was going on in the experiment?</b> _____ _____
<b>What kind of reaction did it have? (Circle one)</b> Blew Up    Burst into flame    Melted    Disappeared    Other: _____
<b>What kind of noise did the reaction make?</b> _____

### ... Create a cartoon using **Computer Animation:**

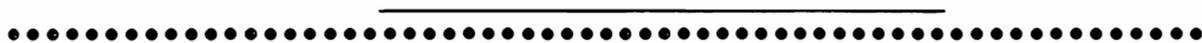
Decide what you would like the three objects to be doing in the cartoon, then use the tools to make your animation.

*Sketch the first and last frames from your cartoon:*



..... **TRIVIA MADNESS** .....

*How can you paint using a computer, without a keyboard, mouse, or trackball? (HINT: You can find out in a dark area of the exhibit)*



# Background Information

## How Do Computers Work?

### The Walk-Through Computer



#### A Giant Computer

What if you could walk inside a computer to see how it works? At The Computer Museum, you can. The Walk-Through Computer is a two-story tall desktop computer that you can explore to find out how computers work.

#### Using The World's Largest Desktop Computer

The Walk-Through Computer looks just like a desktop computer from the outside—except that it is twenty times normal size! As soon as you enter the Museum, you can see The Walk-Through Computer's giant *screen* displaying a map of the world.

The Walk-Through Computer runs a *software program* called "World Traveler." By pressing a key on The Walk-Through Computer's huge 25-foot keyboard, you can select the map of any continent in the world. The program then helps you find the shortest path between any two cities on the continent.

#### Getting The Program

Leaning against the wall in front of The Walk-Through Computer is a 6-foot high *floppy disk*. (Most floppy disks are only 3-1/2 inches or 5-1/4 inches square.) The giant floppy disk has a copy of The World Traveler program on it.

When you buy a computer game, writing program, or any other computer program, it is stored on a floppy disk. You can use a floppy disk to take a program from one computer to another, or to store your work. Floppy disks come in square plastic cases—but inside each is a round flexible piece of plastic. The program is stored as a pattern of magnetic bits on this piece of plastic.

#### Inside The Computer



When you type on the keyboard, you see the words appear almost instantly on the computer screen. How does this happen? The parts of the computer work so quickly that what seems like magic is actually a series of logical steps carried out very quickly inside the computer.



## Background Information - The Walk-Through Computer

### The Boss Of The Computer

The most important part of a computer is a computer chip called the *Central Processing Unit* (CPU, for short). (It is also known as the computer's *microprocessor*.) The CPU is sometimes nicknamed the "boss" of the computer, because it tells the other parts of the computer what to do. The CPU looks at each of the instructions from the computer program one at a time. It then sends signals to the other parts of the computer to carry out each instruction. The CPU also takes care of directing the flow of information inside the computer. It recognizes where the data is coming from and decides where it should go.

### Hard Disks

Like most computers today, The Walk-Through Computer has a *hard disk* built in. Some people compare the hard disk to a library, because you can store many computer programs and hundreds of pages of your work there.

A hard disk is made out of metal rather than plastic, and can hold hundreds of times more information than a floppy disk. You can copy programs and files from a floppy disk onto the hard disk (and vice versa). The information on the hard disk is saved, even when you turn your computer off.

### The Computer's Memory

The computer's main memory is called RAM, or Random Access Memory. The computer stores whatever you are working on at that moment in RAM. If you are writing a paper on a computer, what you are writing is stored in RAM.

The computer can get to any information in RAM very quickly—much quicker than it can get to what is on the hard disk. However, RAM can only hold a limited amount of information at a time—much less than a hard disk. RAM is made up of computer chips. If you want a computer to have more memory, you can add RAM chips to it.

RAM is only temporary memory. Everything in RAM disappears once you turn your power off. So, it is important to save your work on the hard disk or a floppy disk.

### How Do The Parts Of The Computer Work Together?

The parts of the computer work together to run a program. For example, when you press the letter "B" key on a computer, the computer's CPU receives a message that means: "the 'B' key was pressed." The CPU then gets the next instruction from RAM, which says: "IF a letter is pressed, THEN show the letter on the screen."

The CPU then gets the information for putting letters on the screen from RAM. It sends the information for the letter "B" over to the *video board* of the computer. The video board translates the information into a picture that shows up on the computer screen.

# Classroom Activities

## The Walk-Through Computer

①

②

### How Does A Computer Work?

**Here is the key to a common computer code called ASCII:**

A = 01000001	J = 01001010	S = 01010011
B = 01000010	K = 01001011	T = 01010100
C = 01000011	L = 01001100	U = 01010101
D = 01000100	M = 01001101	V = 01010110
E = 01000101	N = 01001110	W = 01010111
F = 01000110	O = 01001111	X = 01011000
G = 01000111	P = 01010000	Y = 01011001
H = 01001000	Q = 01010001	Z = 01011010
I = 01001001	R = 01010010	

**Can you decode this secret message? (read left to right)**

___ 01001111	___ 01001110	___ 01000101	___ 01001111
___ 01010010	___ 01011010	___ 01000101	___ 01010010
___ 01001111	___ 01010011	___ 01010100	___ 01001111
___ 01010000	___ 01001111	___ 01010010	___ 01000111
___ 01001111	___ 01010100	___ 01001000	___ 01000001
___ 01010100	___ 01001001	___ 01010011	___ 01010111
___ 01001000	___ 01000001	___ 01010100	___ 01000011
___ 01001111	___ 01001101	___ 01010000	___ 01010101
___ 01010100	___ 01000101	___ 01010010	___ 01010011
___ 01001011	___ 01001110	___ 01001111	___ 01010111



## Classroom Activities - The Walk-Through Computer

### Experiment: Mixing colors in light

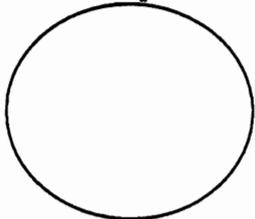
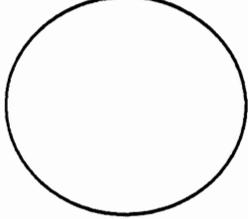
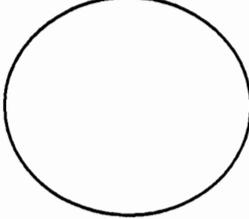
#### Materials needed:

- magnifying glass
- red, yellow, blue crayons, markers, or paint
- three flashlights
- red, green, and blue gel sheets

Look closely at a color T.V. or color computer screen using a magnifying glass. Do you see tiny lines or dots?

In these lines or dots are the colors red, green, and blue. Red, green and blue are the primary colors of light. They are combined to make every color you see on television and computer screens.

Primary colors of light are different from the primary colors you're probably familiar with from art class: red, yellow, and blue. Use crayons, paint or markers to make the colors in the circles below. Write the primary colors you use to make each color below the circles:

	<b>Purple</b>	<b>White</b>	<b>Green</b>
			
<b>Colors used:</b>	_____ _____	_____ _____	_____ _____

Now try to make those colors with light. You need three flashlights. Tape a gel sheet to each, covering the light. Now, make your room dark and experiment with these colors and try to make the same colors you did above. Which colored lights do you use to make...

	<b>Purple</b>	<b>White</b>	<b>Green</b>
<b>Colors:</b>	_____ _____	_____ _____	_____ _____

White light has all of the colors in it. (A rainbow happens when the light is split).

Try putting all three gel sheets over the flashlight. The red subtracts everything but red; the blue; everything but blue; and the green all but green.

Taking away these colors in light creates darkness. This is just the opposite with paints. A tube of white paint has no color in it. If you mix different colors of paints together, you'll get a dark color.

# Museum Activity Circuit

## The Walk-Through Computer



### Information Machine: Text

The **TEXT** panel of the *Information Machine* translates letters into the binary code that computers use. For example, the letter "B" in binary code is 01000010.

How would you write your name using binary code?

<b>Letter</b>		<b>Binary Code</b>							
—	=	—	—	—	—	—	—	—	—
—	=	—	—	—	—	—	—	—	—
—	=	—	—	—	—	—	—	—	—
—	=	—	—	—	—	—	—	—	—
—	=	—	—	—	—	—	—	—	—
—	=	—	—	—	—	—	—	—	—
—	=	—	—	—	—	—	—	—	—
—	=	—	—	—	—	—	—	—	—
—	=	—	—	—	—	—	—	—	—
—	=	—	—	—	—	—	—	—	—

### World Traveler Program

Try using the giant keyboard and trackball to run the World Traveler program on The Walk-Through Computer.

Which continent did you select? \_\_\_\_\_

What was your starting city? \_\_\_\_\_

Where did you end up? \_\_\_\_\_

How do you think the World Traveler program finds the shortest route between the two cities?

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## Museum Activity Circuit - The Walk-Through Computer

1

### Information Machine: Sound

2

Computers store sounds in the form of numbers.

3

Speak a word into the microphone and draw the pattern your voice makes in the first box:



Now repeat the word and draw the pattern it makes in the second box.

Are the patterns:

- Exactly the same
- Pretty similar
- Sort of different
- Nothing alike

## Now Walk Inside The Computer!

### CPU (Central Processing Unit)

The CPU (the giant chip in the middle) is controlling what happens inside the computer.

Which metaphor for the CPU do you think explains it best?

- Heart of the computer
- Brain of the computer
- Boss of the computer
- Other: \_\_\_\_\_

# Museum Activity Circuit - The Walk-Through Computer



## Hard Disk

How is information stored on the hard disk?

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## RAM (Random-Access Memory)

RAM is the place where the computer puts the information it needs to get at quickly. Computer programs are made up of instructions and information. Look into the screens in The Walk-Through Computer's RAM.

There are two different colors of squares moving around. The pink squares are carrying information, the green squares are carrying instructions.

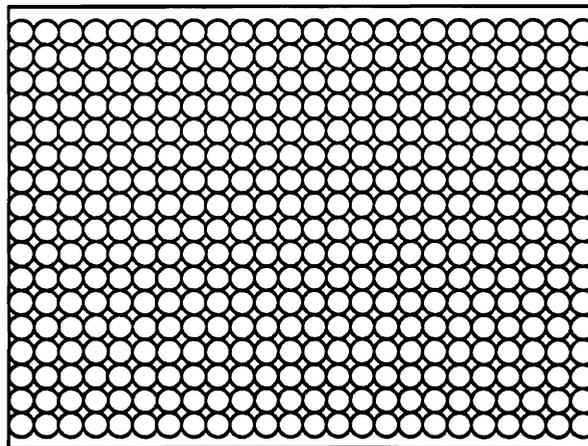
Write something you see in a pink square: \_\_\_\_\_

Write something that's in a green square: \_\_\_\_\_

## Putting Information On The Screen:

Here is a magnified view of a black and white computer screen. The individual dots on a screen are called *pixels*.

Draw a word or simple picture by filling in the dots. Hold it at an arm's length when you're done. Is it clearer when you look at it this way or up close?





## **Background Information People And Computers**

***How and why were computers developed?  
What impact did these developments have on society?  
What did people think about computers?  
How do you feel about computers?***

### **1930s: Before Computers - Punched Card Machines**

During the 1930s, President Roosevelt set up large agencies to help people out of the Depression. Punched card machines made the Social Security Administration and other large national programs possible. The machines kept track of names and numbers of millions of U.S. workers and senior citizens. Punched card machines were the predecessors of computers.

### **1940s: The Computer Is Born**

World War II brought pressure from the military and government to invent machines capable of solving complex problems. The Whirlwind Computer was one of the first computers and was the fastest of its day. It was created at the Massachusetts Institute of Technology (MIT) in the 1940s to calculate problems for the military. It used thousands of vacuum tubes (the size of small light bulbs) to compute numbers. It created so much heat that it needed large cooling systems so it wouldn't break down. These first computers were huge — the Whirlwind actually took up an entire building at MIT!

### **Early 1950s: Computers For Big Businesses**

As a result of the booming economy after World War II, companies produced more goods and grew in size. Large companies needed computers as tools to manage their businesses. General Electric was the first company in the U.S. to buy a computer. The Univac I was used by GE to keep track of its employees. Only the government, some universities and the largest businesses could afford computers at this time.

### **1960s: More Businesses Use Computers**

IBM introduced the IBM System/360 in 1963. By this time, computers had become vital to corporations and the government. Big businesses were becoming more powerful and used computers to collect and organize most of their information. Computers were a symbol of power and control to many people. Because more and more businesses kept records about people on computers, many people felt that their privacy was becoming threatened.

# Background Information – People And Computers



## Early 1970s: Minicomputers

The invention of transistors in the sixties, led to the development smaller, cheaper, and more efficient computers. Minicomputers were more compact and could go places a huge mainframe computer couldn't. As technology evolved, computer chips replaced transistors and minicomputers became even smaller.

## Late 1970s: Supercomputers

By the late 1970s, communication, travel, and the economy were becoming more international, and the world was becoming more complex. Supercomputers, like the Cray - 1, were built to help work on large and complex problems, such as designing supersonic airplanes and studying the global environment.

## 1980s: Personal Computer Power

In the 1980s, computers became available for personal use. Personal computers were affordable and made it possible for anyone to use a computer without being familiar with programming. Spreadsheet and desktop publishing programs popularized the use of computers in homes, schools, and offices.



The IBM PC was the first computer used widely in businesses. The Apple Macintosh first made its way into schools in the late 1980s.

## 1990s: Computers Are Everywhere

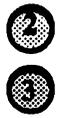
Today computers are everywhere. Some people use computers to gather and organize information. Others use them to create art or solve mathematical problems. You'll also find computer chips in VCRs, stereos, cars, microwaves, and other appliances.

## What Do You Think?

But are computers sometimes annoying? Do they pose a threat to privacy? Does anything bother you about computers? What would you (or do you) like to use them for?

# Classroom Activities

## People And Computers



### ***What Do People Think Of Computers?***

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#### **A Look At Computers And Popular Culture**

These books and movies all have one or more themes that relate to computers. Choose a movie or book from the list below or find a selection on your own. Pair up with someone who is also interested in this movie or book.

Keep these main questions in mind:

*What do the characters think about computers?  
Is this similar to the way you think about them?  
Is it similar to the way most people you know think about them?*

#### **Films:**

2001: A Space Odyssey  
Bladerunner  
Metropolis  
Cloak & Dagger  
Colossus: The Fobin Project  
Max Headroom  
Terminator (1&2)  
Tron  
Star Wars  
Star Trek  
Wargames  
Desk Set  
Total Recall  
Logan's Run  
The Lawnmower man  
The Empire Strikes Back\*  
Spaceballs\*  
2010: The Year We Made Contact\*  
Heartbeeps\*  
The Black Hole\*  
Star Trek: The Next Generation

#### **Books:**

The Left Hand Of Darkness  
-*Ursula LeGuin*  
1984 - George Orwell  
The Terminal Man  
-*Michael Crichton*  
Neuromancer  
Count Zero  
Mona Lisa Overdrive  
Burning Chrome  
(short stories) -  
*William Gibson*  
I, Robot  
-Isaac Asimov

## **Classroom Activities - People And Computers**

①

Plan to lead a group discussion with your partner on your topic. First present a brief summary of your book or movie. Then, discuss with the group the following issues:

②

**These questions will help you explore your topics:**

*Are computers a positive or negative influence in this story?*

*How important are the computers to the main theme of the book?*

*How do the computers interact with the characters in this story?*

*Are the computers very smart?*

*Do the computers have a lot of power and control?*

*Are the computers/robots sophisticated? Do you think people could ever really create such advanced machines?*

*When was it written?*

*What time period does the book or movie take place in?*

*Do you think the way the characters think of computers reflects the way real people thought of computers at the time the book or movie was written?*

*If your book or movie is set in the future, do you think what happens is a possibility in reality?*

## Classroom Activities - People And Computers



### Conduct An Interview

Find an older person who has used computers. Afterwards, write about some of the more interesting things you found out about them. Compare their opinions with your own opinions of computers.

#### Here are some questions to start off your interview:

*When did they first see a computer?*

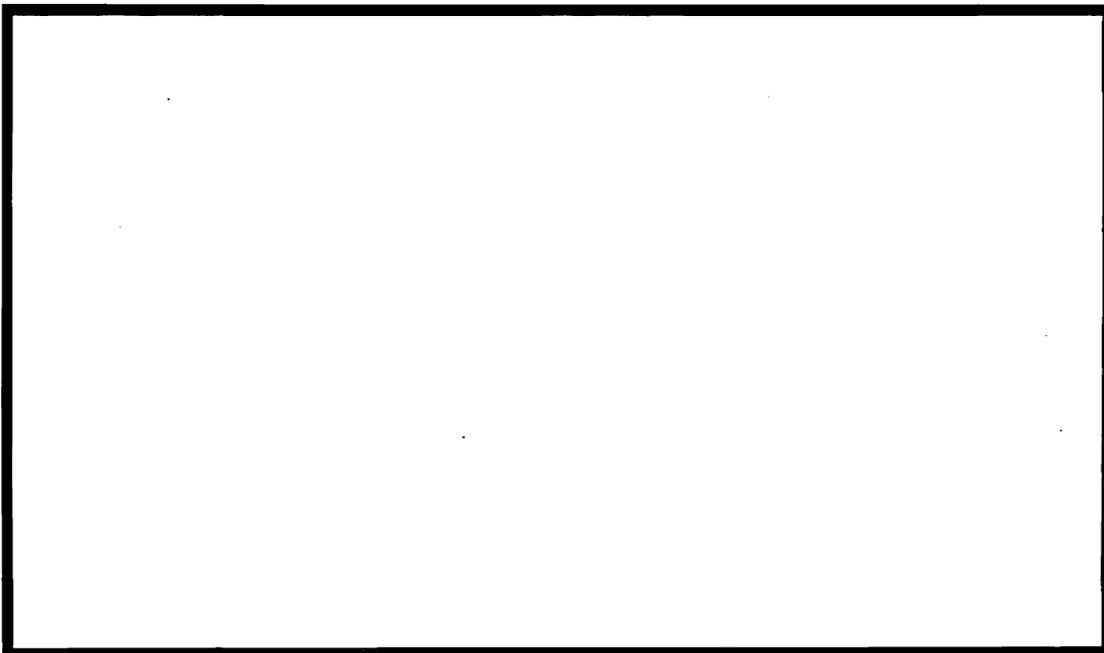
*What did they think computers did?*

*Did they like the idea of them?*

*When did they first use one? What jobs did they use the computer for?*

*What do they think of computers now?*

Ask the person you're interviewing what the first computer they ever saw looked like. Based on their description, sketch it in the space below:



# Exhibit Exploration Circuit

## People And Computers

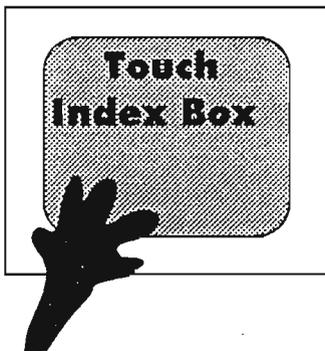
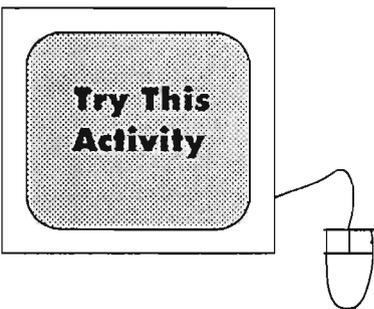
### Time Traveller Trivia

1

2

The People And Computers exhibit is divided into decades from the 1930s to the 1990s. The *KEY* below explains the two symbols that you'll see on these activity sheets.

### KEY

 <p>Some of the computers in the People and Computers exhibit have touchscreens. Touch the "index" box on the bottom of the screen to get a list of videos. Then touch the box next to the video you want to watch.</p>	 <p>Find the computer interactive with the same title as the one on the picture of the computer. Use the computer to find the solution to the trivia question.</p>
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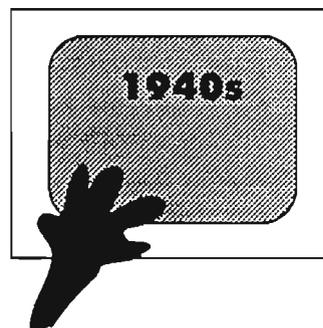
Try to answer the following trivia questions with a partner in any order:



**Decade: 1930s**

What was the name of the golden robot that counted children at the 1939 World's Fair?

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**Decade: 1940s**

What was one thing the computer operator did in the video, "Whirlwind at 3 am"?

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# Exhibit Exploration Circuit - People And Computers

1  
2

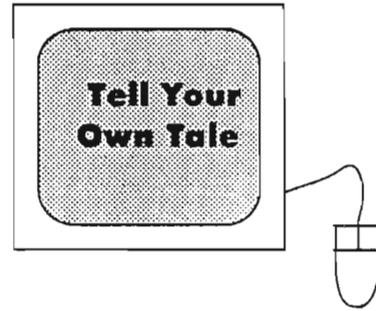


## Decade: 1950s

Watch the video on Grace Hopper. What was the first computer bug?

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## Decade: 1960s

Write a brief story on the computer and save it. What did you write about?

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## Decade: 1960s

Watch the Monkee's video. What does the computer misunderstand?

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## Decade: Early 1970s

What sound does the Batcomputer identify in the Batman T.V. show?

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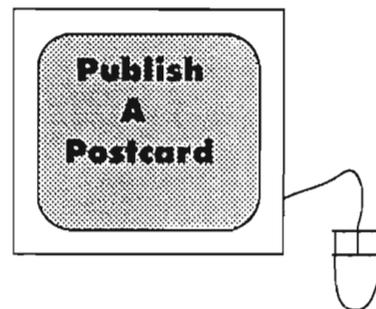


## Decade: Early 1970s

Watch the movie clip from *2001, A Space Odyssey*. What does Hal, the computer, ask Dave about?

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## Decade: 1980s

Use the program to make a postcard. Which pictures did you choose?

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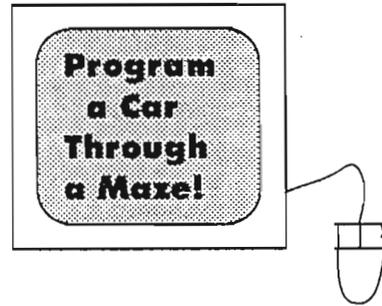
# Exhibit Exploration Circuit - People And Computers



**Decade: Early 1950s**

Watch the video, 'UNIC- A Computer You Can Walk Into'. What was a nickname people had for computers at this time?

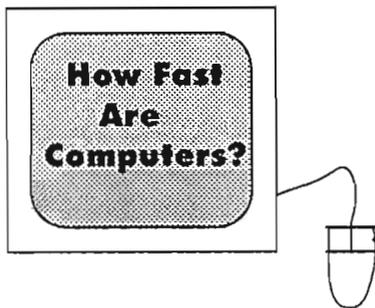
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**Decade: Late 1950s**

When you programmed your car through the maze, how many instructions did it take?

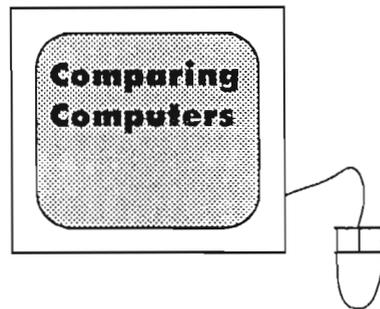
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**Decade: Late 1970s**

How many numbers could a Cray-1 have added in the time it took you to add the five numbers?

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**Decade: 1990s**

Compare a Macintosh 512 (1984) to an HP Palmtop computer (1991). Which is faster?

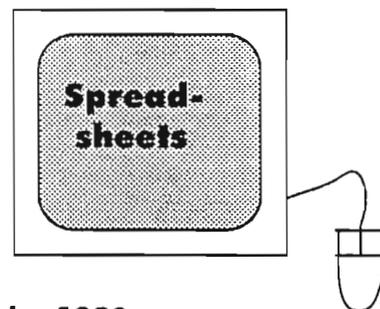
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**Decade: 1980s**

In the video of the commercial which introduced the Macintosh computer, what book is referred to at the end?

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**Decade: 1980s**

Which horses did you buy for the best deal with your \$300?

_____	_____
_____	_____
_____	_____

# Creating Images With: Computer Animation



Testing out new ideas on a computer is much simpler than on paper. Designers and engineers use computer graphic programs to experiment. Computer-Aided Design (CAD) allows them to experiment with an image on a screen to test changes, before the design goes into production.

Computer graphics are also used to create computer animation. Computer animation is now being used in many fields, such as art, film, advertising, and science. More and more cartoons are being made with computer animation. Computer animation lets cartoonists make and edit special effects more easily.

## How Is Creating Cartoons Different From Computer Animation?

### Cartoon Animation

A writer drafts a brief summary of the story. Cartoon animators then create a *storyboard*, an outline of the cartoon that looks like a comic strip.



Artists then create a layout, or design, of the way the characters and shapes will look and move.



Animators then sketch (usually in pencil) the key frames for the cartoon. Frames are usually 8" by 10". Assistants draw the frames in-between.



The frames are drawn in ink and painted very accurately, and are then filmed one frame at a time. One second of film has 24 frames.



Special effects like *panning* (moving the camera from side to side), *zooming* (making subjects appear larger or smaller), and *tilting* (moving the camera vertically) are difficult to do with cartoon animation.



### Computer Animation

Computer animators don't need to write out a storyboard. They can work directly from an idea or concept and begin drawing and painting. They can easily add or change details as they create.

Computer animators use graphic editors to create their designs, characters, and objects. They can use also use 3-D modeling programs to create 3-D objects to add to the animation.

To *animate* an object (make it move), computer animators still draw the key frames for the object, but the big difference is that the computer calculates the in-between frames automatically.



The drawing and painting is usually completed by this stage, and ready to be edited a final time. To film the cartoon, the key frames and the computer generated in-between frames are videotaped.

Computer animators can create a 3-dimensional world! When "filming", they can change the perspective of the camera. For example, if the image on the screen is of a car racing down a mountain road, the computer can act like a camera that's filming from inside the scene (e.g.; from the driver's perspective). They can also use this technique to pan, zoom, or tilt.

## WHAT IS THE COMPUTER MUSEUM?

The Computer Museum is the world's only museum devoted to the past, present and future of computers. Nearly 100 hands-on exhibits allow you to explore computer technology, history, and a wide range of applications, including computer graphics and robotics. The Computer Museum is a unique place where you can experiment, learn, and have fun while discovering how computers work and what they can do.

## WHAT WILL WE SEE AND DO?

*In The Computer Museum, you will be able to:*

Walk inside a two-story working model of a desktop computer and find out how computers work.

Travel 50 years through time to explore how computers have changed our lives in the new exhibit, *People and Computers*.

Play a computer piano that plays along with you or listen to music composed by a computer.

See real robots and learn what they can--and cannot--do in the multimedia Robot Theater.

Use a voice-activated computer to paint a map of the United States.

Create your own designs and computer animation.

Try out innovative educational software.

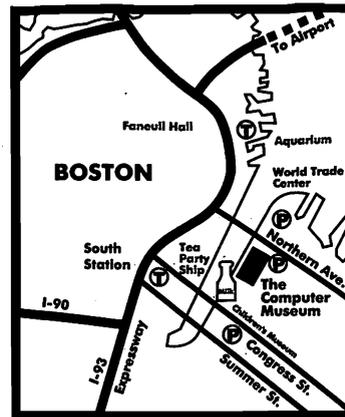
Bargain over the price of a box of strawberries with an artificially intelligent fruit vendor.

*And more!*

## WHY VISIT THE COMPUTER MUSEUM?

The Museum is an exciting place to experience the increasing role of technology in our lives today. See innovative computer exhibits bring science, history, and art alive as never before!

## HOW DO I GET THERE?



Follow the signs displaying a giant milk bottle, our landmark, to Museum Wharf where you can also find The Children's Museum, the Tea Party Ship & Museum, and many restaurants.

**By Subway:** Take Red Line to South Station. Walk across the Congress Street Bridge.

**From the North:** Expressway (I-93) south to exit 23 (High and Congress Sts.). First left onto Congress, and across the bridge.

**From the South:** Expressway (I-93) north to Atlantic and Northern Ave. exit. Immediate right over the Northern Ave. Bridge and right again on Sleeper St.

**From the West:** Mass. Pike (I-90) to Downtown Boston, South Station exit. Go through three lights, onto Congress St. and across the bridge.

**For information, please call (617) 426-2800**



**The  
Computer  
Museum**

Museum Wharf  
300 Congress Street  
Boston, MA 02210

Nonprofit Org.  
U.S. Postage  
PAID  
Boston, MA  
Permit No. 55897

# The Computer Museum

EDUCATIONAL  
**GROUP VISITORS**

**Planning Guide**

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**ARE RESERVATIONS REQUIRED?**

Reservations for groups of ten or more should be made at least three weeks in advance of your visit. You can make reservations by calling (617) 426-2800 ext. 334, weekdays, 9am-4pm. When you call, please have the following information ready:

*Date and time you would like to visit.*

*Name, full mailing address, and daytime telephone number of your group or school.*

*Number of students and adult chaperones--we require one chaperone for every ten students. (We can accommodate up to 75 people every half-hour.)*

*Name of group leader.*

*Grade level of group. (Recommended for ages 8 through adult.)*

If you need to cancel or change your visit, please notify us as soon as possible.

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**WHEN IS THE MUSEUM OPEN?**

*September to Mid-June  
Tuesday-Sunday  
10am-5pm*

Closed Mondays, except Boston school vacations and holidays.

*Mid-June to September  
Open daily 10am- 6pm  
Friday night until 9pm*

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**HOW MUCH DOES IT COST?**

Group admission for ten or more:  
Students-\$4.00  
Adults-\$5.00  
Chaperones free (1 per 10 students)

Full payment by cash, check or credit card is required the day of your visit. Purchase orders can be arranged prior to your visit through the Group Reservations Office. Groups from underserved communities should inquire about reduced admission programs.

Educators: *Admitted free.*

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**HOW SHOULD I PREPARE FOR OUR VISIT?**

You are encouraged to visit The Computer Museum before bringing your group. All educators are admitted free at any time. Special Museum orientation sessions for groups of teachers are available free of charge. Call (617) 426-2800 ext. 334 for more information.

Three weeks before your group visit, we will send you confirmation materials, including an Educational Activities Packet. The Packet provides materials to prepare you and your group for a visit to the Museum. The materials include an introduction to each of our major exhibits, classroom idea sheets, and Museum Activity Sheets that students can work on during their visit.

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**CAN I ORDER THE EDUCATIONAL ACTIVITIES PACKET?**

Yes, additional Educational Activities Packets are also available for order through The Computer Museum Store. Call (617) 426-2800 ext. 307 or send \$5.00 per packet (check or money order only) to The Computer Museum Store, 300 Congress Street, Boston, MA 02210.

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**WHAT WILL OUR VISIT BE LIKE?**

When you arrive at the Museum, your group will be met by a Visitor Assistant who will give a short orientation to the Museum. After the orientation, your group will then have the chance to explore the Museum on its own. Special presentations and tours are offered periodically throughout the day. Check the Museum Activity Map when you receive your confirmation for the times and meeting places of these activities.

Chaperones must stay with the students in their group at all times.

---

**IS PARKING AVAILABLE NEARBY?**

Public parking is available in a lot on Sleeper Street for \$5.00/day. Free parking for buses is available on Northern Avenue.

For cars and vans carrying disabled visitors, a limited number of parking spaces are available in front of the Museum. If spaces are unavailable, visitors may be dropped off in front of the Museum's elevator before the driver parks off-site.

---

**WHAT ABOUT LUNCH?**

Sorry, we have no indoor eating facilities, but you may eat outside on Museum Wharf benches, or on your bus. The McDonald's in the Museum Wharf building is open year-round and has indoor seating. Advance reservations for groups should be made by calling (617) 482-1746.

The Hood Milk Bottle on the Museum Wharf deck serves salads, ice cream, frozen yogurt, and beverages from April through October.

Plan to eat before or after your visit, as there is no re-entry for groups.

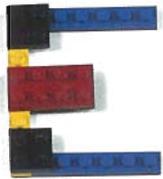
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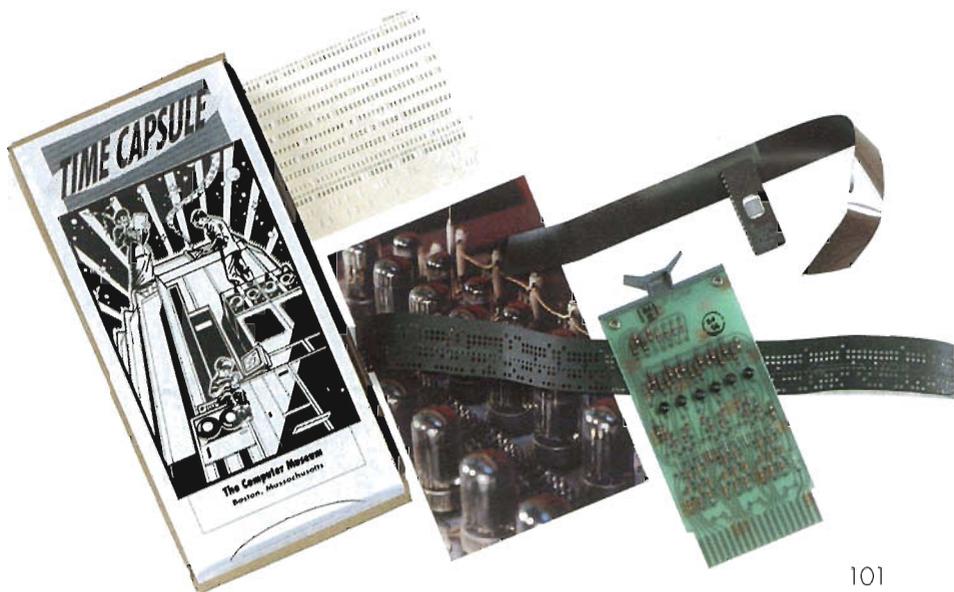
**CAN STUDENTS VISIT THE COMPUTER MUSEUM STORE?**

Yes, we encourage visiting groups to browse in the Store. The Store offers gifts and souvenirs related to computers, many of which are priced under \$3.00. Every 10 students must be accompanied by an adult supervisor when entering the Store. Due to space constraints, *no more than 20 students are allowed in the Store at one time.*

*Teachers can request  
The Computer Museum Educational Catalog  
by calling (617) 426-2800, ext.307*

**The Computer Museum Store**





101

**Time Capsule**

Available exclusively through The Computer Museum, our Time Capsule of computer history is an activity kit full of real computer artifacts, like punched cards, magnetic tape, and a minicomputer module.

With items representing the past 50 years of computer technology, this kit helps demonstrate how rapidly this technology has changed, making computers smaller, faster, and cheaper.

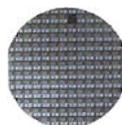
The kit is complete with an informative guide that explains every artifact and offers activities to explore each one.

Time Capsule, designed especially for ages 8-15, \$4.95. (101)

**Silicon Wafer**

These wafers represent one phase in the production of a microchip. Each wafer is a slice from a silicon crystal onto which microchip circuitry is etched. These silicon test wafers, 2" in diameter and a fragile 1/30" thick each contain tens to hundreds of microchips.

Silicon Wafer, \$3.50. (102)

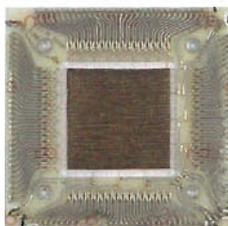


102

**Core Memory**

Here's an actual 1,024 bit core memory plane from Control Data Corporation's CDC 6600. Designed by Seymour Cray and Jim Thornton in 1964, the CDC 6600 was the fastest computer of its time. Each core plane consists of tiny intersecting wires that thread tiny magnetic doughnuts. Each doughnut holds a positive or negative magnetic charge and equals 1 bit. This type of memory storage device was used extensively in the '50s and '60s.

Core Memory, \$7. (103)



103

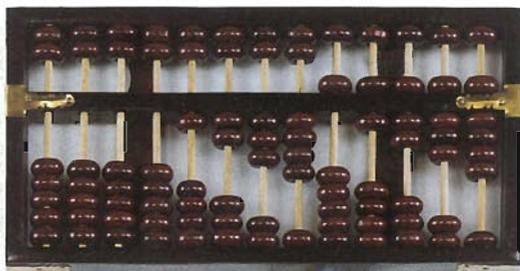
### Calculating Instruments

*These historic calculating devices can show students how people from diverse cultures solved arithmetic problems before the age of electronic calculators.*

#### Abacus and Manual

Dating back to the 5th century BC, the abacus is one of the earliest calculating devices, and continues to be used in Asia to this day. This Chinese abacus comes with a manual covering the history of the abacus, its uses, and easy-to-follow instructions. 5" x 10".

Abacus and Manual, \$8. (201)



201

#### Slide Rule

In use for over 300 years, the slide rule was the most sophisticated portable calculating device available.

This laminated bamboo 5" straight rule has 10 scales, an instruction booklet, and genuine leather storage case. Manufactured by Scientific Instruments Company in the 1960s, the slide rule was only relatively recently outmoded by the electronic calculator...and the price hasn't gone up since 1960.

Slide Rule, \$6.95. (202)



202



203

#### Pascal Calculator

In 1642, Blaise Pascal constructed an 8-digit mechanical adding machine which used a system of gears to keep track of the numbers it added. Our version is a 4-digit adding machine. Its gears move in two directions to allow addition and subtraction.

Stylus, historical information, and instructions included.

Pascal Calculator, \$5. (203)



## Slide Series

### Computer Museum Exclusive

#### History of Computing

Learn about the history of computers from early calculating devices to early computers, supercomputers, logic and memory technologies, and classic integrated circuits. This 48-slide set draws on the Museum's own collection. An ideal visual aid for illustrating the history of computing. A brief descriptive guide accompanies slides.

History of Computing, \$45.  
(401)

#### History of Personal Computers

The first era of personal computing is represented in this set, covering five topics: the first personal computers, hobbyist milestones, homebrew and singleboard computers, early commercial machines and classic commercial machines. The set includes 20 slides and informative descriptions of each.

History of Personal Computers, \$20. (402)

#### People and Computers Poster and T-Shirt



#### Robotics

Featuring vintage robots from the Museum's *Smart Machines Gallery*, this 20-slide set covers past and present developments in robotics, and covers such topics as Robot Arms, Hands and Grippers, Hoppers and Walkers, Rovers and Explorers, and Helpers and Companions. An easy-to-read guide describes each robot and its importance in the evolution of robotics. An excellent overview of the field of robotics.

Robotics, \$20. (403)

All three sets \$75. (404)

This handsome poster and T-shirt commemorate the 1991 opening of The Computer Museum's exhibit *People And Computers*, celebrating the synergy of humans and machines over the last 60 years.

Designed by award-winning graphic designer Theodore Groves, the poster uses stream-lined forms to depict the rapid and astounding advance of computer technology.

Incorporating such computing milestones as the Univac, the Cray I, the PDP-5, and the IBM 360, classic machines meet their modern-day successors: a laptop, a



#### Memories Poster

A 50-year history of memory storage devices from punched cards to microchips stored on one 20" x 30" poster. A Computer Museum exclusive.

Memories Poster, \$25. (405)

cellular phone, and a pocket calculator.

The People and Computers Poster, which is black with copper on ivory, is printed on thick paper stock that measures 20" x 30". \$10. (406)

The People and Computers T-Shirt, in black on ecru, comes in both adult and children's sizes:

The Adult Shirt, 100% cotton, in sizes S, M, L, XL, \$10. (407)

The Children's Shirt, 50% cotton/50% polyester, in children's sizes 6-8, 10-12, 14-16, \$8.50. (408)

**Words...To Go!™**

Twenty language-skills activities, with ten colorful double-sided cards that store right in the case.

Words...To Go! helps children learn seven critical pre-reading skills, including letter recognition, letter sequencing, matching, and rhyming words.

Children can take this electronic learning toy anywhere. And its liquid crystal display, animated graphics, light weight, and big handle encourage use.

Words...To Go!, for ages 3-6, \$19.95. (501)



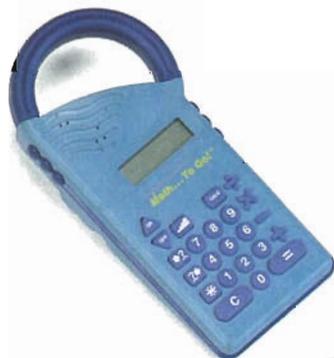
501

**Math... To Go!™**

With a big, easy-to-grasp handle and rugged case, this portable calculator helps Children develop three essential math skills: equation solving, critical thinking, and math tables.

Over 50,000 problems on three levels of difficulty. Correct answers are rewarded with tunes and fast-moving graphics. Incorrect answers result in encouragement to try again.

Math...To Go!, for ages 5-9, \$19.95. (502)



502



601

### **Computer Fun™**

Let Computer Fun introduce your child to the joy of computing. Twelve games in Reading Readiness, Early Math, and Creative Play encourage exploration and imagination. One of them helps children understand the concept of computer programming.

The first electronic toy that speaks in the synthesized voice of a child, Computer Fun is a lightweight portable, with high-quality animated graphics, a large screen, an easy-to-use keyboard, separate cursor keys, numerical keypad, and colorful activity keys.

Computer Fun, ages 4-8, \$89.95. (601)



602

### **Super Speak and Spell™**

With four spelling and four vocabulary activities, Super Speak and Spell is an electronic toy that actually interacts *with* your child.

Its two-line liquid crystal display allows a child to learn by comparing. Extensive music and sound effects encourage learning, and its high-quality synthetic voice is easy to understand.

Super Speak and Spell offers three levels of difficulty and two-player participation.

Super Speak and Spell, ages 6-12, \$65.95. (602)

### **Expansion Packs**

Each expansion pack adds 150 vocabulary words to Super Speak and Spell.

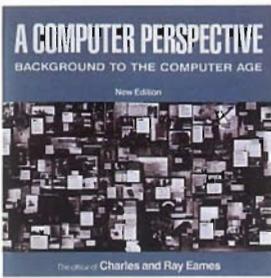
Words, Words, Words (603)

Spell Challenge (604)

Sounds of Spelling (605)

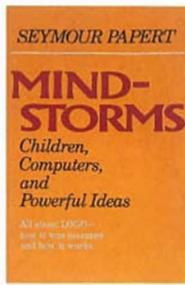
Words Around Us (606)

Each, \$19.95. (603-606)



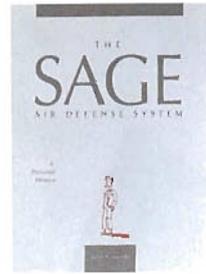
**A Computer Perspective**  
by Charles and Ray Eames. A splendid pictorial history of the origin and development of the computer. Originally published in 1973 in conjunction with an exhibit developed for IBM. Recently updated by eminent science historian Brian Randell.

A Computer Perspective, \$17.95, paperbound. (701)



**Mindstorms: Children, Computers, and Powerful Ideas**  
by Seymour Papert. LOGO, a computer language easy enough for children to understand, was developed by Seymour Papert in the 1960s. Mindstorms is a history of the development of the language—how it was invented and how it works.

Mindstorms, \$9.95, paperbound. (702)



**SAGE Air Defense System: A Personal History**  
by John F. Jacobs. Written by one of the participants in the SAGE (Semi-Automatic Ground Environment) air defense program, this is the inside story of the first military program to use a large-scale, real-time, digital control computer to support a major military mission. Jacobs covers the period from the late '40s to the early '60s, from the SAGE's conception to its manufacture and installation.

SAGE Air Defense System..., \$9.95, paperbound. (703)



**IBM's 360 and Early 370 Systems**  
by Emerson W. Pugh, Lyle R. Johnson, and John H. Palmer. The first comprehensive account of the creation and development of the IBM 360 and its successor, the System/370. Detailed are developments of many computer innovations still in use, among them semi-conductor memories, the cache, floppy disks, and Winchester files.

IBM's 360..., \$37.50, hardbound. (704)

**The Computer and the Brain**  
by John von Neumann. "This book, composed of material prepared for the Silliman Lectures by John von Neumann before his death, represents the view of one of the greatest mathematicians of the twentieth century on the analogies between computing machines and the living brain."

The Computer and the Brain, \$7.95, paperbound. (705)

**A History of Computing Technology**  
by Michael R. Williams. A detailed reference on the history of calculation and the development of the modern computer. With a comprehensive chronology and index.  
A History of Computing Technology, \$43, hardbound. (706)

# To Order:

Just fill in the blanks below. Mail to The Computer Museum Store, 300 Congress St., Boston, MA 02210. Phone in your order by dialing (617) 426-2800 x307. FAX: (617) 426-3568.

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Members of The Computer Museum, the Boston Computer Society, and The Association for Computing Machinery receive a 10% discount on catalog purchases. Expires 9/92.

Order by phone: (617) 426-2800 x307  
9:30am - 5:30pm (EST) 7 days a week  
Or FAX your order anytime! (617) 426-3568

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MA Residents add 5% sales tax

Shipping (see chart)

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Just send us their names and mailing information, below.

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## Shipping Information

Orders are usually filled within 24 hours of their receipt. Please allow up to two weeks for delivery. Delivery time for overseas orders may be longer. Within the continental US, shipments will arrive via UPS.

### Shipping and Handling Chart (Domestic rates)

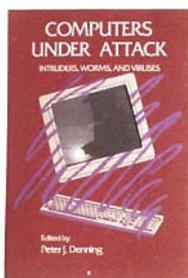
Total	Charge
Up to 9.99	\$3.00
\$10-\$17.99	\$3.50
\$18-\$24.99	\$4.50
\$25-\$49.99	\$5.50
\$50-\$74.99	\$6.50
\$75-\$99.99	\$7.50
\$100 and up	\$8.50

Priority shipment is available. Please call (617) 426-2800 x307 for rates.

### Shipping to Foreign Addresses

To calculate surface shipment charges, double shipping and handling charges listed above. For airmail delivery, triple shipping and handling charges.

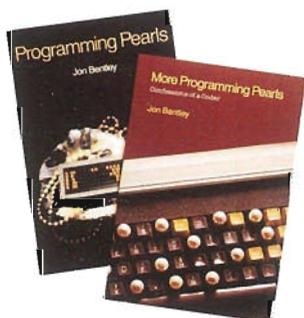
**Shipping to Canada, Alaska, Hawaii, and Puerto Rico:** Double shipping and handling charges listed above.



### **Computers Under Attack: Intruders, Worms, and Viruses**

Peter J. Denning, Editor.  
This book contains some of the most informative, provocative, and frightening reports on the vulnerability of computer systems to harmful, if not catastrophic attack. Actual attacks, the viruses that cause them, and cyberpunk cultures are just some of the topics explored. 592 pages. ACM Press.

Computers Under Attack,  
\$23.75, paperbound. (901)



### **Two-volume set: Programming Pearls and More Programming Pearls**

by Jon Bentley. What do topics ranging from organic chemistry to Napoleon's campaigns have to do with computer programming? This lively collection of essays demonstrate varied aspects of programming, showing how it can be both a fun and elegant science. 402 pages. ACM Press.

Programming Pearls...Two  
Volume Set, \$36.50,  
paperbound. (902)

### **Plan an Educational Group Visit to The Computer Museum**

Reservations for groups of 10 or more should be made three weeks in advance of your visit by calling (617) 426-2800 x334.

Group rates are \$4 for students and \$5 for adults. For every 10 students, we require that you bring one

chaperone who will be admitted for free. Groups from underserved communities should inquire about reduced admissions programs.

Educators are always welcome at the Museum for free.

### **Become a Member of The Computer Museum**

Be a Computer Museum insider—and save \$\$\$\$. For a full year enjoy the fun and privileges of Computer Museum membership.

With an Individual Membership (\$30) you get:

*Free Admission*

*Invitations to Previews and  
Special Events*

*Notices of Exhibitions,  
Lectures, and Gallery Talks*

*Subscription to the  
quarterly Computer  
Museum News and The  
Computer Museum Annual*

*10% Discount on gifts from  
The Computer Museum  
Store and Catalog.*

With a Family Membership (\$45) you get all the benefits of an Individual Membership with unlimited free admission for all immediate family members living at the same address, plus invitations to all family programs.

Computer Museum  
Individual Membership,  
\$30. (903)

Computer Museum Family  
Membership, \$45. (904)

### **Boston Computer Society**

Get a free computer analysis program when you join the Boston Computer Society.

As the world's largest non-profit personal computer organization, the BCS provides free assistance, telephone help, and training to thousands of its members every year. You can share in these benefits by becoming a BCS member. Some of the services you will receive include:

**1.** Availability of over 30 monthly and bi-monthly publications covering specific computers and over 2,000 computer applications. Two of these publications are free with BCS membership.

**2.** Free "Diol Help" for assistance on more than 5 computer platforms and on more than 500 applications.

**3.** Access to over 20 bulletin boards providing nationwide communications.

**4.** Free public domain software and low-cost shareware programs for many different computers and applications.

For more information, contact Carl Mann (617) 252-0600.

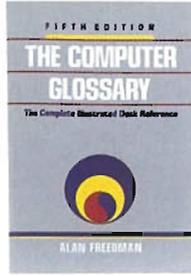
Boston Computer Society  
1 Kendall Square  
Cambridge, MA 02139.



**The Parent's Guide to Educational Software**

by Dr. Marion Blank and Dr. Laura Berlin. Detailed reviews of over 200 educational software programs and guidelines for making intelligent software-buying decisions. The book presents expert evaluations of software—organized by age group, subject area, and special skills taught. Each review lists the required hardware platform and describes the program and the skills it teaches. The authors present advice on selecting software and integrating at-home computer work with in-school curricula. Special information covers software for the learning-disabled.

Parent's Guide..., \$14.95, paperback. [110]



**The Computer Glossary: The Complete Illustrated Desk Reference**

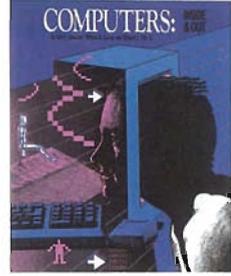
5th edition, by Alan Freedman. An award-winning bestseller, The Computer Glossary contains over 4300 computer terms documented with more than 400 photos and drawings. Freedman also covers backgrounds on important people, companies, and technological breakthroughs that have helped shape the computer industry.

The Computer Glossary, \$24.95, paperback. [111]

NEW!

The Computer Glossary on disk; for PCs and compatibles 3.5" disk, \$29.95. [112]

Macintosh version, \$29.95. [113]



**Computers Inside and Out**

by Kurt Lauckner and Mildred D. Lintner. For anyone trying to understand how computers work and how we use them, *Computers: Inside and Out* is an indispensable introduction.

Part one explains how computers represent, store, and manipulate information; Part II investigates a wide range of practical applications from visual and audio communication to databases, simulation, artificial intelligence, education, and training.

Intended as an introduction for beginning level high school or college students.

Computers Inside..., \$31.95, paperback. [114]

*Books by Robert Glass  
signed copies*

**Computing Catastrophes**

Answers such questions as "why did the IBM challengers of the 1960s—companies like GE and RCA—topple from the computing scene?"

Computing Catastrophes, \$10, paperback. [115]

**Computing Shakeout**

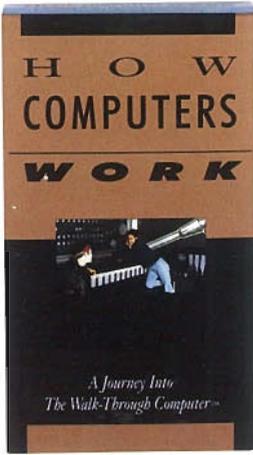
The successor to Computing Catastrophes, Computing Shakeout explains why companies like Peachtree, Gavilan, Ztel, and others failed.

Computing Shokeout, \$10, paperback. [116]

**Software Folklore**

An anecdotal book about some of the weird and wondrous people the computing era has spawned.

Software Folklore, \$10, paperback. [117]



## VIDEO

### **How Computers Work: A Journey Into The Walk-Through Computer™**

Join science correspondent David Heil (of PBS's *Newton's Apple*) and four teenagers as they discover how computers work by visiting The Walk-Through Computer, The Computer Museum's two-story high working model of a desktop computer.

This 26-minute educational video explores both hardware and software, explaining what a software program is and how it works with computer hardware. It examines the major components of the computer, covering the Central

Processing Unit (CPU), Random Access Memory (RAM), the hard disk, and video board.

*How Computers Work* is intended for use in introductory middle school computer classes but is appropriate to communicate computer basics in any setting.

The accompanying teachers' guide suggests discussion topics and related group and individual projects to explore how computers work.

*How Computers Work* (VHS), \$19.95. [121]

### **The Computer Museum Store**

300 Congress Street  
Boston, MA 02210  
(617) 426-2800 x307

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