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Brøderbund
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Brøderbund Software

Brøderbund Software 1938 Fourth Street San Rafael, CA 94901

WHILE OTHER COMPUTER COMPANIES ARE BUSY SETTING NEW PRICES, SPECTRAVIDEO IS BUSY SETTING NEW STANDARDS.

MSX™ and LOGO™: Two more reasons why Spectravideo is leading the way in Personal Computers.

While price wars and confusion reign all around us, Spectravideo goes about its business, setting standards by which all other personal computers will soon be judged. MSX and LOGO are the two latest examples of how Spectravideo is rocking–and reshaping –the personal computer industry.

MSX AND LOGO.

It is now history that, on June 15 1983, Spectravideo, Inc. joined with most of Japan's largest electronics firms to launch MSX: The most far-reaching personal computer standard in history. MSX is the name given to a specific hardware/software configuration that makes product interchangeability possible. While Spectravideo is proud to participate in MSX, we are even prouder of this fact. It was our own SV-318 computer that was used as a prototype for the MSX design! There are two important aspects to this.

First, all future MSX hardware–i.e. computers, peripherals, appliances–will be based on several key design elements of the SV-318. What does this mean to you, the consumer? A great deal, because when you buy an SV-318, you will not only be able to use all of Spectravideo's own software and hardware–you'll also be able to take advantage of all the remarkable new equipment that will be coming from other MSX participants.

In addition, the software aspect of MSX was largely inspired by the software built into the SV-318. From the outset, Spectravideo offered built-in Microsoft BASIC as its resident interpreter. Now, Microsoft also makes a LOGO program compatible with the SV-318. It was Spectravideo's Microsoft BASIC/LOGO that helped to make MSX possible.

Another standard that Spectravideo can take credit for is the built-in Joystick Cursor Control. Built right into the SV console, this control is always at fingertips and is much easier and faster to use than external joysticks or conventional editing controls.

Certain engineering elements that helped to make this built-in control possible have also been incorporated into MSX.

OTHER STANDARDS OF EXCELLENCE.

While these are the computer standardizations that Spectravideo helped to initiate, they by no means represent the whole SV-318 story. This remarkable computer has also established many standards of excellence that other personal computers now aspire to:

- ***Built-In Super Extended Microsoft BASIC**–Makes the SV-318 the first truly programmable affordable computer!*
- ***Extraordinary Memory**–32K ROM expandable to 96K, and 32K RAM expandable (via bank switching)to an amazing 256K.*
- ***Unparalleled Expandability**–A full supporting system of 14 peripherals, including our new Colecovision™ Game Adapter, 7-Slot Expander Unit, Floppy Disk Drive, Data Cassette, Interface Cartridges, etc.*
- ***More Available Software**–Built-in CP/M compatibility gives you immediate access to over 3000 existing software programs. Plus, you can utilize Spectravideo's own fine software library.*
- ***Advanced Graphics Capabilities**–The SV-318 offers 16 colors in high resolution, and more importantly, 32 programmable sprites that allow tremendous control of movable screen objects.*
- ***Many other fine features**–Such as Z80A Microprocessor with fast (3.6) internal clock, top-loading cartridge slot, 10 user-programmable special function keys, 3 sound channels (8 octaves per channel!), low profile and attractive styling.*

SPECTRAVIDEO™

Computer systems you'll grow into, not out of.

MSX compatible software standard

CP/M is a trademark of Digital Research Inc. Colecovision is a registered trademark of Coleco Industries. MSX, Microsoft LOGO and Microsoft Extended BASIC is a trademark of Microsoft Corporation.

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Changing Times

When we first began *Easy Home Computer* as a twenty-seven page special section in the February, 1983 issue of our sister publication *Video Games*, we believed the time was right for a simple, easy-to-understand entry-level home computer magazine. After all, we reasoned, there was still a large majority of the population who lacked in-depth knowledge or familiarity with computers. Where were they going to turn to for 'readable' information?

The answer, we hoped, would be *Easy Home Computer* magazine. In the ensuing months, the commitment we established to cover developments hasn't wavered, as the first two bimonthly issues of *EHC* can attest to. However, times do change, and so too has this magazine.

As the introduction of home computer hardware and software continues to occur at an accelerated pace to meet growing demand and interest, so too has it become more important to have a publication you can depend upon to bring you the news as it happens. Every recent announcement heralding the next technological advancement in system design or programming software, adds that much more which has to be covered, if you're to stay on top of events.

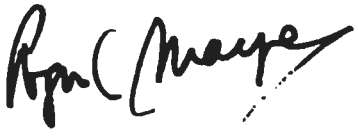
In this, our third issue, we have endeavored to bring you a better idea of what you can expect to find in EHC in the coming months. There are articles and features detailing the latest developments in everything from upcoming personal computer systems, such as a behind-the-scenes look at Coleco's Adam system (our cover story on page 30), as well as an interview with Arnold Greenberg, the guiding force behind Adam.

But in addition, you're going to discover the newest information on peripheral hardware, software releases and a host of accessories for expanding your present system, or help you further decide which home computer is right for your needs.

The intent behind the coverage is to personalize the computer experience for you, the reader. In a world caught up in the magic of ever expanding and complex technology, the need is probably greater than ever to have a single source you can depend on. Easy Home Computer is that source.

Given market conditions, with incredible price discounting present throughout the country, it's become more difficult than ever to know when you're buying a bargain or, instead, purchasing a model soon to be phased out of production. However, whatever the circumstance, either system might prove to be the correct one given your personal needs.

In *Easy Home Computer* you'll be finding all the answers along with up-to-date information guaranteed to keep you ahead of the times as the personal computer revolution continues to unfold and change. To aid in this quest, EHC is pleased to announce that this issue also marks the beginning for Mark Andrews as editor of the magazine. A well-respected and knowledgeable expert in the field, and previously technical editor for *Easy Home Computer*, Andrews is a nationally syndicated newspaper columnist and the author of six books. We welcome you aboard and hope you'll agree that this issue of EHC is even better than ever.



THE ULTIMATE PORTABLE

The Rolls Royce among personal computers just has to be the Model 1101 Grid Compass, priced at $8,150, not including software, a printer, or a disk drive. The computer is manufactured by Grid Systems Corp. of Mountain View, Calif.

The Grid Compass, designed for on-the-road use by successful executives, comes in a magnesium case and weighs just 9 pounds. It's equipped with both a 16-bit 8086 chip and an 8-bit 8087 microprocessor, and it has 256K of RAM and 384K of nonvolatile bubble memory.

The unit has a built-in modem, and can thus be connected by telephone to other computers around the world. It's shown here with an optional Model 2101 disk storage system, which includes both a 10-megabyte hard disk and a 360K disk drive. The drive unit costs $4,100.

GOGH VIDEO

North American Philips Corp. has released a computer-interfaceable laser videodisc featuring indexed stills of more than 200 works of art. NAP says that the disc, "Vincent Van Gogh: A Portrait in Two Parts," will be sold in audio, video and electronics stores across the country for a suggested retail price of about $50.

On Side One, there are 600 indexed frames showing works by Van Gogh and other artists. Side Two, titled "Vincent," is a play about Van Gogh's life starring Leonard Nimoy.

The record can be played on any optical laser disc player, and if the machine is connected to a microcomputer, the sequence in which the information is presented can be preprogrammed.

FUJI FIELDS 5" FLOPPIES

Fuji, which says it developed Japan's first 8-inch floppy disk, has now introduced both 8-inch and 5¼-inch disks in this country. Fuji says its disks are made with an exclusive "RD Binder" and are tested to provide superior performance even after 10 million passes, in temperatures ranging from 41 degrees Fahrenheit to 104 degrees Fahrenheit. The company also guarantees that every track of every disk is error-free.

GAVILAN THE GREAT

Gavilan Computer Corp. of Campbell, Calif, has been making big headlines at computer shows with a new 16-bit computer that weighs just nine pounds, is small enough to be slipped into a briefcase, and has a built-in touch pad that can move a cursor at the touch of a finger.

The new computer, known as the Gavilan Portable, has many special features, including a full-size typewriter keyboard; an eight-line, 66-character LCD screen; and a built-in telephone modem. It can run programs stored on plug-in cartridges, and it also has a tiny, built-in 3-inch floppy disk drive. And a letter-width, letter-quality printer that plugs into the rear of the unit is available.

The Gavilan's most noteworthy feature, though, is a touch panel just above the keyboard that can be used to control a cursor on the computer's screen. The touch pad works like a "mouse," a type of hand controller now being used with the Apple Lisa and other business-oriented computers. But the Gavilan's mouse is invisible; to use it, you simply place the tip of your finger on the computer's touch panel, and then move your finger in whatever direction you want the cursor to go. The cursor will then follow the movement of your finger.

The Gavilan is built around a 16-bit Intel 8088 chip and uses the MS/DOS operating system. It can be operated on both American and European house current, and it will also run for up to eight hours off a built-in rechargeable battery pack.

The computer has 48K of ROM and 32K of RAM, expandable to 288K. It is scheduled to go on the market before the end of this year in both the United States and Europe. The system will retail for about $4,000 without a printer, and for $5,000 with one.

ERASER LASER

Matsushita Industrial Co., Ltd., says it has developted the world's first erasable optical laser disk data storage system. The system was unveiled at a press conference in New York by Dr. Shigeru Hayakawa, senior managing director of Matsushita's $600 million research and development program.

The disks are molded from a new compound that becomes either reflective or non-reflective when exposed to certain types of laser beams. Once a disk has been recorded, it can be read with another beam—and when the data on it is no longer needed, the disk can be erased and rerecorded.

Hayakawa said that the recording capacity of the new disk is about 1,000 megabytes, or approximately 1,000 times the capacity of an ordinary 8-inch floppy disk. "With the development of erasable technology," he said, "Matsushita's line of optical disk machines will be able to meet the strong demand for efficient filing, which is a key element in office automation systems."

Matsushita, based in Tokyo, is Panasonic's parent company.

LOCK & LOAD

Burglars won't walk off with your computer if it's locked into an Anchor Pad security system from Anchor Pad International of Marina del Rey, Calif. The system uses desk space efficiently—it even swivels 360 degrees—yet it secures each component individually, making theft next to impossible while permitting quick and easy removal for service and relocation of computer components. "It will not damage furniture or equipment," its manufacturer adds. The system retails for about $445, including installation.

ON COURSE

GolfSoft, Inc., of Eden Prairie, Minn., has a computer program designed to help you improve your golf score. It's called *Statistician*, it's written for the Apple II Plus, and it retails for $34.95. The package was created by PGA golf pro Dave Haberle, who also just happens to be president of GolfSoft. The program asks you questions about your game, then helps you improve it. "Just as computers have streamlined business, so can this golf analysis program streamline the average golfer's game," Haberle said.

PC PLUS

Pronto Computers, Inc., of Torrance, Calif., has a new computer that resembles the IBM Personal Computer. But Pronto's new unit, the Series 16, actually isn't an IBM clone at all. The unit is built around a newer microprocessor chip than the one in the IBM PC, and Pronto says that the Series 16 runs up to four times faster than IBM's PC.

The microprocessor chip in the Series 16 is the Intel 80186, a recently introduced successor to the popular Intel 8086. The new chip is a VLSI (Very Large-Scale Integrated) circuit that can perform the functions of 15 to 20 lesser chips, but costs less and runs faster, too.

The Series 16 has 128K of RAM capacity that can easily be expanded to more than 1 megabyte. The system includes a keyboard, a processor unit, and a tilting, non-glare green-screen monitor. If a color monitor is added, the computer can produce color graphics.

The Series 16 retails for about $3,000, including an 800K floppy disk drive. A slot for another disk drive is provided. Either floppy or hard disk drives can be installed in both slots in several different kinds of combinations. When two hard disks are installed, the Series 16 has 5 megabytes of disk storage.

The Pronto Series 16 uses the popular MS-DOS operating system, and can therefore run software designed for the IBM PC and for many other brands of 16-bit computers.

Have A Great Playd

Take your marble to the top. Pick your spot and let it drop. Hope for a flip instead of a flop. Once you get it, the fun never stops! It's FLIP OUT — a crazy new strategy game for one or two players. Each marble you drop causes a chain reaction, so take your time and plan carefully. Plan right and you'll flip, if you didn't you Flip Out!

It is up to you to stop the invasion of the evil Quarriors and save Repton. You are armed with devastating Nuke Bombs, a Radar Screen, a Laser Gun and an Energy Shield. You'll need them all! You'll be attacked by Nova Cruisers and Single Saucers. You must avoid Spye Satellites and deadly Dyne-Beam Shooters and you must stop the Draynes from depleting the Reptonian power supply. Repton is a battle so thrilling you'll be relieved to find out you're still on earth when it's over!

New Games For Your Apple II From Si

**For more information contact your local Sirius dealer or distributor or contact us at 10364 Roc
Sacramento, CA 95827, (916) 366-1195.**

KEYLESS KEYBOARD

If you don't like keyboards, you may love the Penpad, a computer input device from Pencept, Inc., of Waltham, Mass. Connect a Penpad to your computer, and you can hand-print letters in little squares on a sheet of paper instead of typing them. The Penpad can read almost anyone's printing—even very sloppy printing—and can thus serve as an excellent substitute for a typewriter-style keyboard.

The Penpad can be used with custom-designed forms, and is therefore suited for many different kinds of data entry by people who can't or won't use computer keyboards. Penpad is available in two configurations—as a stand-alone terminal that sells for $3,950, or as a personal computer accessory with a price tag of around $3,500. The plug-in version can be used with an IBM PC and also with other kinds of personal computers.

TELERAM SLASHES PRICES

Teleram has announced big reductions in the prices of its T-3000 Model 1 and Model 2 portable computers. The Model 1, with 128K of magnetic bubble memory, now sells for a suggested $2,495. The Model 2, with 256K of magnetic bubble memory, is priced at a suggested $2,995.

Teleram, based in White Plains, N.Y., has also unveiled a portable disk drive—the Model T-3620—which attaches directly to the T-3000. The drive will retail for about $900, including a comprehensive package of business-oriented programs from Perfect Software. The software will include a word processing program, a spelling checker, a file management kit, and a spreadsheet system.

The Teleram T-3000 computer weighs less than 9 pounds and has a built-in 80- character by 4-line LCD screen. It has 64K of RAM and 4K of ROM, not including its magnetic bubble memory packages. The computer is built around a Z80L microprocessor chip and uses the popular CP/M 2.2 operating system. It can be operated on house current or with a rechargeable battery pack.

ADD A DASH OF DATA

More than 150 recipes are at your fingertips when you own the Micro Cookbook, a software package manufactured by Virtual Combinatics for Apple and IBM personal computers. Virtual Combinatics, based in Rockport, Mass., also offers a bartender's-aid package called the Micro Barmate. Each program sells for $40.

With the Micro Cookbook, you can look up recipes by name, ingredients, and ethnic or national classifications. You can enter, modify or delete recipes, and you can use the program to help prepare shopping lists and adjust the serving sizes of recipes.

The Micro Barmate program has similar functions. With it, you can select drink recipes by name or ingredients, and you can also add favorite drinks of your own. A holiday beverage guide is also included in the program.

DIAGONAL SCROLLING...GROUND-TO-AIR FIRING...3-D STRAFING RUNS

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BLUE MAX™ by Bob Polin takes you back to World War I, with 3-D scrolling the other games only wish they had.

For the Atari 400/800/1200

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APPLE, MEET ALBERT

Here's Albert, an Apple-compatible computer with a 256-color graphics palette that can display 6 video colors at a time. The Albert has a professional-style RGB (red-blue-green) video monitor output, and its memory can be expanded to 192K without the use of expansion slots, says the unit's manufacturer, Albert Computers, Inc., of Thousand Oaks, Calif. The company also says that the Albert will retail for a suggested $1,595, including an estimated $2,500 worth of special firmware.

"Albert is the alternative to buying an Apple IIe," said Rod Mansfield, president of Albert Computers. The unit will run more than 15,000 programs written for Apple computers, and even its disk drives are compatible with Apple's, Mansfield said. But he emphasized: "Albert's circuitry is absolutely unique, not a copy of Apple's."

THE LITTLEST TRS-80

A new TRS-80 Color Computer—the micro-size Model MC-10—has been introduced by Tandy Corp., Radio Shack's parent company. Aimed primarily at first-time buyers, the unit sells for about $120 at Radio Shack Computer Centers and participating Radio Shack Stores.

The MC-10 has a typewriter-style keyboard with flat-top moving keys. Each key can produce either a typed character or a graphics character—or, when used with a control key, can type a command in BASIC with a single stroke.

The computer can generate video graphics in eight colors. Its onscreen text display measures 32 typed characters by 16 lines.

The new MC-10 weighs 29½ ounces and measures 7 by 8 inches. It has 4K of random access memory, expandable to 20K with a plug-in cartridge that will soon be available.

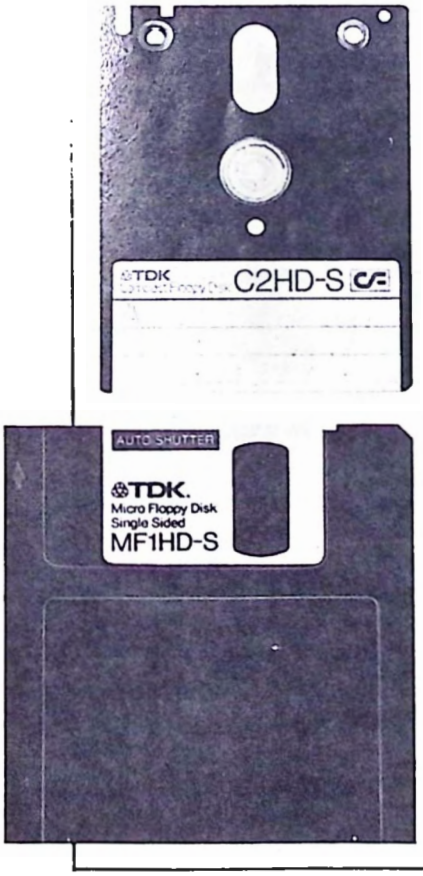
The unit operates on house current and can be plugged into an ordinary television set. It has both a cassette port and a serial port, and can use a standard audio cassette recorder as a program storage device.

Most programs that run on a standard TRS-80 Color Computer with 4K of RAM will also work on the MC-10, its manufacturer says. And programs designed especially for the new unit are on Radio Shack's drawing boards.

TDK BOWS MINI-FLOPPIES

TDK, which recently unveiled a line of 5¼-inch and 8-inch floppy disks, has now introduced both 3-inch and 3½-inch micro floppies. The 3½-inch format was created by Sony, and the 3-inch configuration was developed by Matsushita and Hitachi. "Since there are two systems, TDK will produce both 3-inch and 3½-inch micro floppy disks, and we are prepared to meet market demand for either of these two products," said TDK executive Ed Pessara.

TDK, long a leading manufacturer of premium-quality audio and video tape, began manufacturing ¼-inch and 8-inch disks late last year. All TDK disks are certified 100% error-free. They come packed in 10-disk boxes, with each disk protected by an individual envelope. ●



What Do You Think Of Easy Home Computer? We'd Like to Know!

What do you like best about *Easy Home Computer*? What do like least? And if you could, what changes would you make in *EHC*?

Please put down that joystick, hit that pause button, and take some time out to fill complete this questionnaire.

When you've filled out the questionnaire, please mail it to *Easy Home Computer*, 350 Fifth Ave., Suite 6204, New York, NY 10118. We really do want to hear from you!

Your Name: _____
Address: _____
City, State, Zip: _____
Sex (M or F): _____ Age: _____

FACTS ABOUT YOUR COMPUTER SYSTEM

Do You Own a Personal Computer? (Yes/No):
If So, What Kind? (Make and Model): _____
What's the Approximate Value of Your System (Not Including Software) _____

How Many Hours a Week Do You Spend at Your Computer? ____
Do You Use a Computer in Your Job? _____

What Do You Use Your Computer for? (Rate numerically in 1-2-3 order):

Games ____ Education ____ Home Management ____
Job ____ Programming ____ Telecommunications ____
Other (Please Name): _____

What's the Approximate Value of the Software You Own? _____
How Much Money Do You Spend on Computer Software Per Week? _____

☐ On Games: _____
☐ On Educational Software: _____
☐ On Business Software: _____
☐ On Home Management Software: _____
☐ On Programmer's Utility Software: _____
☐ On Telecommunications Software: _____
☐ On Other Kinds of Software (Please Name): _____

WHAT YOU THINK OF *EASY HOME COMPUTER*

How Did You Get This Issue of *EHC*: (Check One):

☐ Newsstand: ☐ Subscription:

What Articles Have You Liked Best In *EHC* so far? _____

What Articles Have You Liked Least? _____

What Regular Departments in *EHC* Do You Like Best? (Bits 'n' Bytes, Computer Calendar, etc.) _____

What Regular Features Do You Like Least? _____

What Additional Kinds of Features and Departments Would You Like to See in *EHC*? _____

What Other Changes Would You Like to See Made in *EHC*? ____

OTHER FACTS TO HELP US DETERMINE WHO OUR READERS ARE:

Family Income (Check One):
☐ Under $14,000 ☐ $14,000-$21,000 ☐ $21,000-$40,000
☐ Over $40,000

Education (Check One):
☐ Elementary School ☐ High School ☐ Bachelor's Degree
☐ Master's Degree ☐ PhD

Occupation (Yours or Head of Your Family): _____

BULLETIN BOARD

16 FIRMS SUPORT COMPATIBILITY STANDARD: Fourteen Japanese computer manufacturers, and two U.S. companies, have announced their support for a new set of specifications designed to standardize low-cost home computers and to make them compatible with software from different manufacturers. The U.S. firms that support the new standard are Microsoft Corp., the creator of Microsoft BASIC, and Spectravideo, the manufacturer of the Spectravideo SV-318 and SV-328 personal computers. The Japanese companies participating in the standardization move are Matsushita, NEC, Hitachi, Sony, Canon, Mitsubishi, Toshiba, Fujitsu, Kyocera, General, Yamaha, Pioneer, Sanyo and JVC.

The proposed standard, called MSX, calls for use of a Zilog Z80 8-bit microprocessor in each standardized computer; 32K of read-only memory (ROM); a Microsoft BASIC interpreter; a Texas Instruments 9918 video display chip; a General Instruments 8910 sound chip; and an Atari-compatible game-controller interface.

"This program solves a major software marketing and development problem," said William H. Gates, chairman of Microsoft. "In the past, software had to be modified for each new computer. Now, with these specifications, software developers can be assured of greater software/machine capability."

So far, Spectravideo is the only U.S.-based computer manufacturer that has announced plans to support the MSX standard. Spokesmen from Commodore, Apple and Radio Shack have been quoted as saying specifically that they aren't interested. But several software companies -- including Microsoft, Activision, Sierra On-Line, Spinnaker and Sirius -- have said they maydevelop software for computers that use the new standard.

THE ELECTRONIC COTTAGE: Southampton Co., a California real estate developer, is now building homes that are both solar-powered and computer-ready. The new houses are in Benicia, Calif., and Southampton Co. says they are "the most technologically advanced homes in the country." Each computer-ready home comes with extra telephone wiring for telecommunications facilities, and with extra electrical outlets for computer equipment. There's a small, prewired computer room just off the master bedroom. To furnish that facility, you can pick out $3,500 worth of computer equipment. And the cost of the gear can be figured into your monthly house payments.

NEW APPLE DOS ANNOUNCED: Apple has introduced a new disk operating system that increases the capabilities of the Apple II series of personal computers -- including the Apple IIe -- and makes data files interchangeable between Apple IIs and Apple IIIs. Apple has provided almost 100 program developers with ProDOS, but does not plan to make the system available on the consumer market until early next year.

The new system, called ProDOS, "provides increased compatibility between Apple II and Apple III environments," Apple said. It also "frees the Apple II from the physical limitations of the 143-kilobyte Apple Disk II drive," the company added.

ProDOS will not make the current Apple 3.3 disk operating system obsolete, Apple emphasized, explaining: "Users will be able to convert DOS 3.3 data files to work with ProDOS-based application programs in order to take advantage of the advanced capabilities that ProDOS provides." ProDOS-based applications will not require hardware changes to any Apple II that has at least 64K of internal memory, the

company said. And ProDOS supports interruot-driven processing, which the current Apple DOS 3.3 system does not provide.

SIERRA PLANS "B.C." AND "WIZARD OF ID" GAMES: Sierra On-Line of Coarsegold, Calif., has announced a multimillion-dollar licensing agreement permitting it to market a series of computer games featuring characters from the comic strips B.C. and The Wizard of Id. The games will be designed by Johnny Hart, the cartoonist who created the strips and writes and draws them for newspapers around the world. The first B.C. game to be produced by Sierra On-Line, Quest for Tires, will be released before Christmas, the company said at a press conference in New York. Apple- and Atari-compatible versions of the game are scheduled to be released first, and adaptations for other brands of personal computers will follow. "The venture is the largest licensing agreement made by an independent software company to date," said a spokesman for Sierra On-Line. "It includes world publishing and sub-licensing rights for all popular home computers."

WE BELIEVE IT: Roklan Corp. of Arlington Heights, Ill., and Ripley's International, Ltd. of New York have announced another licensing ..eement under which Rocklan will design and market a line of home ..puter and video games based on Ripley's Believe It or Not cartoons .. television shows. "The games will tie in with the Ripley's ..toon characters and will be an extension of the popular ABC ..evision series that has been carried into the 1983-84 prime-time ..son," said Jim Gonzalez, Roklan's vice president of sales and ..keting. Three Believe it or Not games are scheduled to be ..roduced next January, and others will follow.

..ERFECT MATCH: Innovative Electronics has introduced what it says ... the first interface for connecting an Okidata printer to the ..rallel port on the RS-232 serial card of a TI-99/4A home computer. ... device costs $29.95, plus $2.50 for postage and handling, and is ..vailable by mail. Innovative is at 4150 Fox St., Unit A-5, Denver, ..olo. 80216. The company's phone number is (303) 458-5600.

SOFTWARE DIRECTORY ANNOUNCED: A directory listing more than 1,200 software packages for the Texas Instruments 99/4A computer is now available from TI's consumer relations department, P.O. Box 53, Lubbock, Tex. 79408. The volume costs $7.95, including $2 for shipping and handling. TI also announced as this issue went to press that there are now 144 officially recognized TI-99/4 owners' groups in the United States and abroad. A complete list is available from TI's user's group coordinator, P.O. Box 10508, MS 5890, Lubbock, Tex. 79408.

POOR RICHARD: Ben Franklin is dead and gone, Franklin Computer Corp. has acknowledged. Franklin Computer, the company that makes the Franklin Ace 1000 and the Franklin Ace 1200, has featured Benjamin Franklin in its advertising and has used his kite in its logo ever since the firm was founded. But that's all over now, the company says. Ben was officially laid to rest at a recent company wake, and the Franklin Computer logo has been redesigned without Ben's famous kite. Why? The company has decided it wants a more modern image, Franklin president Joel Shusterman explained.

EASY HOME COMPUTER CRITIC'S CHOICE AWARDS

What are the best home computer games on the market? And what are the best educational, home management, and utility software packages?

What companies make the best personal computers? And the best accessories?

We want to know—and we want to hear it from you!

We hope you'll participate in the first annual EASY HOME COMPUTER Critic's Choice Awards.

Deadline for voting is Dec. 31. Results and awards will be announced in the June 1984 issue of *EHC*.

HELP PICK THE WINNERS

THE FIRST ANNUAL EASY COMPUTER CRITIC'S CHOICE AWARDS

HARDWARE

Best Personal Computer: _____

Manufacturer: _____

Best Personal Computer Peripheral: _____

Manufacturer: _____

SOFTWARE

Best Home Computer Game: _____

Manufacturer: _____

Best Home Management Software Package (Word Processors, Spreadsheets, Etc.): _____

Manufacturer: _____

Best Utility (Programmer's Aid) Software Package: _____

Manufacturer: _____

List your choices on this handy form, or send in your entry on a plain sheet of paper.
Vote in all categories, or in only as many as you like. Send entries to EASY HOME COMPUTER, 350 Fifth Ave., Suite 6204, New York, NY 10118.

Your Name: _____

Address: _____

City: _____

State: _____

Zip Code: _____

YOU ASKED FOR IT

At EHC, We Hope We'll Always Stay Young

Dear EHC:

Congratulations on your premiere issue. Given that some three to four million people will discover computing this year, and that, predictably, twice that number of newcomers will arrive next year, there is an abiding need for a magazine that addresses the interests of beginners. Although I've been involved with computing for four years, I still consider myself a novice. I am conversant with BASIC, Pascal and assembly language, and have had programs published and marketed, but my experience has been mainly with only one system, the TRS-80. What I don't know about other systems and computer theory in general could fill volumes. What would be especially valuable to me—and, I have to assume, to all beginners—is a detailed, ongoing, nuts-and-bolts comparison of hardware systems, their associated software, and languages.

At any rate, if you are able to maintain your stated goals and point of view—others have tried and failed, or in their rationalizing words, "grown up"—you will have my attention for a long time. Much success.

Harry Bee
Cornish, Maine

Dear Harry:

Delighted you like us. In this issue of EHC—and in future issues, too—you'll find exactly the kind of information you're asking for. This month we're presenting a comprehensive survey of more than 20 new computers introduced at the 1983 Summer Consumer Electronics Show in Chicago, plus a similar report—complete with color screen shots—on the new computer games that were unveiled at CES.

Our cover story this month is a first-hand report on Coleco's revolutionary new Adam computer system. We're also bringing you reviews and late-breaking news reports on the Commodore 64, the Epson QX-10, and many other exciting new computers, computer books and software packages. And to top all of that off, there's a feature by Dawn Gordon explaining everything you need to know about how to choose a computer monitor.

And that's only the beginning. There's a ton of good reading in this issue of EHC, and there'll be plenty more in the months ahead. And we'll never "grow up," so don't worry!

JOIN THE CLUB

Dear EHC:

This letter is being sent to your office to announce a new Commodore 64 and VIC-20 club called *20/64 Hawaii*. The club had its initial organizational meeting on May 12, and over 50 people attended. Based on the fact that our only advertisements were notes pinned to the walls of several computer shops, we are quite pleased so many showed up.

Our goals and purpose focus strongly on education, and we stress family participation. We hope to teach our members what makes their machines tick and to offer a wide variety of educational public-domain software.

As secretary of this new organization, I hope you will add us to your Commodore user club list.

Any cooperation you can give us will be appreciated. Being in the geographical location that we are in, we are not always in touch with updated information, and we feel that being on your mailing list will be an advantage for all our membership.

Wes Goodpaster, KHGML
Secretary
20/64 HAWAII
P.O. Box 966
Kailua, Hawaii 96734

Dear Wes:

Congratulations on your success. And we're sending you and your members a complimentary subscription to EHC.

DISK WOES

Dear EHC:

I am 65, retired, do book reviews part-time to pick up extra money, now do some feature writing, and intend to do more. Late last year, after breaking a leg, I decided that a microcomputer might help pass the time, and that I might learn something in the bargain. I went through the usual games period and then started messing around with a simple word-processing program I had gotten along with my VIC-20 and tape cassette. I was impressed by the possibilities of word processing and switched to a Commodore 64, a single-disk drive, a printer, and a more complex word program. So far, so good.

I'm not stupid. Although my primary interest in computers continued to be word processing, I quickly learned enough BASIC to write and run simple programs just for the hell of it. Unfortunately, I seem to have a hang-up with disk drive operation. Using the examples found in my drive manual, I've figured out how to format and reformat disks, how to get my word program onto and off of a disk, and how to lead, save, and retrieve sequential material (in my case, copy-in-progress).

I have read and reread the disk drive instructions; they seem to have been written for someone else, certainly not for me. I feel dumb as well as embarrassed. Demoralized might also describe my feelings. I joined a computer club hoping I'd get some help there. I live in a university town, and several members of our user club write articles that are published regularly in national computer magazines. But as far as I can tell, no one word-processes. I might as well belong to Ladies Aid as far as getting any help with my computer problem is concerned. I've learned several varieties of BASIC, and I'm starting to learn how to use

machine language. But, I'm still unable to use my disk drive with any confidence or with the assurance that it will do what I want it to do every time.

Last night while shopping, I picked up a copy of your premiere issue at a local supermarket. It looks promising, I'll continue to buy it. I'll consider subscribing if you really do what you say you intend to do. The comments in *On Line* are correct. We do indeed "lack a viable resource to turn to." If your intent is truly to be a "reference guide in discovering the whys and wherefores," I'll be right there with you.

Name Withheld
By Request

Dear Mr. X:

Welcome to the fast-growing family of EHC readers. Next month we're publishing two articles that may help you with your disk-drive difficulties. One is a how-it-works article about disk drives by Craig Stark, tape columnist at Stereo Review and technical editor of EHC. The other article, called *Easy DOS It*, is an information-packed report on disk operating systems by Michael Bane.

ON THE AIR

Dear EHC:

Just a note to say how much I enjoyed your premiere issue and am looking forward to future issues.

Concerning the article by Lois Cantwell on how to increase your computer literacy: She listed several methods, and I'd like to suggest another: a radio talk show that has just celebrated its first anniversary.

The program, *Computer Talk*, is a two-hour Saturday morning call-in show hosted by A.J. Austin on WAVI in Dayton, Ohio. Austin reviews new products, lists user groups, has manufacturing firm guests, answers our "novice" questions, and makes us aware of any problems or changes in the hardware and software that is available.

I especially enjoyed your buyer's guide.

Mary Ann Warner
New Lebanon, Ohio

Dear Mary Ann:

Thanks for the compliment, and we think your show's right on target. Next time we're in Ohio, we'll listen in.

99er NEWS NEEDED

Dear EHC:

I own a TI-99/4A home computer, but I'm frustrated. I can't find one magazine that has information or reviews on TI-99/4A hardware or software. Maybe you could help me? If not, then I'll tell you something. Your magazine was the first one in which I saw a review for a TI-99/4A product. But I still want more, and I'm sure other TI-99/4A owners do, too.

Trevor Diseko
Manitoba, Canada

P.S. Your magazine is great!!!

Dear Trevor:

There's a monthly publication called 99er Home Computer Magazine that seems to be just what you're looking for. It contains information about the TI-99/4A, reviews of TI-99/4A software, and programs written by owners of the machine. The magazine's address is P.O. Box 5537, Eugene, Ore. 97405, and the telephone number is (503) 485-8796. Subscription rates in the United States and its territories are $25 for one year, $45 for two years, and $63 for three years. In Canada the cost is $32 for one year, $52 for two years and $70 for three years.

Glad you think EHC is great. We agree!

OOPS!

Dear EHC:

I purchased your premiere issue for $2.50 due to the cover, which led me to believe an article about the Commodore 64 computer was inside. Well, where was it? *The Commodore 64 Breaks Out* was not inside. I feel like I've been had. I would appreciate a refund and an explanation.

Michael Karas
Peabody, Mass.

Dear Michael:

Sorry about that. Amid the frenzy of getting out a brand-new magazine, the Commodore 64 review that we received for our premiere issue was too little and too late, and we simply couldn't use it. A new and much better review (by a different author) is in this issue of EHC, and we're sending you a couple of copies (of the magazine, not just the review) with our compliments. Hope you keep reading EHC!

This Month: **A**

Digital Dictionary By DON BENNET

ADAM, according to the Bible, was the first man on earth. And now . . .

Adam is also a prepackaged, bargain-priced home computer system made by Coleco.

TO BEAT OUR NEW HOME VIDEO GAME, YOU'VE GOT TO MOVE YOUR BUNS.

If you've been waiting for the home version of one of America's hottest arcade games, your order is ready. Introducing BurgerTime™* from Mattel Electronics. For your Intellivision,® Atari®2600, Apple®II,** Aquarius™**or IBM® Personal Computer.

Shown on Intellivision. Game varies by system.

Your job is to climb up the ladders and assemble an order of giant hamburgers. But you've got to do it fast because you're being chased by killer hot dogs, sour pickles and a very nasty fried egg.

Good thing you've got your pepper shaker. One shake and they're stunned. But just make sure you don't run out of pepper. Because you know what happens then.

You stop making lunch. And you start becoming it.

BurgerTime™

FROM MATTEL ELECTRONICS®

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IF YOU OWN A COMMODORE VIC YOU KNOW IT CAN DO ALL THIS.

NSE
DAR

BASIC PROGRAMMING

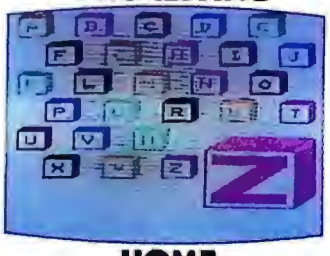
WORD PROCESSING

PERSONAL FINANCE

VISIBLE SOLAR SYSTEM

ING
OR

BINGO/ SPEED MATH



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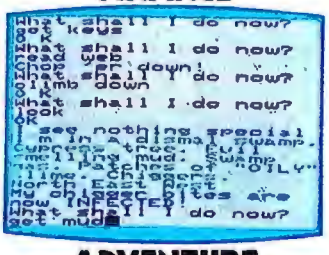

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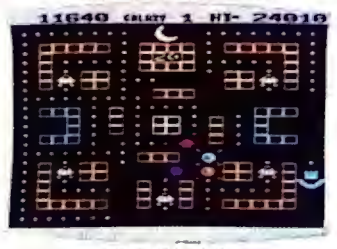

COSMIC CRUNCHER

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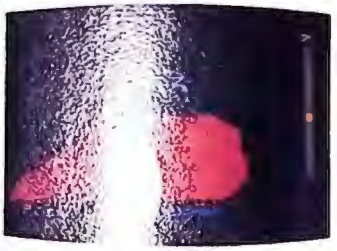
RADAR RAT RACE



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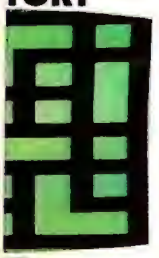

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VIC AVENGER

GORF

OMEGA RACE

What those extra few dollars get you is a simple little device called a Commodore VICMODEM.

It connects your telephone to your VIC 20™ or Commodore 64™ computer (resulting in something aptly called telecomputing), giving you access to information such as you see on the screens to your right.

Normally, you'd have to type a short program into your computer to help it make the final transition into a telecomputer.

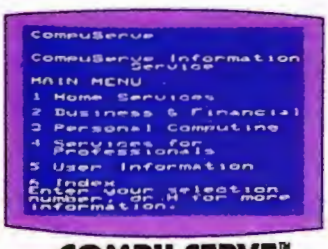
However, when you buy a VICMODEM, you'll find we've included a free software program. You just load it into your Commodore Datassette Recorder, and presto (give or take a moment or two), you have access to a vast library of information and games.

Speaking of free, Commodore also includes a free subscription and a free hour's time on CompuServe™ and Dow Jones News/ Retrieval Service,® a free trial offer on The Source,℠ and a discount program offer with Comp-U-Store and General Videotex Corp.

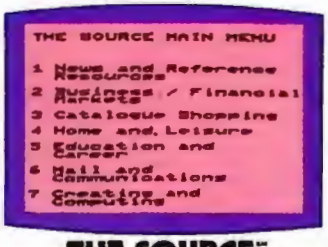
Let's see. Did we leave anything out? Oh, yes. Along with CompuServe comes a free membership in the Commodore Information Network. This is your HOTLINE to Commodore. (How often do you get to speak directly to a manufacturer?) Through it we

Certain offers subject to change. CompuServe is a trademark of CompuServe, Inc. and H.&R. Block Co. Dow Jones News/Retrieval Service is a registered trademark of Dow Jones & Co., Inc. The Source is a service mark of Source Telecomputing Corporation, a subsidiary of Reader's Digest Corporation, Inc.

BUT DID YOU KNOW FOR ABOUT $100 YOU CAN ALSO GET IT TO DO ALL THIS?



COMPU SERVE™



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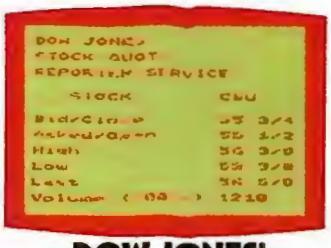

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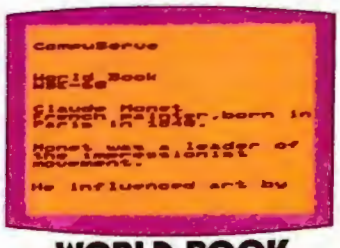

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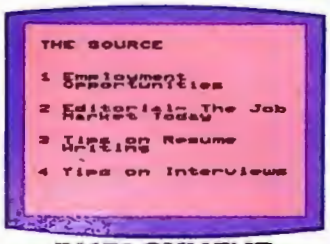

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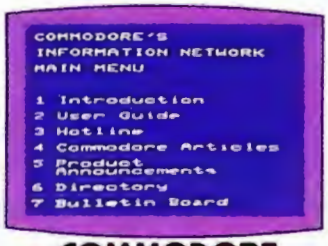

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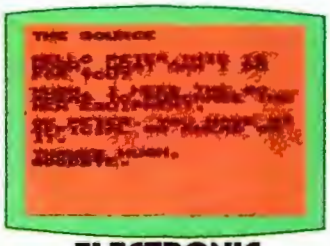

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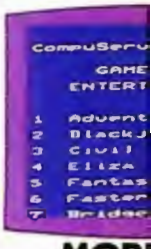

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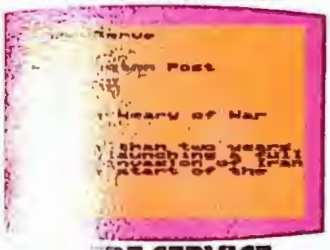

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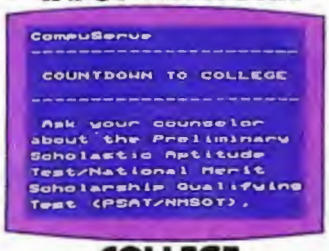

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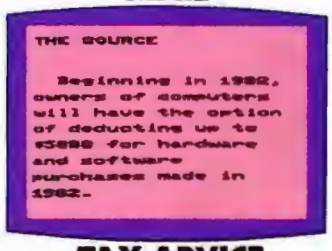

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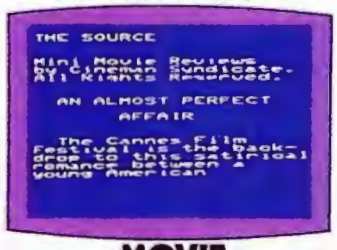

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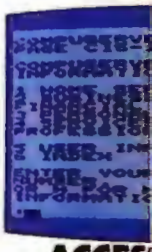

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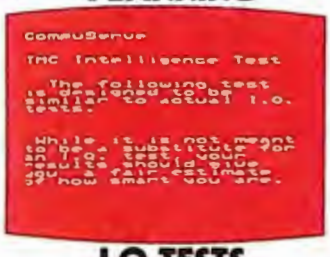

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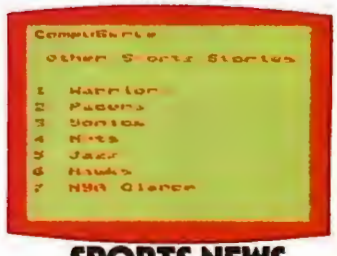

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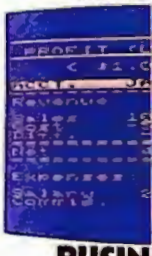


BUSIN

can answer any questions you might have about your computer, or programming, or anything else Commodore-related, via electronic mail.

The Commodore Information Network is also your direct line to the Commodore Bulletin Board, which Commodore owners use to keep in touch with each other, for programming tips, Public Domain Software, and technical support.

THE COMMODORE VIC 20, A REAL COMPUTER FOR THE PRICE OF A TOY.

Altogether, these little extras we've included with our VICMODEM add up to a value of $197.50. A nice return on an investment of around $100.

Some computer companies think it's reasonable to ask as much as $500 for telecomputing capabilities such as ours.

However, with the Commodore VICMODEM selling for around $100, we feel we're being a whole lot more reasonable. Don't you agree?

commodore COMPUTER

These are just a few examples from our existing library of software available for the VIC 20.
U.S.A.–P.O. Box 500, Conshohocken, PA 19428; Canada–3370 Pharmacy Avenue, Ontario, Canada M1W 2K4.

TECH TALK

THE FOUR FACES OF AI

(1) Natural Language (2) Expert Systems (3) Robotics (4) Tutorials

By Mark Andrews

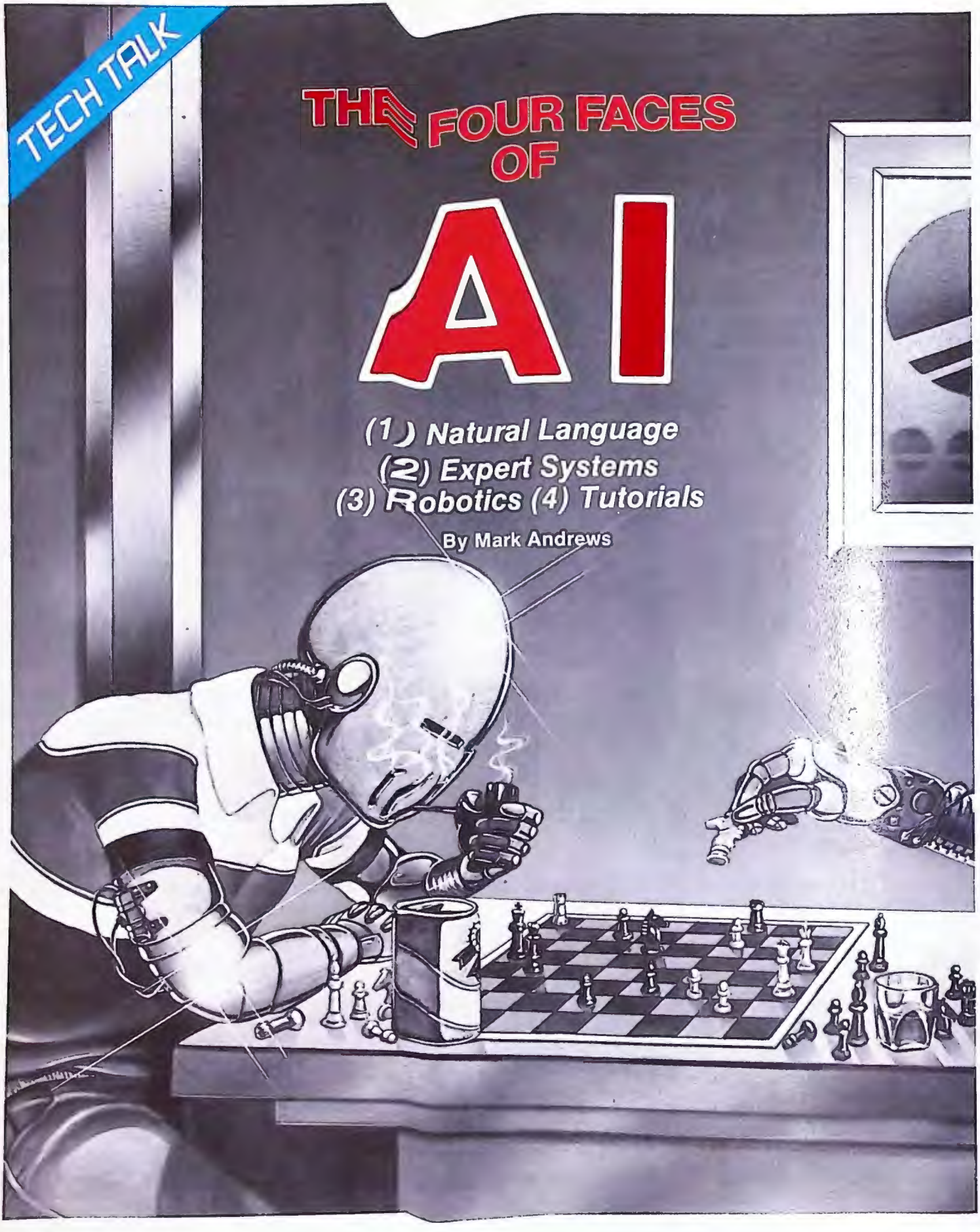


Illustration by Michael Dooney

Artificial intelligence—the ability of machines to think, or at least to mimic thought—has long been a controversial topic in the field of computer science. And now the controversy over artificial intelligence—AI, in computer jargon—is beginning to spill over into the microcomputer industry.

Until fairly recently, AI experts scoffed at small computers. AI programs consumed such vast amounts of computer memory, and required such complex processing procedures, that only large mainframe computers—like those used in universities, large corporations and government offices—could handle them.

Over the past couple of years, this situation has begun to change. New computer languages have made AI programs more compact, and new technology has made personal computers more powerful. And now, AI—or at least something very much like AI—is gradually becoming available to owners of personal computers.

To understand what all of this means to the microcomputer user, it's helpful to know a little about what AI is.

AI programs can be divided into four general categories: natural-language systems, expert systems, robot systems, and tutorials.

Let's take a look at each of these categories now.

1 NATURAL-LANGUAGE SYSTEMS

"People shouldn't have to be computer-literate: computers should be people-literate." Jerry Astor, vice-president of Mattel's computer division, made that comment in a recent interview with *Easy Home Computer*. And computer companies that manufacture natural-language systems wholeheartedly agree.

Natural-language systems, their manufacturers point out, are designed specifically for people who are not computer-literate—for people who don't understand computer languages such as BASIC, COBOL, FORTRAN and PASCAL. Natural-language systems are designed to accept instructions that are written in plain English. And they're so user-friendly that some large corporations are now using them for tasks such as filing, word processing, and data management.

A program called Intellect, manufactured by Artificial Intelligence Corp. of Waltham, Mass., is one of the most successful natural-language systems now being used by businesses. Intellect is designed to be run on large mainframe computers and costs from $50,000 to more than $70,000 per installation.

Larry Harris, the founder of AI Corp., says he has sold more than 100 Intellect packages. "We are in the process of implementing a microcomputer version of Intellect, which we hope will be on the market in 18 months," he added in a recent interview.

COMPUTER LANGUAGE and Artificial Intelligence Corp.'s "Intellect" system, a natural-language front end.

Intellect, Harris said, is one of the most user-friendly computer programs ever designed. He gave this example:

If you had an Intellect system, and wanted it to help you compare your company's sales projections with its actual sales, you could type in a sentence such as: "I need to know how the actual sales for last month compared to the forecasts."

You wouldn't have to use those exact words; any similarly worded request would do. No matter how you phrased your instruction, the computer would understand it, and would immediately provide you with the information you needed.

APPLE SAVVY

Another company, Excalibur Technologies of Albuquerque, N.M., manufactures a package that's not quite as powerful as Intellect but is available right now for Apple II and IIe computers. The program is called Savvy, and it can turn an Apple computer into quite a people-literate machine.

Savvy is available in three different versions that range in price from $350 to $950. The top-of-the-line system is called Business Savvy. It includes a set of business-oriented programs; a specially designed computer language that simplifies program-writing; and a "Robot Programmer" package that makes programming even easier.

The software that comes with Business Savvy includes a mailing list package, a general ledger system, and a multi-purpose data base management program. There's also a document-writer program, and that package is now being expanded into a full-fledged word processor, said Nelson Winkless, the founder of Excalibur Technologies.

The heart of the Business Savvy package is a plug-in circuit board equipped with a Z80 microprocessor chip. The kit also includes four 5¼-inch diskettes.

Excalibur also has a smaller and more technically oriented Savvy kit designed especially for programmers. It's called Pro Savvy, and it retails for $450. And there's also a $350 version of Savvy that comes on a single disk. It has most of the major features of the other two packages but is not quite as versatile.

What sets Savvy apart from other software packages is a built-in capability called Adaptive Pattern Recognition Processing, or APRP. Here's how it works:

When you use Savvy, you can give any program or data file any kind of name you like. The name can include spaces and punctuation marks, and it

can be any reasonable number of characters long.

To run a program, or to retrieve a file or an entry in a file, you simply sit down at your computer keyboard and type out the name of the program—or the name of the file—that you want to run or see. If the name you type is the name of a file, Savvy will retrieve that file and display it on your screen. If the name you type is the name of a program, then that program will run.

And that's not all. When you use Savvy, you can give programs and files as many names as you like. You can add more names whenever you like. And this capability makes Savvy even more user-friendly.

Suppose, for example, that you've decided to give the name "Telephone Book" to a file of phone numbers. And suppose you're afraid you might not remember that name the next time you want to consult your phone directory. Well, with Savvy, you can give your directory as many alternate names as you like—names such as "Phone Directory," "Phone List," "Friends' Phone Numbers," and so on. And once you've done that, you can call up your telephone file by typing in any of those names.

And that's still not the best part. Suppose you forget *all* of those names—every one of them. Can you retrieve your list of numbers then? Well, believe it or not, you can. Thanks to APRP, Savvy can always find your directory for you—as long as you type in a guess that's *something like* the name you've given to your program!

Here's how that works: When you're using Savvy and type the name of a file into your computer, Savvy sees it as a string of binary numbers, or bits. "Savvy looks at this string of bits," explained Winkless, "and says to itself, 'Of all of the strings of bits I've ever seen in my life, what does this most look like?' "

If what you've typed in is a computer instruction, Winkless continued, Savvy will carry out the instruction. If it's the name of a file, Savvy will get the file. If it's the name of a program, Savvy will run the program. And if Savvy can't make heads or tails out of what you've typed in, then it will make a guess!

What this means is that you can make typing mistakes—or even forget things—and Savvy will do its best to help you out. If you can't remember the exact name you've given your phone book, for example, you can simply type in "friend," or "telephone," or "phone," or "number"—and chances are that Savvy will be able to find your telephone file.

EXALIBUR PRESIDENT Jim Dowe and Savvy system.

Savvy does sometimes make mistakes, Winkless acknowledged. But then, so do people. And Savvy, like any reasonably intelligent human file clerk, can learn from its mistakes. Winkless explained:

"Say you have a program that you can run by typing, 'Who's been hired lately?' Now suppose you type in, 'Who's been fired lately?' To the computer, that looks almost exactly like 'Who's been hired lately?' So won't the computer make a mistake? Certainly! You have to teach it—and it learns!"

EPSON'S VALDOCS SYSTEM

Another approach to natural language—a hardware approach—has been taken by Epson America, Inc. Epson recently introduced a new computer called the QX-10 which, according to company executive Jack Whalen, is "the first computer that can be operated by anyone who can use a typewriter."

The Epson QX-10 not only understands English commands, but also has a bank of special keys with clearly marked names such as "Mail," "Sched," "Retrieve," "Help," and "Undo." The system also comes with a user-friendly, multi-function software package called "VALDOCS" (short for Valuable Documents). The VALDOCS package includes a word processor, a spreadsheet-style bookkeeping system, a "message center" program, and a business-graphics system. With VALDOCS, said Whalen, "every document, every graph—everything—is indexed by up to eight keywords of your choice. And it's all instantly available."

One unusual feature of the QX-10 is a built-in calendar and clock, with a battery backup that keeps the clock running when the power is off. Press the QX-10's "Sched" key, and the computer will display a calendar page (for the correct day, of course), complete with any appointments that have been scheduled that day.

The "Sched" key can be pressed at any time, even if the computer is being used for something else. Suppose, for example, that a letter is being typed on the computer's built-in word processor. When the "Sched" button is pressed, the letter will disappear, the day's calendar page will appear, and new appointments can be added. When the "Sched" key is pressed again, the letter that the computer was typing when it was interrupted will reappear on the screen, and the computer will be ready to resume what it was doing before it stopped to consult its calendar.

The QX-10's graphics program is a powerful package that can be called up from the keyboard and can merge graphs and charts with documents that are being created on the screen. Even special type styles—italic, bold and roman—are accessible from the keyboard with single-stroke commands.

AI AT YALE

One trailblazer in the field of natural-language systems is Dr. Roger Schank, the chairman of Yale's department of computer science. In addition to his academic pursuits, Schank

is founder and president of a company called Cognitive Systems, Inc.

Cognitive Systems, under Schank's direction, created and is now marketing a widely known "natural-language front end" called Explorer that is now being used by a major oil company.

A spokeswoman for Cognitive Systems explained. "What this major oil company had," she said, "was a very large data base that contained information about all of the oil wells that had been drilled anywhere. But the query language needed to access the data was so complicated that the geologists refused to use it. Now the geologists can type in their requests in English."

This, the spokeswoman said, is an example of a typical request made by a geologist using Explorer: "I want a structure map of the smackover formation for Bibb County with a contour interval of 100 feet and a scale of 1 inch to 2000 feet." Explorer, she said, can easily carry out that kind of request.

Dr. Schank said it will probably be a long time before microcomputers can handle the sophisticated kinds of programs that Explorer can. But "the day will come," he believes.

Until that day arrives, microcomputer owners will probably have to settle for a great deal less than what Explorer has to offer. There are many software packages that can make personal computers "smarter" in specific areas of knowledge. They're called expert systems. They can't begin to match Explorer in their data-storage capabilities, and they don't have such memory-hungry extras as natural-language front ends.

2 EXPERT SYSTEMS

Robert Frankston, president of Software Arts of Wellesley, Mass., says that's perfectly all right as far as he's concerned. Frankston feels that a lot of people have mixed up the concepts of natural language and artificial intelligence. Often, he says, it's more convenient to communicate with a computer in a specialized language than in English.

"For example," said Frankston, "if you're using a word processor, you don't tell the computer, 'Move the cursor to the third line.' You press an arrow key, and the cursor moves."

TK!SOLVER, an AI-like program from Software Arts.

Frankton and Daniel Bricklin, his partner at Software Arts, are the creators of VisiCalc, the world's best-selling business program in the history of personal computers. Now they manufacture TK!Solver, a microcomputer software package designed for business and professional people who use mathematical formulas.

TK!Solver requires no knowledge of programming, Frankton explained. The user simply enters an equation or a set of equations into the computer, supplies the known values, and presses the exclamation point key. TK!Solver can then solve each equation for any unknown variable or set of variables.

The equations that TK!Solver uses can be provided by the operator or can be found in TK!SolverPacks, packages of standard equations often used in specific professions. TK!SolverPacks for mechanical engineers, financial managers, building designers, and other categories of professionals are available.

TK!Solver is designed to be run on the IBM Personal Computer, and retails for $300. It will also be available soon for two Digital Equipment Corp. computers—the Rainbow and the 350 Professional, said Frankston. A library of a dozen TK!SolverPacks costs about $100.

3 LOOK HOMEWARD, ROBOT

This is the dawning of the age of robotics. Robots are now science fact, not science fiction. Factories now use robots to assemble cars, to build computers, and even to create other robots. The cops on New York City's bomb squad have a radio-controlled robot that handles bombs, and now a couple of companies are building and marketing personal robots—robots for the home.

Heath, a company that has long manufactured do-it-yourself kits for electronic hobbyists, has a picture of a friendly robot on the cover of its current mail-order catalog. The robot's name is Hero 1, and he's for sale. As a basic kit, he costs $1,000. As a deluxe set—with a voice synthesizer and an arm that can grip and pick up small objects—he sells for $1,500. Fully assembled, with his voice built in and his arm attached, Hero 1 retails for $2,500.

Heath calls Hero "one of the most important microprocessor-controlled devices since the introduction of the microcomputer." The robot stands about two feet tall, rolls around on three wheels, and weighs 70 pounds, including its arm and hand.

Hero doesn't see very well, but he

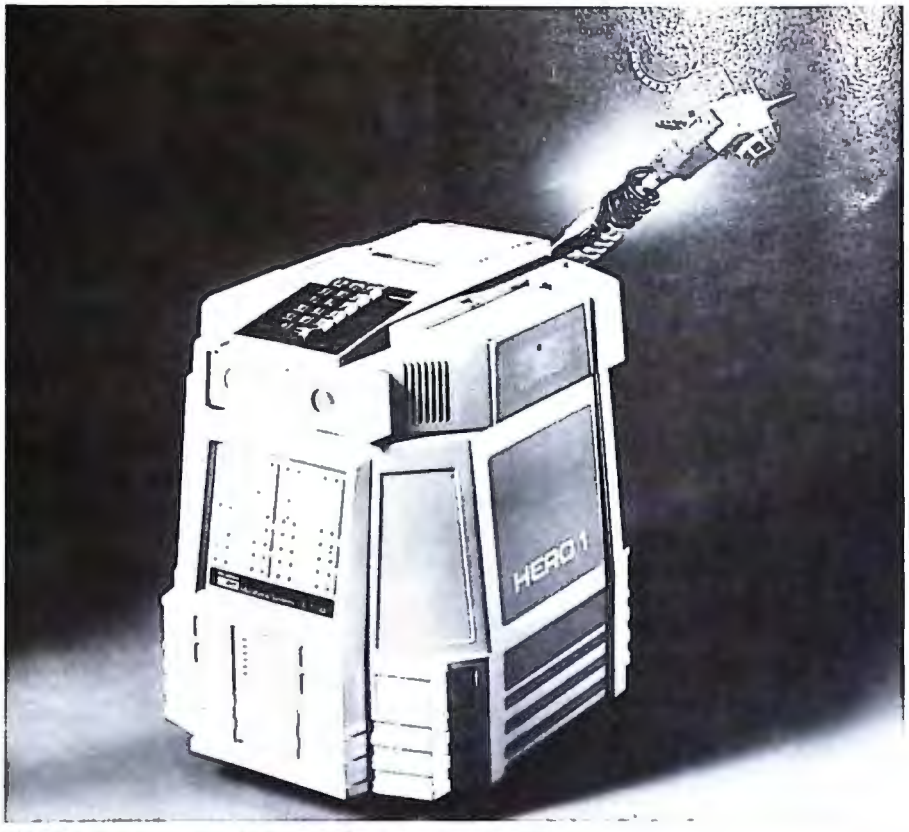
can pick out shapes and can sense variations in light intensity well enough to maneuver around objects in his path and to keep from running into walls. He is also sensitive to changes in sound levels, so he could conceivably be of some use as a sentry in your home.

And what else can Hero do? Well, not much, really—not at the moment, anyway.

You could teach him to roll around from room to room, doing cute things and entertaining guests with preprogrammed patter. He could probably serve snacks and drinks—with a little help from someone in the kitchen. But if you're looking for someone to vacuum your carpets, do your dishes or sweep up the patio—well, you'd better keep looking. No one has created a personal robot yet that can do chores as complicated as those. But within the next few years, there's absolutely no doubt that someone will.

That someone could turn out to be Nolan Bushnell, the founder and chairman of a company called Androbot Inc. Bushnell is extremely optimistic about the future of personal robots, and when he talks about technical trends like that, people tend to listen. Bushnell, you see, is not only the founder of Androbot; several years ago, he also founded a company called Atari.

Bushnell has created two robots so far, and Androbot Inc. has just begun shipping them to dealers across the country. One is called Bob (an acronym for "Brains on Board"). Bob has a microcomputer in his head, and he retails for just $1,300.



HERO, a personal robot manufactured by Heath.

The other robot is named Topo. He can be interfaced with a personal computer and moved around the house with a joystick. His suggested retail price is $500.

Bob's microcomputer brain is powered by three 16-bit Intel 8088 computer chips. For a guidance system, he uses a bank of infrared and ultrasonic sensors that can tell the difference between people and inanimate objects, and can spot obstacles in his path so he won't bump into things.

"Bob may walk up to a guest, crack a joke, sing a song, or quote the daily stock market totals," a spokeswoman for Androbot said. "His potential for intelligent communication and usefulness is nearly limitless, and will depend largely on how rapidly complex software is developed to expand his basic 'personality'."

"Bob and Topo are the pioneers of a new generation, with limitless creative and intellectual potential," says Tom Frisina, president of Androbot. "We have designed them to relate with humans, as friendly-looking, inviting companions. Pursuing the limits of microprocessor technology, we have made them capable not only of autonomous action, but of executing complex instructions provided by software. And we have made them affordable.

"In this spirit, and with no little pride, we have taken an age-old dream out of the lab and put it on your threshold: the first generation of Androbots—Bob and Topo."

TOPO, from Androbot.

4 TUTORIALS

AI could never have reached the state of development it has if it hadn't been for the development of new computer languages. The programs used in AI systems are not usually written in traditional computer languages such as BASIC, PASCAL, FORTRAN and COBOL, but in a new generation of languages that more closely approximate the human thought process—languages with names like LISP, ADA, FORTH, and C.

The new languages now being used in AI systems can perform all of the usual computer tasks as well as older languages like PASCAL and COBOL—and sometimes even better. But their real claim to fame is the way they can

juggl[illegible]mbols that represent words, sentences, and even ideas. When they can't solve a problem directly, they'll often look around for another way to find an answer. If all else fails, they may even guess. And if they guess wrong, they can often learn to do better next time.

One language that is widely used in AI research is LISP (an acronym for *LIS*t *P*rocessing). LISP is difficult to learn, and it runs slowly on computers that aren't specifically designed to handle it. But it is such a powerful symbol-manipulation language that programmers often use it to create other AI-related languages.

LISP, as its name implies, is a language designed to manipulate lists of information. It can sort lists, alter lists, compare lists with other lists, and so on. Most important, any *item* on a list in a LISP program can also be a list. And any item on *that* list can be *another* list. And so on.

This capability of putting lists inside other lists can be extended indefinitely, and that's what gives LISP most of its power. A LISP programmer, by apparently manipulating just a few items on just a few lists, can actually be manipulating vast quantities of data.

LISP was extensively used in the design of ADA, a new language that is expected to become the U.S. Defense Department's standard programming language. Many of the principles used in LISP have also been used in writing other new computer languages such as FORTH and LOGO. And now several companies offer software packages designed to enable personal computer owners to program in LISP and to help them learn the language.

Datasoft, a software manufacturer in Northridge, Calif., offers a LISP interpreter designed for Apple and Atari computers. Lifeboat Associates, a software supplier in New York, markets a LISP package for Radio Shack TRS-80 computers. Gnosis, a company in Philadelphia, has a $150 LISP package for Apple computers that includes two disks, a tutorial kit and a manual. And Integral Quality of Seattle offers a LISP interpreter that runs on the IBM Personal Computer and IBM-compatible machines.

Datasoft's LISP interpreter for Apples and Ataris comes on a 5¼-inch disk that also contains some sample LISP programs. An instruction manual comes with the disks, and so does an authoritative textbook called *LISP* that was written by LISP experts Patrick Henry Wiston and Berthold Klaus Paul Horn. The whole package retails for about $100.

GOING FORTH

FORTH is not as widely used in AI applications as LISP is, but it has more uses in real-world applications. Programs written in FORTH run up to ten times as fast as BASIC programs, yet can take up less memory space than assembly language programs. FORTH is now being used by many professional game designers to write arcade-style computer games. And the language is also being used in many other kinds of applications.

Excalibur's Savvy program is written in FORTH, and so are the programs that make Androbot's robots run. FORTH is now being used in both administrative and scientific applications in hospitals, scientific laboratories, and observatories. And many kinds of FORTH tutorials and programming aids are now available for home computer owners.

Most of FORTH's power lies in the fact that its instruction set can be extended by the user. When you program in FORTH, you're not limited to using sets of predetermined instructions such as PRINT, LIST, and so on. At any time you like, you can write a FORTH routine and give it a one-word name. And from then on, you can simply type in the name you've made up, and the routine will run.

Because of this capability, a FORTH program can include an almost unlimited variety of instructions. And once you've used an instruction in a program, you can also include it in other programs. So FORTH, like LISP, is an incredibly versatile language.

Valpar International of Tucson, Ariz., publishes an extensive line of software designed to teach FORTH to Atari computer owners and to help them program in the language. Valpar says it will also have FORTH packages on the market soon for Apple and IBM personal computers.

Mountain View Press of Mountain View, Calif., makes FORTH packages for CP/M computers, Apple and Timex-Sinclair computers, the IBM PC, and other microcomputers. The prices of its packages range from around $100 to $400.

One personal computer—the Jupiter Ace 4000, manufactured by Data-Assette of Rochester, N.Y.—has a FORTH interpreter (instead of the usual BASIC interpreter) built into its random access memory. The Jupiter is a small computer with calculator-style keys and 3K of RAM, expandable to 51K. It sells for less than $150.

The Jupiter Ace is far too small a computer to be equipped with any kind of real artificial intelligence. But it still "marks the beginning of a new era in personal computing," declares H.W. "Pete" Wills, president of Data-Assette. Despite its small size, light weight and low price, says Wills, it has "more computing power—and a wider variety of uses—than many personal computers that cost much more and are many times its size." ●

SPECIAL REPORT

AND COLECO CREATED ADAM

By Mark Andrews

Illustration by Michael Sullivan

$600 PACKAGE INCLUDES DAISY-WHEEL PRINTER, WORD PROCESSOR AND DIGITAL CASSETTE DRIVE

Coleco has pointed the way toward a new era in home computing with the creation of Adam, a complete home-computing and word-processing system priced at less than $600.

That incredibly low price includes an 80K computer, a built-in word processor, an 80-column daisy-wheel printer, and a new kind of mass storage medium called a digital data pack. A digital data pack looks like an ordinary cassette tape, but it doesn't work like one. As its name implies, it stores data digitally, not acoustically, and Coleco says that its data pack module can transfer information faster than some disk drives.

Adam, the first computer ever manufactured by Coleco, was introduced at a press conference in Chicago on the eve of the 1983 Summer Consumer Electronics Show. And, because of its prepackaged design and its extraordinarily low price, the system made bigger headlines when it was unveiled than any computer since the IBM PC.

And no wonder. At its suggested retail price of under $600, a complete Adam system—including a letter-quality printer and word-processing software—costs less than what consumers have been accustomed to paying up to now for a printer alone.

The price of the system is so low, in fact, that some reporters literally didn't believe it when they saw it listed in press kits handed out by Coleco in Chicago. Some writers didn't use the price in early reports on the show, and others asked Coleco's press spokesmen if it was a typographical error.

The overall result of the introduction of Adam was a media blitz by Coleco. Major feature articles about the Adam appeared the next day in *The New York Times, The Wall Street Journal* and many other newspapers across the country. And Coleco immediately began earning profits from its new computer system.

Coleco held its press conference on Saturday, June 4, at the Art Institute in Chicago. And by the close of business on the following Monday, stock in Coleco had climbed 9½ points—from 50⅝ to 60⅛—on the New York Stock Exchange.

Photo by Perry Greenberg

ADAM IN ACTION: *EHC* editor Mark Andrews tries out a pre-production model of Coleco's Adam system at the company's headquarters in Hartford.

A few weeks later, after the hoopla had died down, *Easy Home Computer* was treated to a closeup look at Adam during a day-long visit to Hartford, Coleco's hometown. During the visit, *EHC* spoke with Arnold C. Greenberg, the president of Coleco, and had a chance to put a preproduction model of his computer through its paces.

The computer module that the Adam is built around has 80 kilobytes of random-access memory (RAM) and 32K of read-only memory (ROM). The console has a typewriter-style keyboard with 75 full-stroke keys, including six programmable function keys. And it has the same kind of spectacular graphics capabilities as the ColecoVision video game system.

Asked to explain the relationship between Adam and ColecoVision, Greenberg recalled: "The modern-day Adam was born at the same time ColecoVision was born. ColecoVision was designed originally as part of the Adam system. That's the reason why Adam can do so much for as little as it costs. It was designed into ColecoVision. The electronic architecture of the ColecoVision system was intended from Day 1 to accommodate its expansion into a full-fledged Adam."

Adam is so closely related to ColecoVision, Greenberg continued, that Coleco decided to make it available either as a stand-alone system or as an add-on system that can be plugged into a ColecoVision game console. As an add-on module to ColecoVision, the system retails for a suggested $400.

The cosmetics of the system's stand-alone and add-on configurations differ, but their abilities and specifications are identical. Both versions of the Adam can be used for playing ColecoVision video games, Atari VCS-compatible games (using an optional VCS adaptor), and "Super Game Packs"—computer games recorded on digital tape cassettes and created espe-

cially for the Adam system.

One Super Game Pack—*Buck Rogers, Planet of Zoom*—will be packed with every Adam system sold. And another Super Game—a computer version of *Donkey Kong*—is scheduled to be released soon. Adam *Donkey Kong* will be a 128K spectacular with better graphics and more screens than the game's arcade version, Greenberg said.

Home-management packages that will soon be introduced for the Adam include a data base system, a personal financial planning system, a spreadsheet program, a LOGO language package, and a series of educational programs. Greenberg said that the educational packages will feature Dr. Seuss, the Smurfs, and other popular kid-oriented themes.

Adam's home-management packages—the spreadsheet program, the data base manager, and the rest—will be available by the end of this year, Greenberg said. And during the first quarter of next year, he added, "There will be an important series of homework-helping cartridges for teenagers, covering a broad range of high-school subjects."

A collection of CP/M-based programs for the Adam will also be introduced this year, said Greenberg. Initially, he said, this software will be offered in the form of digital data packs. But during the first quarter of next year, he said, a disk drive and a CP/M card for the Adam will be introduced. Then, he said, CP/M programs for the system will be made available on disks. "So the machine will be fed by a great deal of software," Greenberg said.

HOW IT WORKS

The Adam is built around a Z80 microcomputer chip—the same chip used in Radio Shack's TRS-80 computers and in business-oriented computers with CP/M operating systems. Theoretically, that means that the Adam is compatible with a vast library of programs written for CP/M computers. Since the architecture of CP/M computers varies, however, CP/M programs written for other computers will actually have to be revised somewhat before they can be run on the Adam—even after the computer's promised disk drive comes along.

Until then, Adam owners will have to settle for software that can be run on Coleco's digital data pack drive. Some critics have called the data pack an unproved device that could cause delays in the production of the Adam. Coleco denies that charge and says that the data pack is far superior to the wafer tape (or "stringy-floppy") tape drives recently introduced by Texas Instruments and other manufacturers.

Coleco's data pack is a two-reel cassette tape, not an endless loop like a wafer tape. Coleco says that its data pack has a faster storage rate than a wafer tape, and can hold more data—half a megabyte (500K), or approximately the equivalent of 250 typed pages.

Another unusual feature of the Adam system is its built-in SmartWriter word-processing program. SmartWriter is built into the Adam's ROM package, and is ready to operate as soon as the machine is turned on.

SmartWriter is designed to work much like a typewriter; when the program is in use, the computer's screen becomes a window that can be scrolled horizontally and vertically over 78-character lines of type. Tab stops are shown on the screen to help the user set margins, and easy-to-understand instructions are displayed in a special window at the bottom of the screen.

BASIC, on the other hand, is not built into the Adam. Instead, a BASIC interpreter will be supplied as a data pack with each Adam system sold. The dialect of BASIC that the computer uses was designed specifically for the Adam system. But it is fully compatible with Applesoft BASIC, Coleco says.

ADAM GRAPHICS

In its text mode, the Adam has a 36-character by 24-line screen display. In its high-resolution graphics mode, its screen measures 192 by 256 pixels (picture elements).

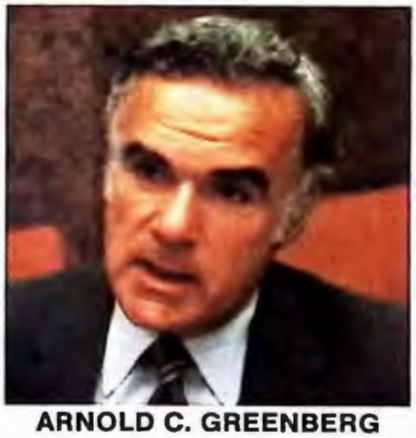
In both its stand-alone and add-on versions, Adam has 80K (80,000-plus typed characters) of random-access memory. Of that RAM, 64K is user-addressable, and the other 16K is video memory. That means that the Adam has more useable RAM than most 64K computers, and also better graphics—the same kind of high-resolution graphics as Coleco's state-of-the-art ColecoVision video game system.

VIEW FROM THE TOP

Easy Home Computer interviewed Arnold C. Greenberg, the president of Coleco, in his company's headquarters in Hartford.

EHC: What types of stores will Adam be sold in ?

AG: Initially, the primary distribution thrust will be in retail stores of all kinds—Sears, Ward's, Penney's, the catalogue showrooms, the mass merchandising outlets, the freestanding toy stores like Toys R



ARNOLD C. GREENBERG

Us and Child World. There will hardly be a major retail outlet in the U.S. that will not be carrying Adam, just as has been the case with ColecoVision. As a matter of fact, the only major retail outlet we're aware of that doesn't carry ColecoVision is K Mart.

EHC: Why is that?

AG: It just shows that even a big company like K Mart can make a mistake. Another thing it shows is that a fine product like ColecoVision can be successful without K Mart.

But the primary distribution thrust for Adam will be large retailers.

EHC: How long do you think it will take computer stores to start handling Adam?

AG: I think they'll handle it as soon as it's available. But Adam will be production-limited this year. We expect to be making about

596 [illegible]nits, but they're all spoken for already.

EHC: How long will it take you to fulfill the demand that exists?

AG: It will be well into next year, I think, before we can begin to catch up with the demand.

EHC: Have schools already approached you?

AG: They have, yes.

EHC: We noticed in your literature that multi-tasking is possible with Adam.

AG: Yes, it is.

EHC: Could you tell us what that means?

AG: Adam's a network system. The peripherals are linked with each other, and therefore data does not have to be repetitively entered. As a result of certain software that will be available next year, simultaneous multi-tasking can be done, such as the printing of your theme while you're playing Donkey Kong.

EHC: In other words, it can print a piece of text while you're working on something else.

AG: We will make that kind of advanced aspect of multi-tasking available next year. But multi-tasking capability is built in.

EHC: We're very anxious to sit down at Adam and try it out.

AG: The great surprise you will have is that Adam is better than I'm telling you, better than you thought it was at CES, and even better than all the very positive publicity it has received. In fact, there have even been some final finishing-touch changes made in Adam since the CES show.

EHC: *The Wall Street Journal* said it's a year ahead of everything else.

AG: It's at least a year, even in this field where lead times get compressed. In fact one of the best-kept secrets is the fact that as good as the publicity has been, the product is even better than the publicity.

EHC: Adam has made a great splash in the computer market. Everybody is anxiously awaiting it. However, some other computer companies are having difficulties now. TI lost tremendous amounts of money in the first quarter of this year, and Atari apparently has a computer division that—despite some excellent equipment—hasn't turned a profit yet, I believe, in the years that it has existed.

THE SYSTEM: Adam, data pack drive, printer and game controllers.

Doesn't the picture look rather gloomy, with all of these things considered, for the introduction of yet another computer system?

AG: Well, I'd say the future looks not gloomy, but extraordinarily exciting and bright. We're convinced that the home computer market has yet to open truly in a big way. The reason why others have lost money is that others have not focused on what is always the primary question: Namely, what is it that the consumer wants and needs? Heretofore, most of the companies have resorted to selling technology by the pound and focusing on lowering the price as quickly as they can.

Coleco is a consumer products company. We don't specialize in marketing technology by the pound, but in creatively applying the state of the art in the way that satisfies consumers' needs and desires. That may sound like an easy pat phrase, but it is everything in understanding what Coleco is.

What we do is spend our time trying to find out what's wrong with the market and what the consumer wants. We feel the consumer has been sold a bad bill of goods heretofore in the home computer market. All he has been given is a naked central processing unit that does very little. Take some of those $99 wonders in the marketplace. They don't come with popular licensed games, and they don't come with game controllers. They don't come with disk drives or tape drives. They don't come with word-processing software. Certainly there are no printers included. All you get is a modified BASIC language and a compressed keyboard. You get an entry level in frustration.

What has really happened is that the absence of consumer expertise has backfired and boomeranged on these companies. Each has positioned the other into lower prices and getting involved in a war to see who can be cheaper than the other without anyone coming up with any points of distinction or an answer to the puzzle that the consumer has had: What on earth is this machine for? It can't be for entering my recipes in, because it doesn't have a printer. It can't be just for playing video games, or I'd have bought a video game machine.

We have eliminated that puzzle. We've eliminated the trips back to the store to spend many times more than the original purchase price to buy an uncertain grouping of peripherals. This is the first computer system designed to operate as a system—to think like you, and to make instruction manuals unnecessary and unimportant.

We've also come up with a second great use for a home computer (the first being entertainment). The second use is low-cost, high-quality word processing.

This is the first package to put it all together. Adam gives more for less. That is why we will be selling every Adam we make, and it is why we expect that we'll have even more impact in the home computer market this fall than we had a year ago in the video game marketplace.

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COLECO'S COMPETITORS

By unveiling Adam at a gala press conference on the eve of the Summer Consumer Electronics Show, Coleco managed to steal the spotlight from all other computer manufacturers who were in Chicago for Summer CES this year.

Atari introduced four new computers and 11 new peripherals at CES, but still couldn't manage to capture the limelight from Coleco.

That was unfortunate for Atari, since it also unveiled a prepackaged home-computing and word-processing system priced at less than $600.

Atari's system, like Coleco's, includes both a word-processing program and a budget-priced letter-quality printer (which can be purchased separately for less than $350).

The Atari ensemble does not come with a data storage device. But even when a cassette data recorder is added to the system, Atari says, it can be bought wholesale for $465, or 11% less than the price that Coleco intends to charge its retailers for Adam.

The conventional cassette data recorder which Atari offers for its system is not nearly as fast as Coleco's data pack, however, and the computer in Atari's system is supplied with only 16K of RAM (expandable to 64K with plug-in modules), compared with 80K of RAM built into the Adam.

The printer that comes with Atari's system can type twice as fast as the one that comes with Adam. It does not have a daisy wheel like the Adam printer has, but instead uses a cylinder-shaped type element that has been criticized for printing wavy lines, at least in preproduction models. And the Atari kit cannot be used for playing video games (though it can, of course, be used for playing computer games).

Atari's under-$600 system is built around the new Atari 600XL computer, which was introduced at Summer CES and will succeed the current Atari 400. The 600XL has a set of full-stroke typewriter-style keys and is priced at $190. Atari's three other new computers are the 800XL, with 64K of RAM; the 1400XL, with 64K RAM, a built-in modem and a built-in voice synthesizer; and the 1450XLD, with everything the 1400XL has, plus a built-in double-sided, double-density disk drive.

MATTEL'S AQUARIUS II

The creation of Adam also stole some thunder from Mattel, which was at Summer CES with both a

prepackaged Aquarius computer system and a new computer console called the Aquarius II.

Mattel announced at the show that its original Aquarius system is now being sold as a complete home computing package for a total price of less than $400. The package includes a 4K computer (expandable to 52K), a pair of game controllers, a 40-column thermal printer, and a cassette data recorder. And if you buy an Aquarius system during a special promotion campaign now under way, you can also get a 13-inch Sampo color TV monitor for $99.

The new Aquarius II has full-stroke keys (not calculator-style keys like the original Aquarius), and also more memory—20K of RAM, expandable to 64K. The Aquarius II will probably retail for $150 to $180, according to Mattel.

Mattel also announced that a "MicRobot" unit—actually a computer-interfaceable BSR X-10—is now available as an accessory for the Aquarius computer system. BSR's X-10 is a unit that plugs into household wiring and can dim lights, turn lights and appliances on and off, and manage home security, either by remote control or with a built-in timer. When the X-10 is linked to an Aquarius computer, all of its functions can be programmed from the computer keyboard, using a pictorial screen display similar to the one generated by Commodore's *Magic Desk* program (See *Magic Desk* article in this issue).

"Some people have characterized the home computer as a solution in search of a problem," said Peter Lesser, general manager of BSR's X-10 division. "Computers in the home have been suffering from a lack of things to do around the house, and an X-10 MicRobot will finally give a home computer a thoroughly useful in-home job to do. The BSR MicRobot will retail for under $75, with the ability to add on as many X-10 modules as required."

Jerry Astor, the vice-president in charge of Mattel's Aquarius division, said that his company's computer systems are the answer to the beginning home computer owner's needs. "People shouldn't have to be computer-literate; computers should be people-literate," he said.

Al Kahn, Coleco's vice-president of marketing, expressed a similar view during Adam's official debut in Chicago. "In developing Adam," he said, "we focused on one single premise: Computers should think like humans. Humans should not have to think like computers. And so Adam was designed to interact with the user—in words and graphics that the user can readily understand."

SPECIAL REPORT

Computers Are Superstars at Con

By Lancelot Braithwaite

Twice each year, the world's electronics manufacturers get together amid considerable hoopla to show off their newest products to retailers, to each other, and—indirectly—to you. They do this at a pair of dazzling, incredibly overwhelming events known as Summer CES and Winter CES—the Summer and Winter Consumer Electronics Shows.

The public is never invited to Summer or Winter CES, but both shows make headlines around the world anyway. They're two of the largest trade shows held each year in this country, and they're also the world's biggest electronics trade fairs. This year's Summer show, held in Chicago, was the biggest CES ever, with 1,275 companies exhibiting products and with more than 83,000 people attending.

Products displayed at CES include audio and video equipment, electronic games, and personal and household gadgets like calculators, digital watches, microwave ovens, and cordless telephones. But the personal computer was the undisputed star of this year's Summer show.

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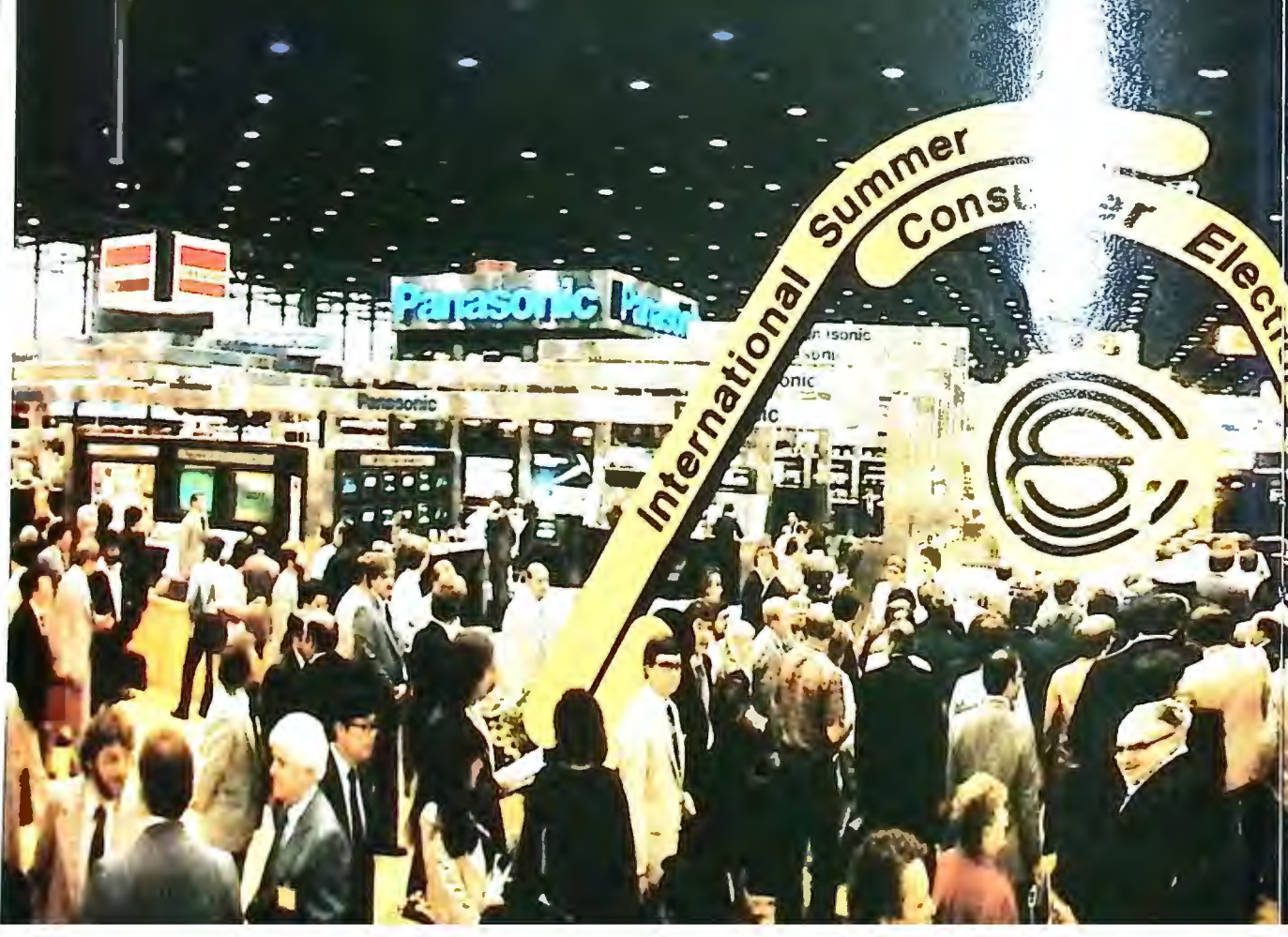
Other manufacturers that introduced new computers at CES included (in alphabetical order) Atari, Mattel,



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Atari 600XL

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The screen display in the 600XL's text mode permits 24 lines of 40 characters. An international character set and five text modes are available. The

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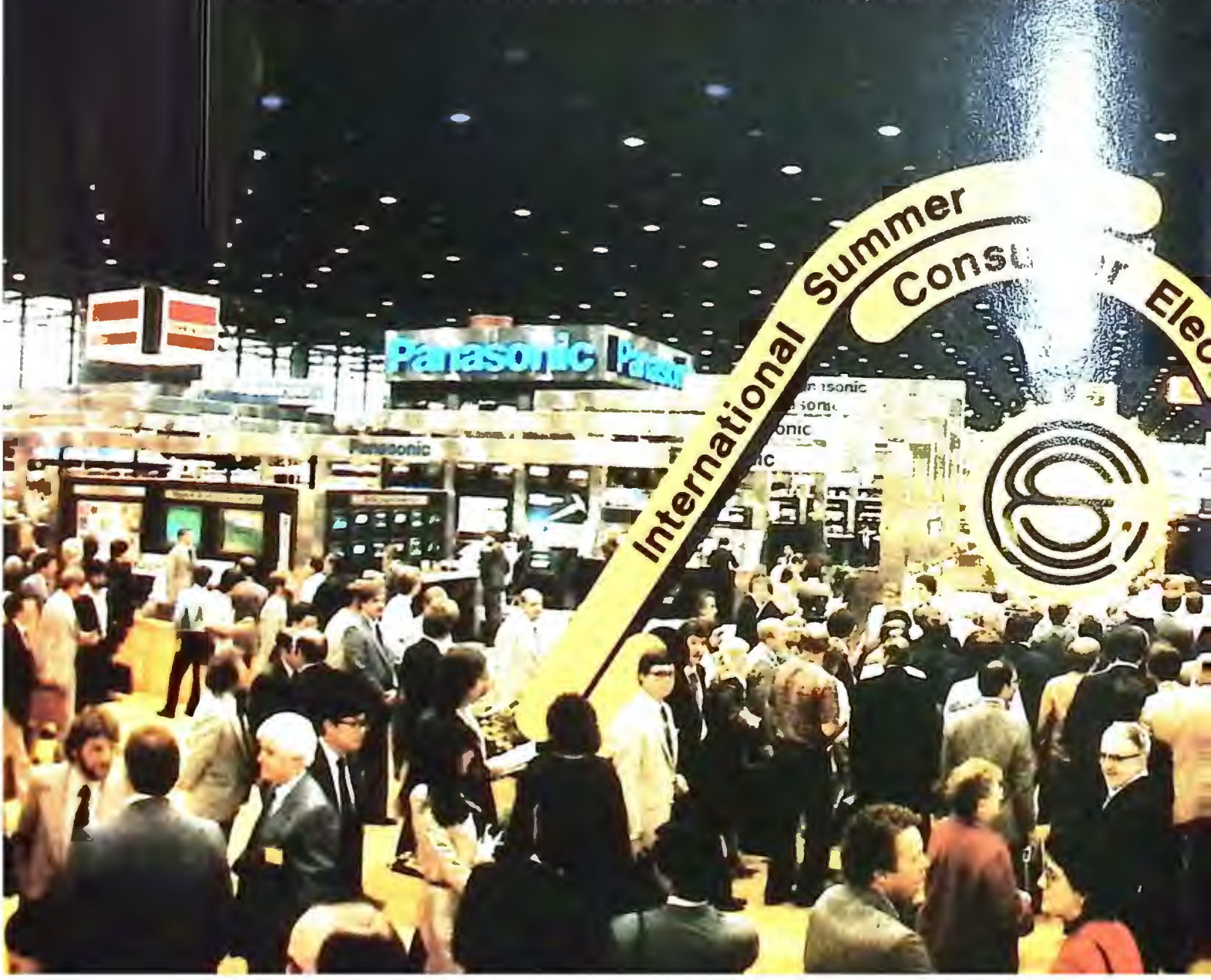

REPORT

Consumer Electronics Show

NEC, Panasonic, Rabbit, Royal, Sanyo, Sharp, Spectravideo, Timex/Sinclair, Texas Instruments, Tomy, Unitronics, and Video Technology Ltd. Another manufacturer, Kaypro, was not a CES exhibitor but does have a new computer that will be mentioned in this article because it demonstrates what looks like a significant trend in personal computing.

Here, then, is a report on computers that were—and one computer that wasn't—introduced at the 1983 International Summer Consumer Electronics Show in Chicago:

Atari 600XL

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The screen display in the 600XL's text mode permits 24 lines of 40 characters. An international character set and five text modes are available. The

computer also offers 11 graphics modes with a resolution of up to 320 by 192 pixels (picture elements). Optional peripherals let you store programs on disk or tape, print both text and graphics, and use wireless joysticks or a track ball for arcade fun.

Atari did not announce the price of the 600XL—or of any of the other new computers it introduced at the show.

Atari 800XL

The 800XL replaces Atari's earlier 800—but, except for being a shade larger, looks exactly like the 600XL. It offers many of the same features, too: a full-size, full-stroke keyboard; a Help key; an international character set; a 24-line by 40-column text display; five text modes; 11 graphics modes; and 4 voices over a 3½-octave range. The major difference between the two machines is that the 800XL has its entire 64K RAM space already full. That means that the 800 can use all of the more than 2,000 Atari-compatible programs that are available, while an unexpanded 600XL can only use the 1,000 or so programs that will fit in a 16K machine.

The 800XL accepts the full line of Atari peripherals. These include several printers, cassette and disk drives, a telephone modem, and game accessories such as joysticks, wireless joysticks and a track ball.

Atari 1400XL

The 1400XL is a little deeper than the 800XL, and while the keyboard is the same as on the 800, the function keys are in a row above the standard keys instead of in a column down the keyboard's right side. The cartridge slot is not above the keyboard, either, but on the left side.

The main advantage of the 1400 over the 800 is that its modem is built in rather than being an optional peripheral. Another difference is that the 1400XL has a built-in speech synthesizer. The modem can provide access to The Source, CompuServe, Dow Jones News/Retrieval and other subscription services with a simple connection between the computer and a telephone line. The speech synthesizer lets you use the built-in BASIC language to make your computer say anything that you want, and Atari plans many programs that will include synthesized speech. The modem is available as an accessory for Atari computers that do not have one built in, and peripheral speech synthesizers are available.

The 1400, like all Atari computers, can easily be connected either to an ordinary TV set or—with an optional cable—to a video monitor.

The 1400XL offers the same text and graphics capabilities as the other machines in this series. And it can use the same peripherals, although there is no need for an external modem, of course, since there is one built in.

ATARI'S TOP-OF-THE-LINE 1450XLD

Atari 1450XLD

The 1450XLD is quite a bit bigger and heavier than the 1400XL because it has a disk drive built right into its stepped top. The 5¼-inch double-density, double-sided drive built into the 1450XLD provides 254K bytes of mass memory storage.

Otherwise, the 1450XLD is pretty much the same as the 1400XL—with a built-in modem, a built-in speech synthesizer, and an architecture that accepts the same peripherals as the rest of the Atari line, including extra disk drives. Other identical features include the keyboard, the cartridge slot, text and graphics capabilities, BASIC and sound capabilities, the character set, and the Help key. And BASIC is built in.

Unitronics Sonic

Unitronics, a firm based in Oakland, Calif., has introduced a new computer that comes with a built-in 128K wafer drive and is priced at less than $400, including an impressive software package. The computer comes with Microsoft BASIC, a Frogger game, a Magic Windows word processor, and a package of blank wafers. Wafer tapes, also known as "stringy floppies," are narrow-gauge endless-loop tapes that store information digitally and are almost as fast as disk drives. Unitronics says that its Sonic computer is Apple IIe-compatible and "CP/M complimentary." The company also plans to produce a line of modems and a new hard-copy printer.

UNITRONICS SONIC HOME COMPUTER

Coleco Adam

The most attractive thing about Adam (see cover story, this issue) is that it is a complete system—except for the TV, which you supply. The second best thing is its price—$600. For that you get three units: an 80K RAM memory console with a data pack (digital cassette) storage drive built in; a sculptured keyboard with 75 keys plus two game controllers; and a

letter-quality daisy-wheel printer. RAM can be expanded by another 64K, to 144K, and a second data drive may be added.

Software is what makes your computer different from an expensive hi-tech paperweight, and Adam comes with SmartWriter word-processing software built right in. Coleco Smart Basic, which is just like Applesoft BASIC, from the user's point of view, is supplied on a digital data pack. The Adam also comes with a ColecoVision Super Game pack: *Buck Rogers, Planet of Zoom*. The computer accepts all existing ColecoVision cartridges—and, since it is CP/M compatible, can also use thousands of CP/M compatible programs that are scheduled to be available soon on digital data packs.

The Adam has four expansion slots and three sound channels. With an optional converter, it will play Atari 2600-compatible games. Its screen display in text mode measures 36 characters by 24 lines. An 80-character option is also planned.

Casio FP-200

Casio's new notebook computer, the FP-200, has a suggested retail price of $699. It contains 8K of RAM, expandable to 32K, and 32K of ROM, expandable to 40K. It comes with both BASIC and CETL (Casio Easy Table Language) built in. It has a 20-character 3-line LCD screen, and a full-size "QWERTY" keyboard. There's also an integral keypad for easy inputting of data, and a spreadsheet program is built in. Ports include an RS-232 socket for connection to a modem and other RS-232 devices, a Centronics parallel port for printers and plotters, a cassette port for connection to any standard cassette recorder, and a general I/O port for future expansion.

Tomy Tutor

Tomy, one of the world's biggest toy companies, has unveiled a good-looking home computer and has hired an even better-looking celebrity to promote it. The computer is called the Tomy Tutor, and the spokesperson is called Sarah Purcell.

"If you're like me," Purcell said at CES, "on one hand you're convinced that computers are here to stay, and that their job is to make life easier. On the other hand, you wish they'd go away and stop complicating things. 'Who needs it?' you cry.

SARAH PURCELL AND TOMY TUTOR

"Thank goodness for Tomy Tutor, a real computer for people like you. A complete computer that comes with computer-ease, instead of computer-ese. Tomy Tutor is so simple, even an adult can use it!"

The Tomy Tutor has 16K of RAM, expandable to 64K, and a sophisticated but easy-to-use graphics system is built in. Twelve game cartridges for the computer are available. Optional accessories include game controllers, a cassette data recorder, a telephone modem, a voice synthesizer, a 40-column printer, and a disk drive. The Tutor is expected to be on the market before Christmas, and will sell for less than $150.

Kaypro 10

Although The Kaypro 10 was not shown at CES, the timing of its introduction suggests that it should be included here. Kaypro has a family of computers that some analysts rank as the third best-selling line, after the IBM PC and the Apple II series. The Kaypro 10 is a one-piece transportable unit containing a processing unit; disk drives; a 9-inch, green-screen CRT display, and a full-featured keyboard in a detachable cover. The whole system closes up into a 31-pound package about the size of a portable sewing machine.

What makes the Kaypro 10 most unusual is that one of its disk drives is a hard-disk model with a capacity of 10 Megabytes (10 million bytes, or 10,000K). The other drive is a 5¼-inch double-density, double-sided floppy disk drive with a capacity of 400K. That is quite a lot of memory for a personal computer. The Model 10's other claim to fame is that it comes with a package of software that could easily cost almost as much as the machine if purchased separately. That software includes the CP/M 2.2 operating system, Perfect Writer, Perfect

Speller, Perfect Calc, Perfect Filer, Perfect Lesson, S-BASIC, M-BASIC, Profitplan, and Word Plus, and they're all preloaded on the hard disk and ready to go.

At $2,795, the Kaypro 10 is a lot cheaper than an IBM PC or an Apple IIe with the same options. But, it doesn't have color capabilities, so it's less than ideal as a game machine.

Kaypro 4

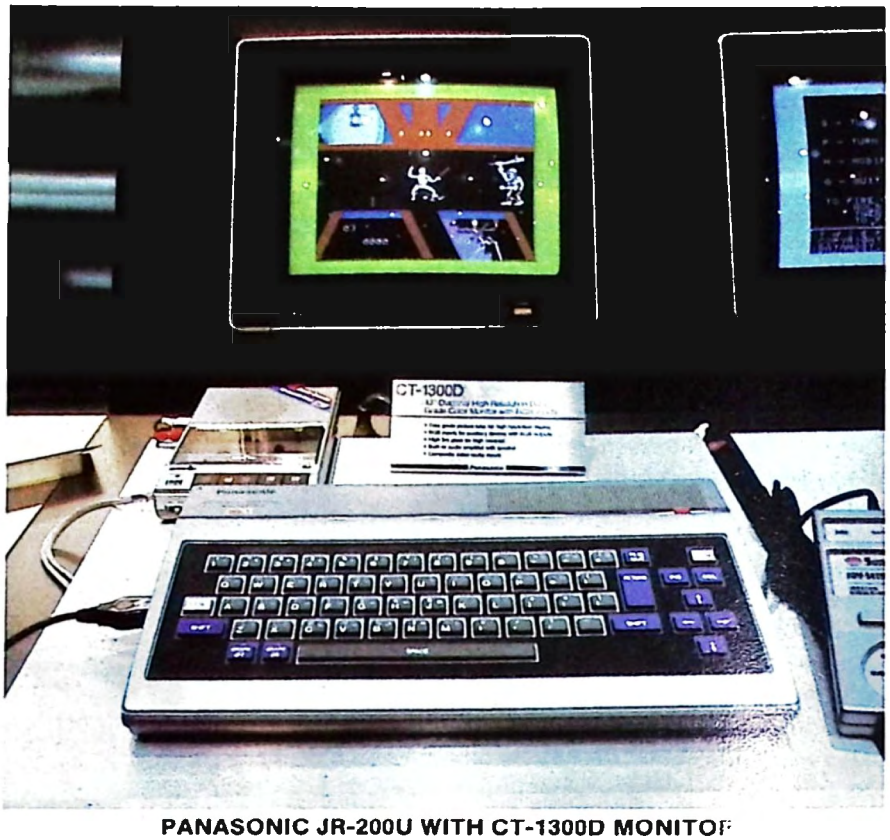
The Kaypro 4 is the Kaypro 10's identical twin, right down to the software. The only difference is that the Model 4 has two 5¼-inch double-density, double-sided floppy disk drives instead of one, but no hard-disk drive. The Kaypro 4 costs $1,995.

Panasonic JR-200U

Panasonic's JR-200U comes with 32K of RAM and 16K of ROM built in. It is a self-contained unit with a full-size typewriter keyboard (with flat-topped keys) and built-in speaker. You just add your TV and a cassette recorder, and you're ready to go. An RS-232 card is necessary for connecting serial devices like a modem, but a Centronics parallel port is built in for connecting an optional printer. A 2-joystick socket is provided, as well as sockets for a TV set or an RGB monitor. The screen display is 24 lines of 32 characters in text mode,and a 64 by 48-pixel matrix in graphics mode, with 8 colors available. The sound generator covers 5 octaves of triad chords which can be played over the internal speaker with controllable volume. An external speaker jack is also provided. Its built-in language is Panasonic's JR-BASIC 5.0 but machine-language programming is also possible. Educational, entertainment, and personal finance programs are available, and Panasonic plans a full line of software. Peripherals including a floppy disk drive are also planned. The JR-200U's suggested retail price is $349.95.

Mattel Aquarius

Mattel has two computers: the Aquarius and the Aquarius II. The difference between them is that the original Aquarius has a keyboard with flat-topped keys, 8K of ROM and 4K of RAM, while the Aquarius II comes with a typewriter-style keyboard, 12K of ROM and 20K of RAM. Otherwise, their specifications are the same, and they can both be expanded to a maximum of 52K of RAM. They both use a Z80A processor and are CP/M compatible, so they can run CP/M programs that are modified to their architecture. Mattel also has a large library of software designed especially for the Aquarius systems.



PANASONIC JR-200U WITH CT-1300D MONITOR

The computers have 16-color displays, 40-character displays in text mode, and 320 by 196-pixel displays in graphics mode. A complete line of accessories is available, including a master expansion module, a mini-expansion module, disk drives, memory expansion cartridges and boards, a cassette recorder, a printer, a modem, game controllers, and more. A complete system called the COM/PAC sells for about $400. It includes an Aquarius keyboard, a printer, a data recorder, a mini expan[illegible]nd hand controllers. The compu[illegible] the system is the original A[illegible]s. And when you buy the system[illegible] can get a 13-inch Sampo color T[illegible] in additional $99.

Rabbit RX[illegible]

The Rabbit RX83 is a [illegible]mputer based on a Z80A comput[illegible]p. It has 8K of ROM and 2K of RA[illegible] expandable to 64K. Its built-in language is BASIC, and its 8-color display can handle either 16 lines of 64 text characters or a 256 by 192-pixel graphics display. Its output is RF on channel 3. Available accessories include a cassette recorder with a data transfer rate of 1200 baud; joysticks; 16K RAM expansion cartridges, and other software on cassette tape and in cartridge form.

MATTEL'S NEW AQUARIUS II

A cable is available for connection to Centronics printers and Rabbit's own printer. A modem and expander are to be available soon.

Royal Professional Computer

Royal calls its Professional Computer a "personal computer with professional capabilities." The unit is a CP/M-compatible computer with a built-in power supply, and it can be used with a cassette recorder, disk drives, and Centronics-type printers. It also has a RS-232C serial interface for connection to other printers and peripherals.

The unit's microprocessor is a Z80A, and its screen display can be adjusted to show either 40 or 80 text columns per line. It has a professional-style RGB (red-green-blue) output, plus a standard video monitor output, and an RF modulator is supplied for use with standard TV sets. When used with a color monitor or color TV set, the Royal Professional can generate e[illegible] foreground colors and eight b[illegible]ground colors in 64 different c[illegible]nations. Its keyboard has 79 t[illegible]iter-style keys plus 12 programm[illegible] function keys. Its suggested r[illegible]rice is around $700.

TI-99/4A

[illegible] unveiled a "new" computer at [illegible] but it was not the one that had [illegible] expected. It is the old 99/4A in a r[illegible] light gray. (Some call it white.) [illegible]tionally, it is the same computer it always was, but the on/off switch has been moved to a new, more convenient location, and some cost reductions in the manufacture of the unit have been made.

THE WHITE COMPUTER—THE NEW TI-99/4A

TI-99/8

TI also has a new 16-bit machine tentatively called the 99/8. It was shown to some members of the press behind closed doors at CES, but a TI spokesperson said the unit was not officially introduced because the company didn't think a new product should be unveiled just because there was a show. The unit will be announced when it's ready, a TI spokesman said. It will probably be priced at under $500, and it will have both PASCAL and BASIC built in, along with 18K of ROM and 62K of RAM—with a memory expansion capability all the way up to 16 megabytes. It will have 56 full-stroke typewriter keys, will run programs stored on solid-state plug-in cartridges, and will be fully software-compatible with the current 99/4A. So there will be over 200 software packages available when it arrives. It should be considered as work in progress and should be available soon—maybe before the end of the year.

THE ROYAL PROFESSIONAL COMPUTER

Sanyo MBC 550

The Sanyo MBC 550 is an IBM PC lookalike that will run IBM PC software. It is a 16-bit machine with an 8088 CPU (Central Processing Unit) and it has a RAM capacity of 128K bytes. Its single-density, single-sided disk stores 160K bytes. That can be expanded to 320K with a double-density option, and to 640K with a double-density, double-sided option. A second drive can also be added. The MBC 550 has a Centronics printer port and comes with Sanyo BASIC, diagnostic and utility programs and word-processing and spreadsheet software programs. A speaker and a joystick port are built in. Scheduled for fall delivery, the computer has a suggested retail price of $995. Options that will be availalbe include an additional 128K of RAM; an 8087 "number cruncher" for doing complex mathematical calculations; and optional floppy and hard-disk drives. Sanyo color and black-and-white monitors designed for the unit are available, but other standard monitors can also be used. The MBC 550 is the same computer that was previously introduced at Comdex, a computer trade show, as the MBC 555. Its new designation is the MBC 550.

Spectravideo SV-328

Spectravideo, the company that makes the computer with a joystick built into the keyboard, now has a second computer called the SV-328. This one is directed to the small-business owner and sophisticated home-user so the joystick is no longer on the keyboard. Built around the same CPU

Continued on Page 70


IMAG
TEXAS INSTRU
ATARI

SPORTSWARE

SLAPSTICK SOFTWARE

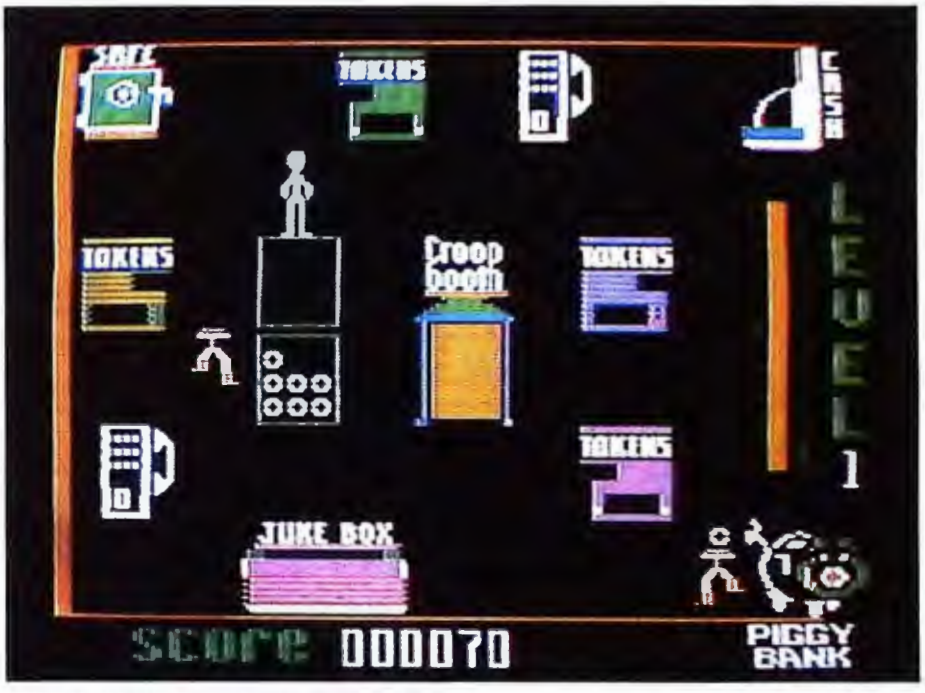
These New Computer Games May Remind You Of Saturday Morning in Front of the TV

By Cindy L. Morgan

Charlie Chaplin would love the new computer games that premiered this year at the Summer Consumer Electronics Show in Chicago. In fact the Little Tramp would probably get a scholarship yen to produce and direct a game or two himself after getting a look at this latest lineup of computer games.

With more action, sounds and colors than ever, the computer adventures unveiled at this summer's CES push the home computer to its most entertaining limits yet—beyond the capabilities of earlier computer games, and well beyond the capabilities of home video game systems. Many of this summer's crop offer new graphics of almost cartoon quality. Some have humorous story lines. And many are populated by interesting characters—including computerized heroes, their wily sidekicks, and their devious arch-enemies.

In the games presented here, most of the characters are less blocklike than they were in the computer games of yesteryear, and some are downright lifelike. Spaceships look less like beehives than they used to, and seem to have finer detail. Planets . . . well, they look like planets instead of round blobs of color. And stars are shimmering arrays of sparkles, not just dull blotches of white light.



SURE WINNER: Looks like Broderbund has hit the jackpot with **Spare Change.**

The sounds of the new games are more artfully orchestrated than ever, too, and often contribute to the plot. Almost gone are those lifeless blips and blops that served as sound effects in many older games. Some of this year's new games are so carefully scored, in fact, that they sound like science-fiction symphonies.

So here's a little software slapstick. We like it, and we think you will. In fact you'll probably enjoy just watching some of these new games as much as actually digging in and playing them.

BRODERBUND

SPARE CHANGE

For Apple Computers. Soon to be released in Atari format.

Spare Change should climb to the top of the computer game charts this year. Most definitely a member of the Slapstick School of Software, this is also a

Cindy L. Morgan is a free-lance writer who specializes in electronics.

Illustration by Ron Walotsky, photos by Perry Greenberg

great game to watch someone play. Its cartoon-like graphics could make it a hit at parties and small gatherings.

The game stars a clever guy who runs the Spare Change Game Arcade. Business has been good. But, alas, his amusing leggy adversaries (which Broderbund calls Zerks) are out to pick up the arcade's Spare Change for themselves.

You, playing the role of the wily arcade owner, must stop them. You do everything imaginable to trick them. You pop popcorn so they'll stop to eat. You keep ringing the pay phone so they'll chat. You'll even stoop to playing the jukebox to start them dancing and get them away from your property. Each time you fill up their game slot with tokens, these zany Zerks return to the screen and act out a series of cartoons. First-class sight gags highlighting the squabbling, mischievous Zerks take place between game levels. And this game is as much fun as a rerun as it is the first time around!

BRODERBUND
GUMBALL
For Apple Computers.

This summer release is a clever action-oriented game that also requires a good memory and fast thinking. **Gumball** puts you in the unlikely role of

being a sorter in a gumball factory. Gumballs of various colors appear at the top of the screen and start rolling down chutes, and your job is to maneuver switches that route them into appropriately colored carts at the bottom of the screen. A count of your quota is kept, and a clock clicks away the time (9 to 5).

Occasionally, usually when you're feeling most harassed, your supervisor shows up and shakes his fist at you in a "hurry up" gesture. And each time a gumball falls into the wrong cart, he comes out and dumps out the whole bin!

When 5 o'clock rolls around, there's an interlude during which you quit work and go home. And as you become more skilled at your job, the house you return to after work gets nicer. You start off with a small cottage. Then you get a ranch house. Get a high enough score, and you can wind up with a mansion. But a low score will land you in the doghouse—literally.

There are also hazards placed in your way to keep the game exciting. There are explosive gumballs in the assembly line, for instance, which you have to eliminate before they "gum up" the works. To make things even more sticky, the order of the colored bins keeps changing, keeping you alert, and the gum and switches move at an increasingly faster pace as your score mounts.

CBS GAMES
BLUEPRINT
For Atari Computers.

Blueprint is your basic Silent Movie Melodrama, based on a "Damsel in Distress" escapade presented in three game scenarios. In its Atari format, it is a dead ringer for the Bally/Midway arcade version of the game. Memorization of hidden objects plays a key role in successful scoring.

In **Blueprint,** a character called Ollie the Ogre is out to harm our Fair Lady—and you, of course, must try to rescue her. But to save her you must assemble a getaway contraption. The trick is to find all of the parts you'll need to build the vehicle and to put

them together the way the Blueprint says. Unfortunately, the parts are all hidden in houses scattered around town. You can't see the pieces in each house, so you must ferret them out through a process of elimination.

As you get better at the game, and start uncovering machine parts, a dastardly little squealer named Sneaky Pete abets your foe by revealing your location. (He also tries to steal your pieces.) As the action speeds up, you must also dodge bombs, which you must dispose of in a bomb pit.

The bombs that threaten you have different colors, depending on how long it takes them to detonate. Red bombs go off the fastest, and you must not waste time getting them out of your way.

If you are slow and are "killed" by a bomb, you sprout angel's wings and float to heaven with a smile. If you stay alive, you assemble individual code letters which, upon successful completion of the game, reveal a hidden password.

CREATIVE SOFTWARE
MOONDUST
For Commodore 64; other versions to follow.

This game is for the artistically and musically inclined player. It requires a joystick if you want to make most of its wealth of colors. Joystick is

certainly one of the most attractive games around, and its designers also worked to take advantage of sound opportunities. Its chords change from major to minor, and from tonic to dominant, and its tones go all around the musical scale in tandem with your joystick's movements. The result is a sort of moonstruck science-fiction symphony.

The game opens with the **Moondust** title traced out by gumdrop-shaped spaceships, along with an opening musical theme. Next you select your playing level: Beginner, evasive, freestyle, or "spin-sanity."

That done, a doughboy-shaped hero and six spaceships burst forth from

center screen. As these ships move across the screen, they leave jet vapor trails behind in sparkly speckles of color.

The object of the game is more than just watching the graphics, of course. Each spaceship drops twinkling "seeds." As the action builds, the music fades—just like in the movies—and you work to manipulate your ships through the sparkling seeds, spreading them like butter through a kind of bullseye. More and more seeds continue to appear. You score points on how close you move seeds to the center of the target. Of course, the ships speed up and change direction as complexity builds.

DATASOFT

POOYAN

For Atari computers; Apple, Commodore and VIC-20 versions available soon.

In **Pooyan,** an arcade classic now available for home computers, your mission is to protect a community of innocent piglets from a pack of ravenous wolves. The piglets live in a happy valley, and the wolves, using balloons and parachutes, keep leaping off a cliff and drifting toward the ground. You're in a movable car that moves up and down, and you have a bow and lots of arrows. When the wolves descend, hurling objects at you, you can fire arrows at them—and at their balloons.

Pooyan requires fast thinking as well as quick reflexes. Every wolf you let escape is not only a threat to the

piglets you're protecting, but also a threat to you. Balanced precariously on a precipice above you, there's a giant rock—and the wolves are cooking up a scheme to give it a shove and squash you. And the more wolves you let by, the better a chance they have of carrying out their plan!

DATAMOST

COSMIC TUNNELS

For the Commodore 64 and Atari Computers.

Cosmic Tunnels moves through 16 different screens: four screens for each of four different cosmic tunnels. The story line takes you away from your home planet in a mighty spaceship, but before you do anything else you must get

through the first of four colorful tunnels. You've got about 60 seconds to work your way through Tunnel No. 1. When you emerge, you're on another planet.

When you leave the tunnel, you're on Screen 2—a long shot of this new planet. You must dodge missiles and knock out missile sites as you try to land. When you destroy all of the missile sites and land, the computer switches to Screen 3.

Your next goal is to leave your spaceship, walk around the planet, and pick up all-important energy bars. Nasty aliens attack you again and again as you pick up bars and take them back to your ship. When you load up enough bars, with the help of springs that can propel you across the screen, you proceed from whence you came—back through the tunnel and home. Then you start over, proceeding to Tunnel Number Two—and increasingly difficult levels of game play—until you conquer all four cosmic tunnels. High scorers are those who move the fastest through all four quadrants of the galaxy.

EPYX

JUMPMAN JUNIOR

For Atari Computers.

Familiar with Epyx' popular **Jumpman** game? This sequel bears a strong resemblance to the original, with a similar ladders-and-grids theme. But **Jumpman Junior** takes you even further—through 12 screens and with eight different speeds.

An acrobatic and agile **Jumpman Junior** leaps from ladder to ladder, from grid to grid—and tries to beat the

clock. As he progresses from level to level, he is pitted against a series of increasingly tough challenges. In one screen, Electrocution Pads crop up to thwart Junior's movements. In a Hurricane scene, a great wind tries to knock our hero off his balance. In a level dubbed Hellstones, falling objects from the sky chase Jumpman from grid to grid. The sequel's tough, but even better than the original.

FOX GAMES

PORKY'S

For Atari Computers, the VIC-20, and the TI-99/4A.

Porky's is a takeoff on the Twentieth Century Fox film of the same name that broke box-office records last year.

Game play focuses on the antics of the now famous quartet of Pee Wee, Miss Ballbricker, Porky and Wendy. Pee Wee, the character who is player-controlled, is dead set on blowing up Porky's den of sin and making time

with Wendy during his quest. Pursuing our intrepid hero are the dastardly computer-controlled villains, Miss Ballbricker and Porky.

Before you get an opportunity to

blow up Porky's, you must work through a variety of obstacles. Scenes that slow you down include a highway, a potential swim in a swamp, some tempting showers, and a scaffold. Depending on your ability to get across these obstacles, you can accumulate points. You can also lose points if you are clumsy.

Porky's is designed primarily for people who saw Porky's—the Movie—and loved it. If you didn't see the film, you might not quite understand this computer game. But if the game baffles you, you can go see Porky's II.

HES
(Human Engineered Software)

ATTACK OF THE MUTANT CAMELS

For the Commodore 64 and VIC-20.

What's a Mutant Camel? And do we care?

Anyway, the Camels are here—courtesy of one of the most creative game publishers we know. But don't worry about what a mutant camel is. It's sort

of an in joke between the City of San Francisco, its radio station KMEL 106 (get it?), and game designer Jeff Mintner. Since Mintner liked KMEL 106 and the Bay City, he simply decided to honor it in this his newest game.

What's more important, is that Mintner was the designer behind the popular **Gridrunner** game—and with **Attack,** he's added 20 new skill levels to his original concept. The first several levels are identical to those in **Gridrunner.** Oldtimers are free to skip ahead to the new parts if they like.

A unique "pause" feature in the game benefits all levels of players, allowing you to stop at any given point to get a snack, to answer the phone—or to simply catch your breath.

Each of the game's 20 levels presents a different scenario. As the Gridrunner, you use a joystick to move through the different levels and away from your enemies, the Droids. These Droids, when hit, are good for points. But they also split up into pods which go through their own changes during the course of the game. You try to gun down each pod as it forms.

The game features special point-scoring rounds featuring the "camels" themselves and a magic point score of "106." (Like the station's call letters.) If at any time you bump into grids or energy bolts . . . you die.

On the first six levels, your ship moves left to right. As the game gets tougher, you move diagonally as well. As if this wasn't hard enough, a "snitch" character crops up—a humanoid who reveals your location to Droids.

This game's got great cult potential—even outside San Francisco. A hidden Mystery Bonus can get you an extra 2,000 to 8,000 points. But we don't know exactly how you can get all these points, and HES isn't telling. The only hint they gave us was that by experimenting and fooling around you can literally stumble onto the solutions to many mysteries. For example, if you go off the edge a certain way (so clued a HES game player) you might pick up some of those bonus points.

The idea of the Mystery Bonus is to encourage experimentation and thus make the game longer-lasting. As you discover Mystery Points, HES suggests that you jot them down. Then you can swap your findings with other **Camel** lovers who, through their own trial-and-error processes, have discovered Mysteries that you missed.

IMAGIC

MOONSWEEPER

For VIC-20 and Atari Computers.

Some hard-working miner types are stuck on Jupiter's moons and want to

be rescued. And you are the rescuer in **Moonsweeper,** 3-D-style space game.

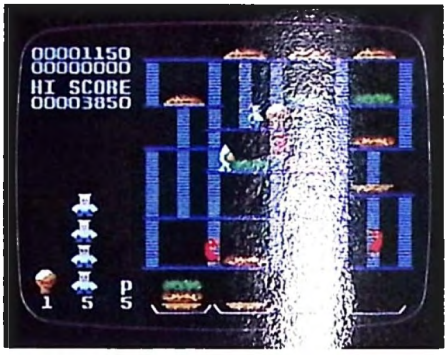
Radar reveals where the miners are stuck, but you have to avoid the usual meteors. As you destroy flying obstacles and avoid enemies, you try to land and pick up miners. When you lift off from one moon, you look for other moons and faster enemies. The Atari computer version is much more graphic than its VCS counterpart.

MATTEL

BURGERTIME

For Apple Computers and the IBM PC.

Who doesn't like the lure of a good burger? Everybody—unless you're a pickle or an onion. In this computer



game by Mattel, the ho[illegible]s and the pickles are in fact jealo[illegible]he attention the chef is giving the [illegible]ers. You, as the chief Burger Chef, [illegible] up and down in ladder format[illegible] build a proper burger—with all [illegible]f patties (we assume), lettuce and b[illegible]us (no special sauce). To keep those angry hot dogs and pickles away, you try to bury them in fixings. You can even slow them down with a hit of pepper. If you successfully build four burgers, you can proceed to faster and more difficult levels.

PARKER BROTHERS

Q*BERT

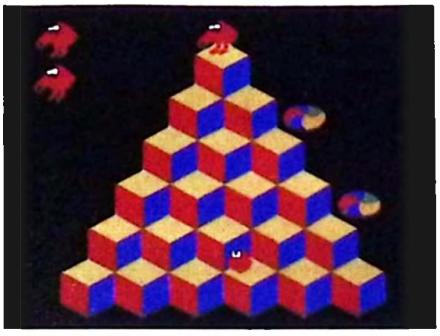
For Atari, VIC-20 and Commodore 64 Computers.

Q*BERT is a popular character: he may never be quite as well-known as Pac-Man, but he's working on it.

Q*BERT has tireless little feet, a long snout, and resembles a kiwi. Agile little bird that he is, he spends much of his time hopping about on a pyramid of cubes. As he deftly lands on a single

cube, it changes color.

But rolling down from the top of this pyramid after **Q*BERT** are avalanches of colored balls. He can't escape by running all the way down the



pyramid since two characters (that Parker has named "Ugh" and "Wrong Way") have learned to fall up after him. A real surprise for **Q*BERT** is Coily, a snake who hatches from one of the purple balls, and who must also be avoided.

To help **Q*BERT** get away from snakes and falling objects, you must [illegible] him off the pyramid and onto a [illegible]ng disc which floats like a magic [illegible] and takes him back to his van[illegible] at the top of the pyramid.

[illegible]omputer version of **Q*BERT** [illegible]h better than the VCS video [illegible]ersion, but as good as the [illegible]version. Still, you'll have little [illegible]e recognizing **Q*BERT** when he [illegible]ars on his own CBS network car[illegible]series this fall. This game is well-[illegible]d to younger family members, by the way.

SIERRA ON-LINE

APPLE CIDER SPIDER

For the Apple (Upcoming for Atari, Commodore 64 and others).

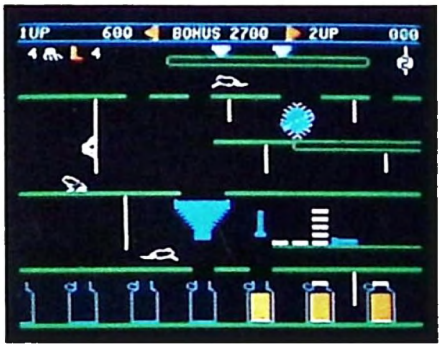
You don't have to be afraid of spiders any longer.

In this new Sierra On-Line game you'll meet the **Apple Cider Spider**—a spider who makes his home in an old Apple Cider Mill. By day, the mill is busy making cider. By night, the **Apple Cider Spider** prowls the mill spinning webs, constructing drop lines, and generally touring the facilities.

But, he gets into trouble one morning when he loses track of time and doesn't get back to his home web before the mill opens. Your goal is to guide him through his escape webs and back to his family.

The game features three screens. The first places you at the upper end of the mill. In the second, you're near a production line where apples are cut. You must pull the spider up from floor to floor by his own drop lines.

In addition, you must help him dodge birds, frogs, and wasps on his way through the mill. And, you must avoid dropping him onto the conveyor belt the wrong way. You have to work to get the hang of this game. Beginners can start out slowly, familiarizing themselves with the spider's run-and-



jump antics. As you become more experienced, you can work on trimming the time it takes you to get your spider home.

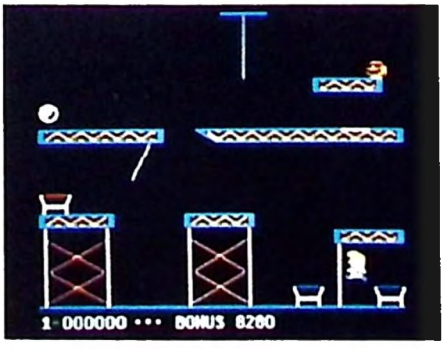
P.S.—You'll love the reception the spider gets when he safely reaches home and his family joins together in a "Hail, Hail" merry melody.

SIERRA ON-LINE

SAMMY LIGHTFOOT

For the Apple (Soon in formats for Atari computers and the Commodore 64).

Sammy, a penguin-like fellow with an Elvis haircut, wants to join the circus. And the game that bears his name takes you through the trial and errors of his audition—all 12 levels of it. The game passes through three scenes. In the first, Sammy bobs up and down on a trampoline. To make his work more



difficult, barrels come rolling down toward him from the upper left corner of the screen, and he has to avoid them. Eventually, at midscreen, he runs and jumps onto a trapeze.

The next screen shows blocks lined up in a row, moving up and down like pistons. Sammy has to cross over the pistons without getting mashed. As the action gets rougher, the pistons move faster and start disappearing and reappearing at random.

When he's had enough of the pistons, Sammy gets a quick magic carpet ride. Sounds simple, but the carpet moves like a roller coaster, and you must keep Sammy on board as it rolls around. Sammy eventually parks the carpet and moves on to his next trial.

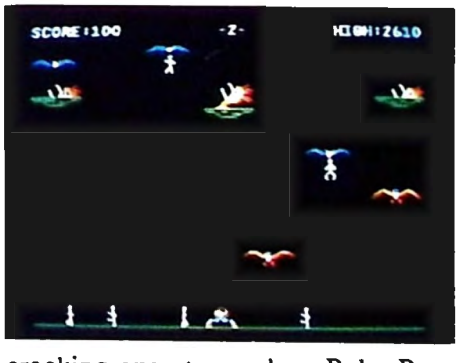
Here, Sammy is caught in the midst of a collection of bouncing, ricocheting balls. But that isn't all. He also must get past a barrier of bars that move up and down. After he does that he has to jump to another trapeze. And then he starts all over again, at faster speeds. Will Sammy get into the circus? That's up to you!

SIRIUS

BUZZARD BAIT

For the VIC-20, Apple Computers, and the IBM PC.

This animated cartoon-like game has a real Saturday morning flavor. At the opening, you see three buzzard nests at the top of the screen. Boy Buzzard swoops down and meets Girl Buzzard in a mating game routine, with the resulting eggs ultimately



cracking open to produce Baby Buzzards. Now there are hungry mouths to feed, and the Parent Birds must dive at humans to feed their chicks. The action gets more and more frantic as wave after wave of Buzzards comes flying down, trying to capture you and other Humans. You'll marvel at the

well-animated humans on the screen who run around the nests, dive off into space, and do many hilarious things to avoid becoming Buzzard Feed. Now and then some penguins also show up to add comic relief and extra challenges.

The action gets really silly when the penguins start to segue into Buzzard scenes—and when the Humans have to get out of the way of splattering eggs.

STARPATH

ESCAPE FROM THE MINDMASTER

For Atari Computers.

This game takes full advantage of six tricky game levels and offers many computer colors. An overview map tells you where you are, and the direction you are facing in a complicated

maze. Essentially, the scenario places you in the hands of a superior being who is putting you through the paces to test your intelligence level. Your goal is to show how smart humans are by passing all of the tests as quickly as possible. While you work through a matrix of doors, many of them one-way, you must also avoid falling objects. Speed, dexterity and memory are all important in this fast-moving game.

SYNAPSE

BLUE MAX

For Atari Computers.

The **Blue Max** is a World War I biplane. You get to fly the Max and prove you're a Flying Ace—or better—in this three-scenario game. The object is to fly through enemy territory and destroy outposts, bridges and runways. Ultimately, you must destroy three targets in an enemy city. In Scene 1, you'll find yourself scrolling diagonally, **Zaxxon**-style, up a realistic-looking river surrounded by enemy emplacements. Before moving on to Level 2, you may land and refuel. Next, you'll move over the land, coming closer to your goal, once again shooting down a volley of attackers

and enemy holdings. In Scene 3, you reach the City.

As you scroll over that river, your joystick lets you simulate a flight in as many ways as possible, controlling altitude, banking and landing patterns. In other scenes, as you dogfight, you'll be greeted by a host of realistic sounds. Anglophiles will appreciate the opening "Hail Britannia" tune, and you Flying Aces will love the airplane motors, bombs hitting the water, machine gun rat-atat-tats, flack and wind sounds. Other sounds will warn you of fuel leaks, damaged bomb doors, or gun problems.

Speed isn't this game's strong suit, but it does test maneuverability.

The big question, though, is: How do you rate at the game's end? If you handily accomplished your mission, you get the ultimate rank: "Blue Max." You are considered a "Flying Ace" if you pass Level 2. A rookie score makes you an Air Cadet. And if you just bombed out ... well, a Runway Sweeper is what you are.

TRONIX

JUICE

For the Commodore 64 and Atari Computers.

Juice, created by the same person who thought up **Kid Grid**, isn't about the orange or grapefruit product. No, it's about a "power"-ful character named Edison who builds circuit boards.

Edison doesn't think building boards is really all that tough ... but a series of foes are out to debilitate him throughout six play levels. Each level offers three rounds and a bonus round. The higher the level obtained, the more characters attempt to thwart poor Edison. Edison jumps around a board, **Q*BERT**-style, and the faster he gets through a round, the more points he scores—just like in any other assembly line! When he beats his arch enemy Killerwatt, he is awarded 500 points. Each time he "contacts" two other characters—Flash and Recharge—another 200 points are tallied. In addi-

tion to scoring points, he ... quick to duck Flash, a character ... disconnect everything in sight ... his high-energy game offers an E... option that lets you freeze the a...

NOT THE EN...

Well, that's all, folks. T... st reel is in the projector, the last ...itle has come and gone, and the ...ist has pounded out his final cre... ...lo.

You've rescued the fai... ...amsel in **Blueprint**, braved the **Attack of the Mutant Camels**, and somehow managed not to wind up as **Buzzard Bait.**

You've helped **Sammy Lightfoot** pass his audition, dropped into Mattel's for a Coke and a burger, and you may have even taken **Burgertime** out to get drunk and get loud over at Porky's place.

And now, after all that and a full day at the **Gumball** factory, it's about time to go home.

Well, now's your chance. The house lights are coming up, the fat man next to you is getting up, and those famous words "The End" have just flashed on the screen.

But wait—these aren't the movies—they're computer games! So if you want to Play it Again, Sam, don't despair. Just press the reset button, settle back, and roll it again! ●

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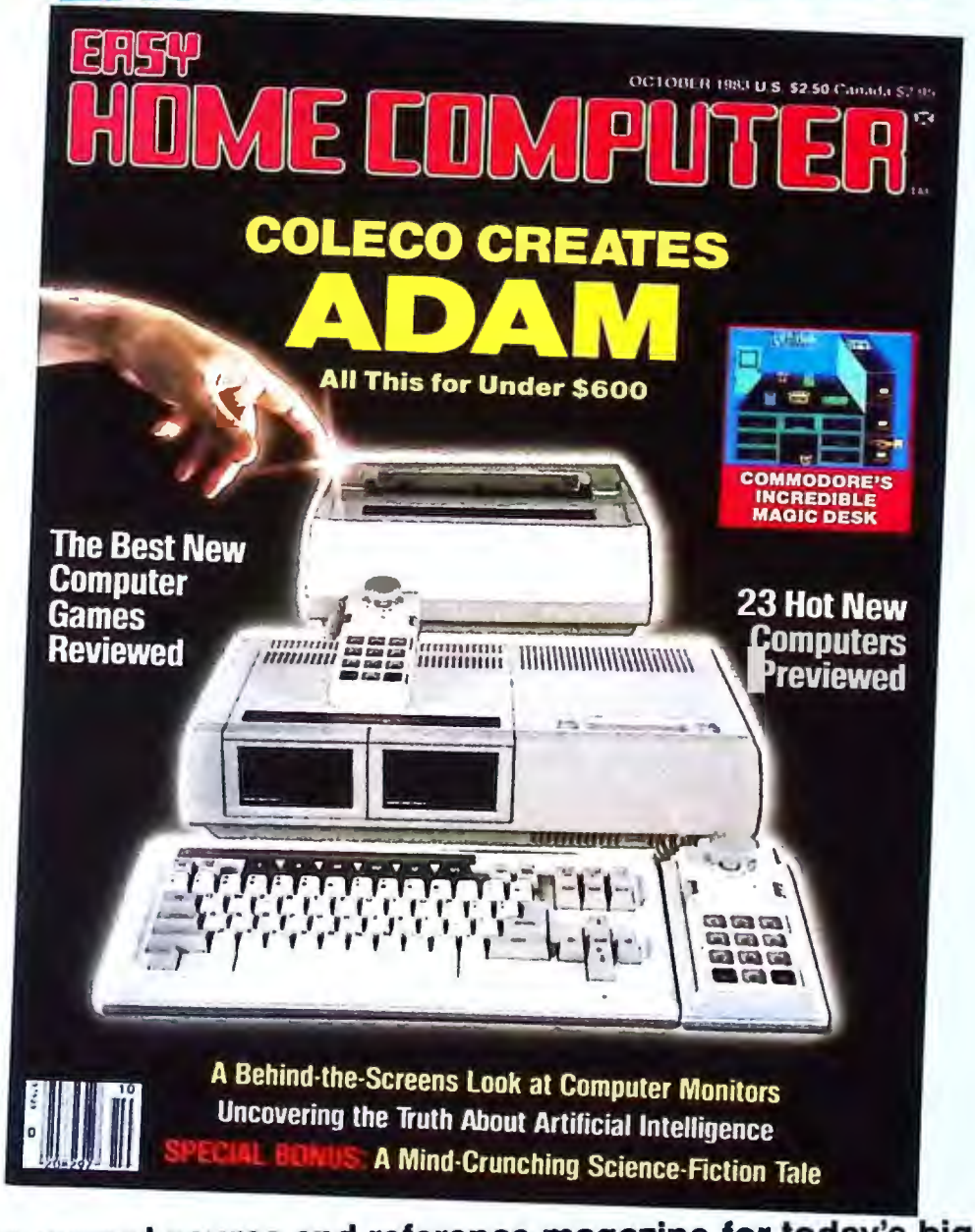

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PORTS OF CALL

A HITCHHIKER'S GUIDE TO COMPUTER NETWORKS

By Ric Manning

Feeling fraggled by Frogger?
Vanquished by *Visicalc?*
Wasted on *Wordstar?*

What you and your computer need is a little vacation, a coast-to-coast tour of the roadside attractions along America's data highways. The trip won't cost you a dime in gas, but you might spend a few dollars in long-distance phone bills.

Here's what you'll need:

- **A computer.** Just about any will do, so long as it has the ability to communicate over the telephone lines.
- **A modem.** That's shorthand for modulator-demodulator, a device that lets your computer talk to another computer. They are available for just about every small computer. A lot of Apple owners are partial to the Hayes Micromodem, which costs about $300 from mail-order sources. Commodore's modem, at $109, is among the cheapest.
- **A terminal program.** That's software that tells your computer to act like an extension of the computers you'll be tapping into. A lot of Apple owners use *Visiterm* or *ASCII* Express, while *PC Talk* is popular with IBM owners. And a lot of modem manufacturers provide software with their hardware.
- **A telephone.** In most cases, the garden variety phone will do just fine, but a touch-tone will let you take advantage of MCI, Sprint or other long-distance discount services.

The trip may also involve some late-night navigation. Telephone rates are cheapest after 11 p.m., so if you have to be in bed by midnight, you may not want to buy a ticket.

Here's your itinerary:

New York—You can fatten your software library with a visit to *Astrocom,* an elaborate computerized bulletin board that lists more than 150 programs—and lets you download all of them directly to your computer.

Pennsylvania—Looking for something a little racier? Dru Simon's *Drucom* board in New Hope, Pa., sells lingerie along with computer equipment.

Georgia—If you can't find enough new software at *Astrocom,* a service in Augusta called *Dajax* will sell you programs delivered directly to your computer and charged to your bank card.

Illinois—Time for a recreation stop. *Gamemaster* in Evanston, Ill., sells time on a gaming system that allows several players to compete at the same time.

Texas—*Mines of Moria,* a "pirate board" in Houston, can provide you with tips for cracking copyrighted software. And in Victoria, you can participate in some serious discussions in an electronic forum called *CommuniTree.* This system specializes in topics related to rockets and free enterprise in space.

California—You can end your tour in Los Angeles with a visit to a bulletin board that deals in fantasy and science fiction. You might even want to gamble on *Dial-Your-Match,* a booming dating board for computer users.

COMPUTER CB

That's a quick tour of the world of computerized bulletin boards, the fastest-growing communication system since motorists discovered Citizen's Band radio.

In a way, the bulletin board network is similar to a CB channel. It allows computer users to communicate—anonymously, if they choose—with other users. But while a CB radio reaches only a couple of miles, the nation's data highways are limited only by the boundaries of the international telephone system.

Bulletin boards are the most primitive of the electronic roadside stops. Most are far less elaborate than commercial information utilities like *The Source* and *CompuServe.* But, like a raucous roadhouse, they are often the most entertaining.

Anyone with a computer, a bulletin board program, a telephone line and a modem that will automatically answer incoming calls can start a board. Some bulletin board entrepreneurs have their computers hooked up to their boards permanently, but many boards are put online only when their owners aren't doing other things such as checking stock tables or playing Zork.

A recent list of computerized message systems published by *The Source* contained more than 500 telephone numbers. But new boards appear and old ones disappear faster than network television shows.

Dale Vaughn, who runs the *Forum-80* board in operation in Denver, calls bulletin boards "one of the most exciting ways available for information exchange." But Vaughn also says that keeping a board humming "is a terrible drain on the individual operator."

Marshall Goldberg agrees. Goldberg is the founder of *The Boston Bullet,* a board run on a TRS-80 in Goldberg's apartment.

"The amount of work needed to keep them running is tremendous," he says. "The software has to be maintained perfectly, and your hardware is running 24 hours a day. Equipment right out of the box can't take that—I've had to modify everything so it can

Illustration by Robert Pasternak

run all the time."

Some boards are financed by computer stores, which use them to support local computer user groups and to promote their services. Others are run by hobbyist groups.

Ward Christensen and Randy Suess started *Chicago CBBS*, one of the first boards in the country. They premiered the board in 1978 with the intention of using it as an electronic newsletter for the Chicago Area Computer Hobbyist Exchange. As it turned out, the service was never officially affiliated with that group, but computer organizations use it to post information for their members.

As with most boards, the focus on *Chicago CBBS* is its bulletin section. Callers can seek advice about computer hardware or software, post notices of club meetings or special events and send electronic mail to each other.

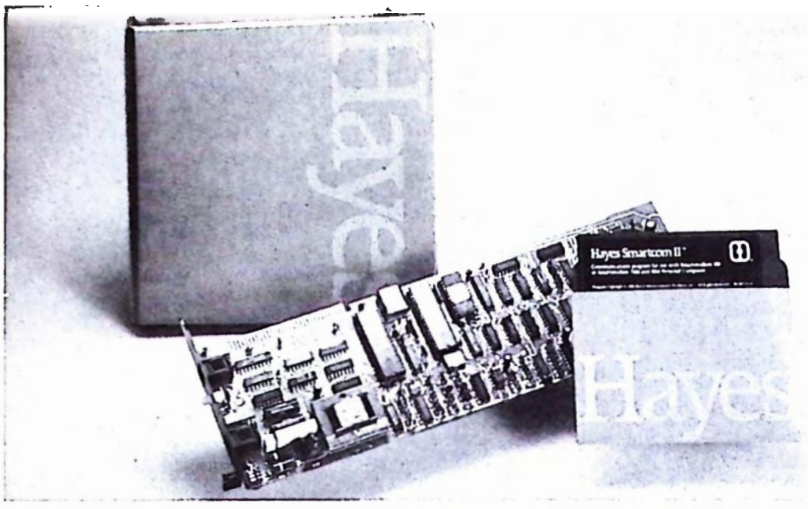
Most of the first bulletin boards were run on Apple or Radio Shack computers and most of their programs and technical information dealt with those computers. But the growing popularity of other brands of computers has spawned dozens of specialized boards for users of Atari, IBM, Commodore and other computer systems.

Over the past few years, individual system operators—"Sysops," in bulletin board jargon—have added other features, including data banks for different types of computers. Most boards are used largely for electronic mail and for downloading software.

"A lot of my callers go straight to the download section," said Dru Simon, whose board offers adventure type games and posters. Simon and Vaughn have each modified and expanded their boards to offer more features and make them easier to use.

LOGGING ON

Most boards greet callers with a brief message that introduces the system. You are then asked to sign on with your name, address and telephone number. Some boards will let you on only if you have a password or some good reason for calling. A Chicago board for computers that use the CP/M operating system asks callers for the name of Digital Research's standard debugger. If you can't answer correctly, it politely logs you off with the notation that "this system wouldn't be useful to you anyway."



PLUGGING IN: With the Hayes Smartmodem 1200B, users of IBM Personal Computers can plug into the world. Hayes also makes modems for most other kinds of microcomputers.

Some boards assign personal password codes to callers. With a password, you can receive private messages and gain access to some sections of the board.

Dru Simon makes you pass a test to determine if you are over 21 before she'll let you into the "adult" sections of her board.

After you're logged in, a board usually presents a list of commands for the functions it supports. One command may adjust the screen width, another will give you lowercase characters and so on.

If you get confused, try the "Chat" command. It will page the system operator (Sysop), who will break in to talk directly with you and help you find your way around.

What you find on the board depends on what the board offers—and on your own interests. A local board will serve well as an electronic mailbox and message clearinghouse for you and your computer-using friends. Most offer a password-protected mail service so only you can read your messages.

Some boards also offer a variety of text files. Those can be funny stories, news reports, lists of board users, or other bulletin board telephone numbers.

GOING COMMERCIAL

As boards become more popular, operators are finding ways to let users pay some of the costs—or even turn the services into money-making enterprises. Rob Nebiker, who runs the *Rubber Apple User Group's* board in Akron, Ohio, belongs to a group of computer users who started their own private board in Cleveland. The group is limited to 100 members who all share in the cost of running the system.

Bud Napier, founder of *Pirates' Harbor* in Boston, started the board as a clearinghouse for information on cracking protected software. But Napier soon expanded the board's service and wound up investing about $50 in hardware.

Last year, Napier instituted a password fee and expanded service even further. Now he offers a commercial database called TIMECOR, which is available through a local phone in major cities to the GTE Telenet network.

Dru Simon's board is still free, but she makes a few dollars on her mail-order services. "The bulletin board is paying its own bills, but it doesn't support me really well," she said. Goldberg's *Boston Bullet* is also free, but it now charges a $28 annual fee for users who want access to the game section.

Howard Young, who has experimented with a bulletin board as a way to distribute his stock market newsletter, said he thinks the number of pay-for-play boards will increase. "I think eventually it has to come down to some sort of business aspect because of the time and expense involved in running a bulletin board," said Young. "Unless you're independently wealthy, there has to be some sort of financial return."

A DATA TRIPPER'S ROAD MAP

Here's a look at some of the computerized personal message systems available around the country. Some are free and some charge a fee for full or partial access.

If you can't find what you want here, try dialing up the People's Message System in Santee, CA at (619) 561-7277. It lists the numbers of more than 400 other computer bulletin boards.

Apple Medical Bulletin Board
Iowa City, IA
(319) 353-6528

Tony Frey's board specializes in news and commentary about medical research, equipment and activities.

CBBS
Chicago
(312) 545-8086

[illegible] and Randy's board handles ge[illegible] computer hobbyist and club ne[illegible]ng with ham radio and ge[illegible]lectronics hobby interests.

[illegible] Assembly Line
Louisville
(502) 459-5531

[illegible]Kibbey's service is a general m[illegible]board, primarily of interest to [illegible] owners. Its special feature is [illegible]thly contest for users.

[illegible]agnetic Fantasies
Los Angeles
(213) 388-5198

An Apple-based board that specializes in exchanging messages and information about science fiction and fantasy literature and computer programs.

Microserve
Hawkins, TX
(214) 769-3036

A multi-function board with several specialized message bases, including a section devoted to astrology.

Pontiac Business Bullet-80
Pontiac, MI
(313) 335-9261

A Radio Shack board operated by the General Printing and Office Supply Co., which offers computer merchandise for sale through the board. Special sections include amateur radio news.

Electronic Communications Exchange
Milwaukee, WI
(414) 367-8352

Steve Rundel's board, run on a TRS-80, offers general bulletin board features, including private messages, and a new adult section.

Drucom
North Wales, PA
(215) 855-3809

Dru Simon's elaborate TRS-80 board offers a variety of services in addition to the usual bulletin and mail services. She runs an advice column on romantic topics, a catalog mail-order section for computer hardware and software, along with ads for lingerie and sexual aids. There is also a game section and section for downloading programs and posters.

Gas-Net
Greenbelt, MD
(301) 344-9156

This is a clearinghouse for messages related to the Space Shuttle and NASA's Get-Away Special (GAS) program, which offers the public opportunities to put small payloads aboard space flight vehicles.

Dial-Your-Match
Los Angeles, CA
(213) 842-3322

The flagship of about a dozen boards, most of them in California, that match lovelorn computer users by comparing their answers to a lengthy questionnaire about their activities and interests.

Big Top Games System
Milwaukee
(414) 259-9475

The Big Top offers a wide selection of adventure-style games. Playing time is limited, and the board is so popular it's hard to get connected.

Santee PMS
Santee, CA
(619) 561-7277

Bill Blue's board is the flagship of the People's Message System. It's a good place for copying Blue's huge list of all types of bulletin boards and their telephone numbers.

Mines of Moria
Houston, TX
(713) 871-8577

This board is devoted primarily to software crackers and adventure game players. Members are asked to buy a membership or to contribute material.

Ed Gelb's Data Base
Wayne Township, N.J.
(201) 694-7425

A huge system loaded with games, computer tutorials, a shopper's section and a large list of other boards.

Access-80
Nashua, NH
(603) 888-6999

The Access board has several special subscriber sections, including one for stock market investors.

Education-80
Greenwich, CT
(203) 629-4375

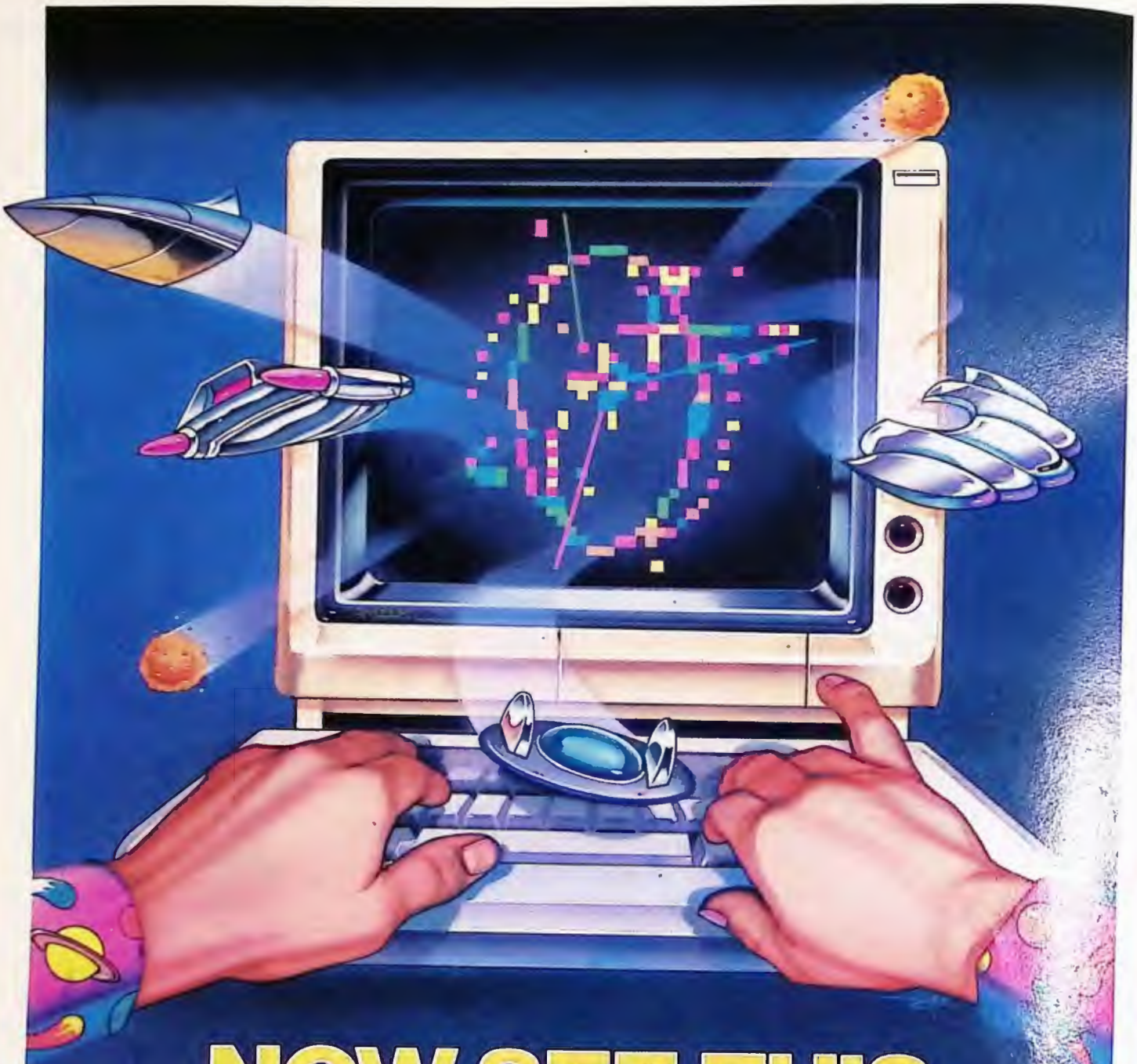
Rob Jackson's board keeps track of education conferences in the East Coast area and posts news about the use of computers in education.

GameMaster
Evanston, Il
(312) 475-4884

An unusual computer gaming system that allows several players scattered around town or around the country to play interactive strategy games. Players logging into the system enter a six-story mansion containing about a dozen game rooms, each devoted to different types of games; military strategy games, for example, or sports games.

Dajax Software
Augusta, GA
(404) 736-3529

This board maintains a catalog of programs and sells them to clients who sign up for the service and give the company a charge-card number. The software comes from their own programmers, from some independent producers and from free-lancers.



NOW SEE THIS

A Behind-The-Screens Look at Computer Monitors

By Dawn Gordon

Stepping out of the video arcade, David walked through the freezing rain and headed toward home. He had been lucky tonight; getting to the twentieth level of Gyruss wasn't easy, and hitting the twenty-third level was all but impossible. Yet he'd done it; and now, back on earth again, he felt like a paid-up member of the Video Arcade Hall of Fame.

Still, oddly enough, he felt dissatisfied. He'd blown his entire monthly allowance—in quarters—and what did he have to show for it? Nothing, really—nothing but an empty wallet, a joystick wrist, and a short-lived high.

Well, that did it. There was only one thing to do—and there would never be a better time to do it than now. As David approached the corner of 79th

Illustration by Gary Yealdhall

Street, a new idea took shape. And by the time he reached the next corner—80th Street and Second Avenue—he'd made his decision. Over the next few months, he'd save every penny—stay out of the arcades—and buy a computer of his own.

Three months (and many odd jobs) later, David finally had his computer. It stood regally in the den, on its own little stand, right next to his family's 25-inch RCA color TV. At a flick of a switch box, he could enjoy a whole evening of video gaming—without spending a single quarter—in the comfort of his own home.

For the next few weeks, David was in ecstacy. Then the inevitable began to happen. Gradually, he began adding accessories to his home computer system.

First came a disk drive, so he could play disk-based games. Then came a printer so he could write and print out his own programs. Next he bought an inexpensive word-processing program so he could do schoolwork on the computer. And then

The discovered he'd need another accessory for the computer monitor.

And also discovered—as most computer hobbyists eventually do—that there are some important differences between ordinary color television sets and computer monitors.

WHAT DAVID LEARNED

Although your family TV set may be quite capable of reproducing computer and video games, it may not be able to handle some of the more demanding jobs that may crop up as you start increasing the sophistication of your home computer system.

For that, you may need a specially designed computer monitor.

This revelation is not intended to make you shake with panic. If you're using your computer with a TV set, and not having any problems, then you may never have to buy a computer monitor.

Sometimes, however, computers do work better with monitors—which, incidentally, are sometimes known as cathode ray tubes, or CRTs.

One advantage that monitors have over standard TV sets is that they never pick up interference, or video noise. Of course TV static may never affect you if you live in a rural area or a small community. But if you live in a big city, video noise may be a real headache.

If you have a static problem, one sure way to get rid of it for good is to use your TV set for what it was designed—namely, TV viewing—and to go out and buy a real monitor for your home computer system.

Photo by Barry Greenberg

Once you have your monitor set up, you probably won't have any trouble operating it. There'll be a few controls to adjust, but you shouldn't have any problems understanding them. A computer monitor works just like a regular TV set, except that it doesn't have a built-in tuner.

A tuner, as you may know, is a device that picks up a TV signal and then does some electronic work on it so it can be displayed on a video screen.

Here's a brief outline of the work a tuner does:

Before a TV signal can be transmitted through the air, it has to be combined with a broadcast signal called a carrier wave. The process of combining a video signal with a carrier wave is called modulation.

When a TV broadcast is picked up by a TV antenna, the signal information that it contains must be separated from its carrier wave before a picture can be produced on a TV screen. This process is called demodulation, and since it has to be carried out every time a broadcast is received, every TV tuner contains a demodulator.

A computer monitor doesn't have to receive broadcast signals, and thus has no need for a tuner—or a demodulator. So there's never a static problem when you use a computer monitor.

ANOTHER PROBLEM

Sometimes, however, a different kind of problem arises when you try to connect a home computer to a video monitor. Some home computers are designed to be used with standard TV sets, and therefore have built-in modulators. These built-in modulators produce modulated TV signals, just like TV stations do. And they must therefore be *demodulated*—by a TV tuner or something similar—before they can be reproduced on a TV screen. So you can't just go around plugging just any home computer into just any monitor and expect the units to work together.

To use a monitor with a computer, you have to find a way to get an *unmodulated* signal out of your computer. And how you do that depends on what kind of computer you have.

If you own an Apple computer or a Texas Instruments 99/4A, for instance, you can get an unmodulated signal without doing anything special. Apples and 99/4As are designed to be used with monitors, and therefore produce unmodulated signals automatically. To use an Apple or a 99/4A with a *standard* TV set, in fact, an external *modulator* is required.

Most other brands of personal computers—such as those made by Atari—are designed to be used with standard TV sets, and therefore produce modulated signals through their built-in

output cables. Fortunately, however, most computers with TV-compatible outputs also have *video outputs* that can provide straight, unmodulated signals to video monitors.

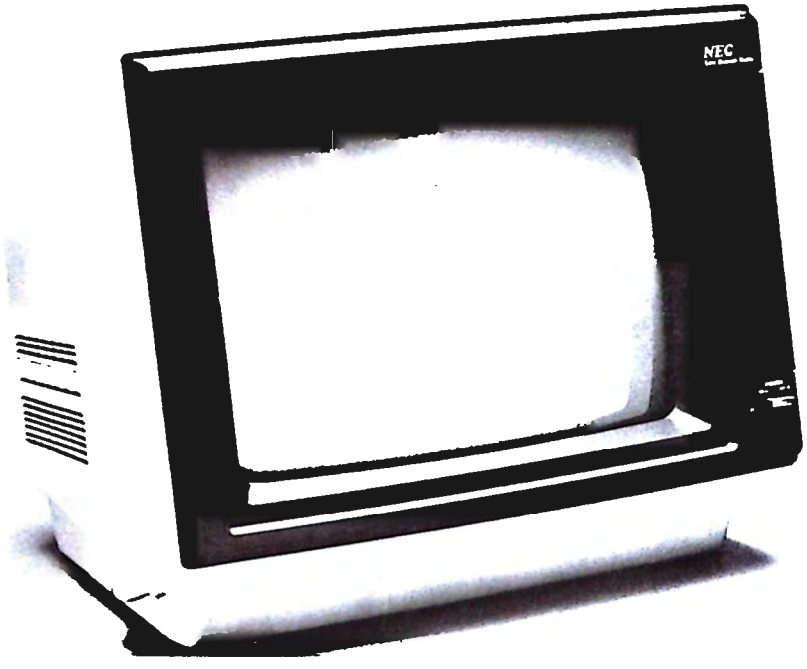
To use these outputs, however, you usually have to buy special cables.

That takes care of just about all of the important differences between TV sets and computer monitors. But if you ever decide to buy a monitor, it might also be helpful to know that several different kinds of monitors are available.

If you like to play computer games, you'll probably want a color monitor—preferably one with a built-in speaker, so you can hear all of those terrific sounds that go with computer games.

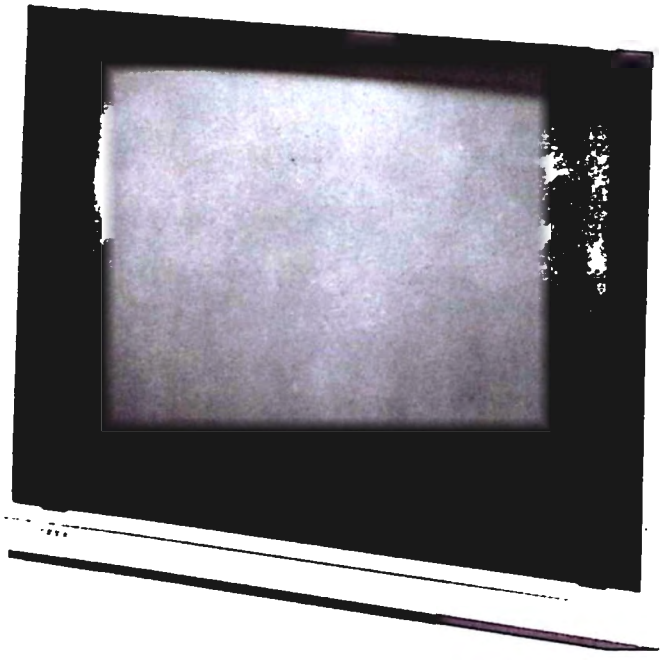
But if you also plan to use your computer for serious purposes—such as word processing—you may want a higher-resolution monitor.

Standard color monitors don't have exceptionally high picture-resolution specifications. But they still work fine with most home computers—and with most home computer software—because home computers are ordinarily designed to produce fairly large letters and numbers on a video screen. The Commodore VIC-20, for example, has a screen display that produces only 22 typed characters per line. Atari and Apple computers produce 40-character



RGB FROM NEC

NEC says that its JC-1216DFA is "a new state-of-the-art color monitor designed for versatile high-resolution graphics." The unit has an RGB input that "answers the need for brighter, full-screen color for many school and business applications," the company adds. The JC-1216DFA has a 12-inch black matrix screen, and a 10 MHz video bandwidth. The unit is compatible with the IBM Personal Computer, says NEC, adding: "Competitively priced, the new monitor permits 'plug-in' versatility for equipment already in service across the nation."

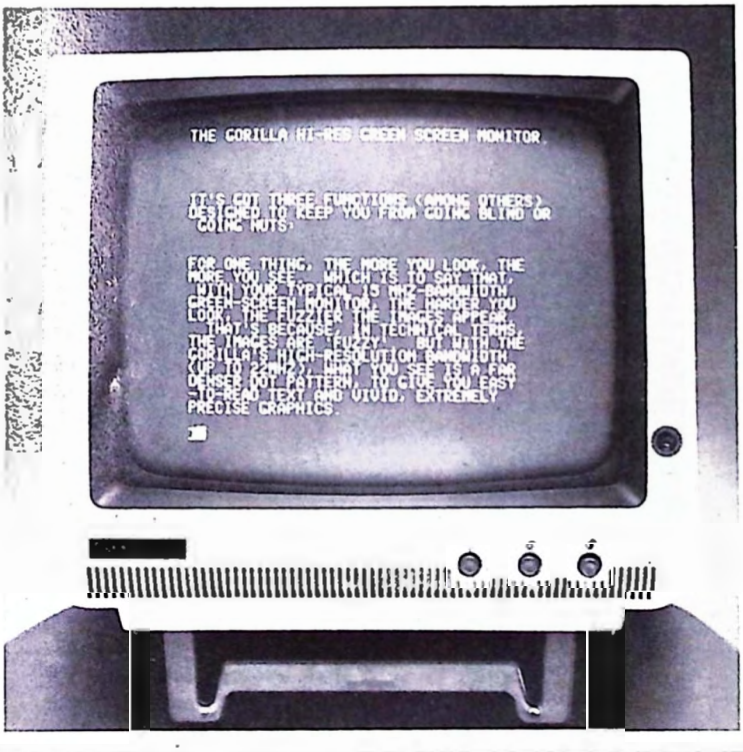


USER'S CHOICE

Sanyo's newest color monitor, the AVM255, has both normal and RGB inputs for color displays, and also has a switchable green-display mode for data processing. In addition, it's equipped with a built-in 5-watt-per-channel audio amplifier and jacks for external speakers. Sanyo says that the AVM255 is "a studio-quality monitor that offers ultra-high resolution from virtually any broadcast or direct video source." Its picture tube is a black matrix model with black glass, and it has concealed front-panel controls. The AVM255 is part of Sanyo's Pro-Ponent line of modular video and audio components. Its list price is $800.

ON THE STAND

"Sakata U.S.A. saw the need and met it," a spokesman for that company declared, "with a standard stand that fits its various color display monitors. It tilts up, tilts down, swivels right, swivels left, swivels to 90 degrees, and—most important of all, is priced far below expectations." The new stand is made of "durable polystyrene in a neutral color," the spokesman added, and is priced at just $49. And special promotional campaigns now under way could make the price even lower when the stand is purchased with a Sakata monitor, he said. Sakata is in Elk Grove Village, Ill., and has a nationwide network of retailers.



A REAL MAGILLA

The Gorilla—a new monitor from Leading Edge of Canton, Mass.—is a high-resolution 12-inch green-screen unit priced at just $99. Its video bandwidth is 18 MHz—about six times that of an ordinary TV set—and it comes with a one-year limited warranty. The Gorilla has a built-in tilt bracket that allows the user to adjust its screen to a comfortable angle, and it has a specially designed non-glare screen that can display twenty-five 80-character lines.

screen displays. And any good color monitor can easily reproduce letters that are that large.

But business-oriented computers usually generate much more detailed displays—and therefore must be used with higher-resolution video monitors. Text displays produced by business computers often have 80 characters, or more, on each line. And now, thanks to plug-in circuit boards being produced by many manufacturers, growing numbers of home computers can also produce 80-column text displays.

To get 80 characters to the line on a video screen, a computer has to generate characters that are quite small. And most color video monitors can't produce a clear display of letters and numbers that are that tiny. For a clear 80-column screen display, you need a high-resolution monitor.

RGB MONITORS

There are two kinds of high-resolution monitors—monochrome and color models. High-resolution color units are usually called RGB (red-green-blue) monitors.

An RGB monitor, as its name implies, has separate inputs for red, green and blue video signals. RGB monitors can generate stunning color graphics,

including multicolored lines of text that can be 80 columns wide or wider. But RGB units are quite expensive—usually over $600—and to use one, you need a computer with special RGB outputs. One computer with RGB outputs is the IBM PC.

Monochrome monitors are much less expensive than RGB models; they usually range in price from less than $100 to around $300. The screen displays of monochrome monitors come in various colors, including green on black, amber on black, and white on black. Black-on-white monitors are also available.

Until recently, green-screen monitors were considered the easiest on the eyes, and therefore best for extended use in jobs such as data entry and word processing. Recently, however, many experts in ergonomics have been saying that amber monitors are even easier to look at, and and therefore even better, than green-screen models.

Monitors come in various sizes; 9-inch, 12-inch and 13-inch sizes are all popular. Small monitors can easily be placed on top of a desktop computer, while larger units must usually be placed father away.

The size you pick is up to you, but the model you buy should produce sharp graphics, with text characters that are easy to read.

There's one important specification

FRESH FROM THE APPLE TREE

Apple Computer, Inc., has a new monochrome monitor designed to match the Apple II computer family—including its newest member, the Apple IIe. The new unit, called the Monitor II, has a tiltable screen with an anti-reflective surface and a high-contrast, high-resolution 80-column display. The screen is coated with P31 green phosphor, which is specially designed to minimize eyestrain. The Monitor II has a list price of $300, and carries Apple's standard 90-day warranty. Apple's extended service plan, AppleCare, is available as an option.

SOMETHING FOR EVERYONE

Amdek says that its new Color II monitor is a perfect match for the IBM PC and PC-compatibles—and, with an optional Digital Video Multiplexer (DVM), the unit is also compatible with the Apple II, the Apple IIe, and the Apple III. The Color II, which comes with RGB digital inputs, measures 14½ inches high, less than 17 inches wide, and 15 inches deep, and it weighs just 30 pounds. Its suggested retail price is $900.

LITTLE GIANT

Comrex International Inc., of Torrance, Calif., has announced the introduction of the new CR-5400 monitor—a 9-inch monochrome model that has an ultra-high resolution and is specially designed for use with portable computers. It's offered in three different models, and each model has a different-colored display: green, yellow-green and amber screens are available. The CR-5400 has a resolution of 800 lines per inch, and a retail price of less than $200. Comrex also has a new 12-inch monitor, the CR-5600, which has a 1,000-line resolution and is priced at less than $230. "It is well-suited for desk-top computer applications," the company says.

ONE AND ONLY

Quadram Corporation of Norcross, Ga., says it has the only color monitor IBM Personal Computer users may ever need. Called Quadchrome, the unit will deliver up to 16 colors, offering new application possibilities for using color in business, graphics, word processing, and entertianment applications, the manufacturer says. The monitor, an RGB 12-inch color model, is designed with a special NEC .31mm dot pitch tube designed to deliver up to 690 horizontal by 480 vertical dot resolution for a sharp screen image. The suggested retail price of Quadchrome is $795.

that can help you determine just how good a monitor's resolution is—and it's a spec that's dependent upon your computer, as well as upon your monitor.

If you're familiar with video specifications, you may be surprised to learn that horizontal resolution—an important spec when TV receivers are being rated—is not the most important specification of a computer monitor. Instead of being rated by its horizontal resolution, as a standard TV set is, a monitor is usually rated by its vertical resolution—or, even more often, by its bandwidth.

Bandwidth is expressed in Megahertz; the more MHz you have, the sharper your image will be.

And the more characters you want to cram into one video line, the higher a bandwidth you'll need.

If your computer displays 40 characters per line, for example, a bandwidth of 6 to 8 MHz will probably be fine. If you have a 64-column display, you'll need a bandwidth of around 10 MHz. For 80-character generation, it's best to have at least 18 MHz for a clear display.

It's helpful to understand specs like these when you go shopping for monitors. But it may save you some time to

check out each monitor's picture first, and then decide whether the unit's bandwidth is wide enough to meet your needs.

To help you check specs, most computer stores can provide you with specification sheets for the monitors they carry.

A FINAL NOTE

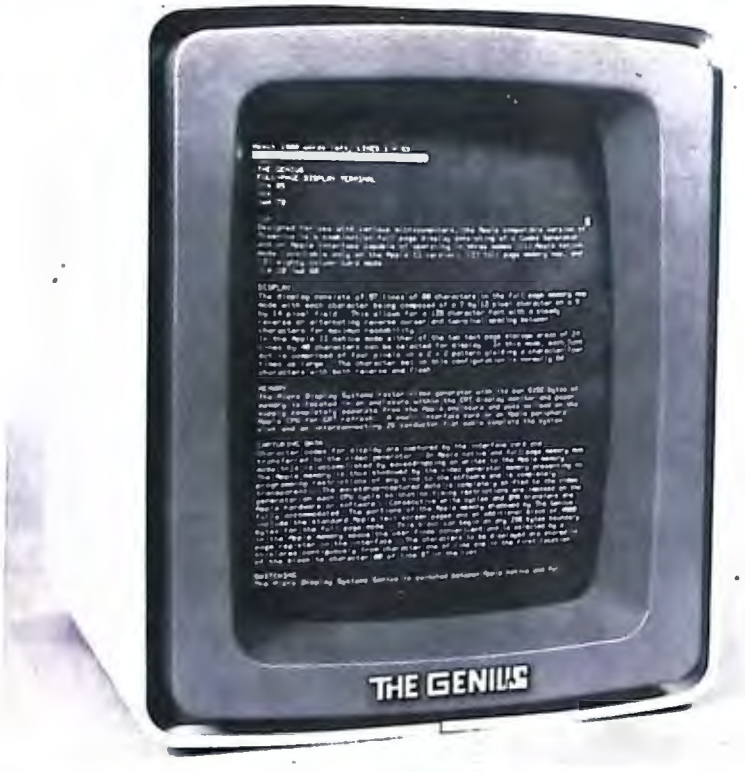
One more note: Some computers come with their own built-in monitors. Built-in monitors can save you the trouble of having to match a computer and a monitor, but most computer-monitor combos have monochrome screens. So before you buy a computer with a built-in monitor, it would be a good idea to make certain that you'll never need a color screen—or that an external monitor can be added later to the computer you buy.

In conclusion, it's very important to select a computer monitor with great care—with as much care as you took, perhaps, when you bought your computer. After all, your CRT is your visual link with your computer—and it would be hard to imagine using a computer without one.

Just ask David. Now that he has a proper monitor, he's making a fortune—designing video games—and that arcade where he used to hang out is just a random access memory from long ago. ●

IT TILTS!

The MM1218 monitor from Hitachi is a 12-inch monochrome model with a convenient tilt-up non-glare screen. The unit's bandwidth is 15 MHz, and it can display 24 rows of 80 characters each, with each character drawn in a 7- by 9-dot matrix. The MM1218 retails for a suggested $200. In mid-1983, Hitachi plans to introduce another new monitor, the CM1490, which will also feature a tilt-up screen. The CM1490 will cost around $700.



STANDUP MONITOR

The Genius—from Micro Display Systems, Inc., of Hastings, Minn.—is a high-resolution monochrome monitor specially designed for word processing. It can display a full page of text—57 lines of 80 characters each—and its characters have fully formed descenders. The unit has a built-in 8K memory, enough to handle the extra graphics capabilities required for its special display. It is available in amber or black-and-white models, and it can be interfaced with an Apple computer through a single printed-circuit card. A model for the IBM Personal Computer is scheduled to be introduced early next year, and versions for other personal computers are also planned. The current model, designed for the Apple II, retails for $1,800 to $2,000.

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THE MAGIC TOUCH

Commodore's New 'Magic Desk' Program is An 'Answer to Lisa,' Manufacturer Claims

THE MAGIC DESK MENU SCREEN

There's some exciting electronic wizardry in the new Commodore *Magic Desk* program, a business-oriented software package billed by its manufacturer as an answer to Apple's $10,000 Lisa computer system.

Actually, Lisa has little to fear from the *Magic Desk*. Lisa, after all, is a super-sophisticated 16-bit computer equipped with a desktop mouse, one megabyte of main memory, multiple screen windows, and spectacular high-resolution graphics. The *Magic Desk* program—designed to be used with a mouse, a track ball or a joystick—is a plug-in cartridge for the Commodore 64 and retails for less than $100.

Lisa and the *MD* program do have some things in common, though. Both systems are designed to be operated using pictures instead of words. Both systems present the user with "menus" showing common objects that you find around the office. The user can manipulate the objects on the screen with a hand controller. And by moving objects around, the user can instruct both systems to perform certain tasks.

Insert a *Magic Desk* cartridge into a Commodore 64, turn the computer on, and what you'll see is a color picture of the interior of an office. In the middle of the screen you'll find a desk, and on top of the desk you'll see a typewriter, a calculator, a financial ledger, a telephone, and a rotary card file.

A filing cabinet stands alongside the desk, and on top of the cabinet there's a digital clock.

Under the desk there's a wastebasket, and hovering over the desk you'll find a picture of a hand.

Using a joystick and a joystick trigger button, you can pick up a sheet of paper with the hand and then move the document anywhere on the screen. Carry the paper to the typewriter, hit the fire button, and the program will become a word processor. Move the paper over to the filing cabinet, press

the trigger, and you can save the document on a disk (or you can load a document into the computer's memory from a disk, if what you want to do is retrieve a file).

There are three drawers in the filing cabinet on the *Magic Desk's* screen. Each drawer can hold up to 10 files, and each file can hold up to 10 pages. You can give each file any title you like. You can look at the names of files any time you like, and you can pull any file out of any stack you happen to be viewing. You can move pages that you've typed from one file to another, and you can copy information from one file to another.

All of the files are stored on disks, so you need a disk drive to operate the *Magic Desk* program. If you have a printer, you can print out information, too.

When you're using the *Magic Desk's* word processor program, the screen display looks like a piece of white paper in a typewriter. Across the bottom of the screen, there's a realistic-looking paper gauge with tab stops numbered and marked. And in the center of the gauge there's a U-shaped indicator that shows you where the next letter you type will be.

The word processor works like a typewriter, too. As you type, the "paper" on the screen moves along from right to left, just like a real sheet of paper would. And the screen—which can display only 40 characters per line on a Commodore 64—works like a window that can be moved around over the paper you're typing.

When you've finished typing a document, you can file it. Or, if you like, you can throw it away. To discard a sheet of paper, you simply move it down to the wastebasket under the desk, hit the trigger button, and the document's gone.

The program's realism doesn't stop there. The digital clock on top of the filing cabinet actually works. Move the onscreen hand up to the clock, press the fire button on your joystick, and you can set the clock. It will then start running, and will keep on keeping time until you turn off your Commodore or stop using your *Magic Desk* program.

Commodore unveiled the *Magic Desk* at the 1983 Summer Consumer Electronics Show in Chicago. And the company said that the cartridge it was exhibiting was only the first in a planned series of *Magic Desk* programs. A telecommunications program (using the telephone on the *Magic Desk)* and an address-file program

WORD PROCESSOR

(using the rotary card file) will be unveiled soon, spokesmen for Commodore said. And still more programs will follow, promised R. John Feagans, the *Magic Desk's* designer.

Even the door behind the desk may be used in some future *Magic Desk* program, said Feagans. But he wouldn't say how.

Feagans said he is the programmer who wrote the operating systems for both the VIC-20 and the Commodore 64. But *Magic Desk* is his first published program, he said.

Now, he said, he is working on several other programs, including some adventure games. And computer users may one day discover some interesting adventures behind the closed door on the *Magic Desk* screen, he added.

Does that mean, Feagans was asked, that the *Magic Desk* program will someday be coupled with an adventure game?

"I didn't say that," he replied.

Feagans' initial *Magic Desk* program is officially called *Magic Desk I—Type and File.* Sig Hartmann, the president of Commodore's software division, said that future packages will include calculator and budget programs, and programs with artistic and educational applications.

Magic Desk I is the first 32K cartridge for the Commodore 64, said Hartmann. Commodore was able to design a 32K cartridge, he said, because the company owns an MOS technology subsidiary and manufactures its own computer chips there.

Hartmann also said that the objects shown on the *Magic Desk* pictorial menu screen are graphic symbols called "sprites"—objects that can be defined in a program and then redefined if desired. By redefining the objects in the picture, he said, program designers can remove objects from the *Magic Desk* and replace them with other objects—for example, ABC blocks for a child's educational program or a guitar for a music program.

Magic Desk is "a truly multinational software package," Hartmann added, because it uses pictures instead of words, and therefore doesn't require the use of any language. "It doesn't matter if the user speaks English, Spanish, French or any other language," said Hartmann, since the symbols on the screen—which Commodore calls "metaphors"—make it easy for people who speak any language to use the program.

Hartmann said Commodore is "No. 1 in hardware" in the home computer industry, and now plans to become No. 1 in home computer software, too. The company introduced dozens of programs for its VIC-20 and Commodore 64 computers at Summer CES, and Hartmann declared: "I assure you that within a very short period of time there won't be any talk about Commodore not having enough software available."

MAGAZINE ON DISK DEBUTS

'Microzine' to Feature Interactive Programs For Youngsters With Apple and Atari Computers

'HAUNTED HOUSE' TITLE SCREEN

Johnny can improve his reading skills—and maybe even become computer-literate, too—by subscribing to *Microzine,* the first children's magazine in a computer software format. *Microzine* is published by Wizware, the software division of Scholastic, Inc.

The magazine, recorded on double-sided 5¼-inch floppy diskettes, features four interactive programs per issue. It is available in versions that are compatible with Apple and Atari computers.

Microzine is targeted toward children 10 years old and older. It is published bimonthly, and it costs $39.95 per issue. School subscriptions—and home subscriptions priced at $149 a year—are also available.

The first issue of *Microzine* includes an interview with Robert Macnaughton, the star of the movie *E.T.;* an interactive, "you-are-there" adventure story titled *Haunted House;* a database program called *Secret File;* and *Poster,* a do-it-yourself computer art program. All of the programs are interactive, and are designed to be both entertaining and informative.

Deborah Kovacs, the creative director in charge of software development in Scholastic's Wizware division, explained: "Features in each issue of *Microzine* have a flexible structure, allowing children to arrive at different results, store these results, and recall

'ASK ME' AND 'SECRET FILES' FEATURES

them each time the program is used. A subscription to *Microzine* provides children with an expandable library of software that is challenging and fun to use over and over again."

Each month, Kovacs continued, *Microzine* will feature a celebrity interview called *Ask Me*. In the magazine's first issue, the interview with Robert Macnaughton is the *Ask Me* feature. Kids who use the program can select questions they want to ask the young star, and if they ask a question more than once, he'll politely point out that he's already answered it. That's one simple example of the interactive nature of *Microzine's* programs.

Another interactive feature, a monthly *Twist-a-Plot* story, works much like a text-and-graphics adventure game. In the *Twist-a-Plot* tale called *Haunted House*, for example, the child operating the computer must decide whether to go through a door behind which a ghost may be hiding, or to escape down a back stairway. Choices such as this must be made over and over during *Haunted House* before the child actually determines the outcome of the story.

In the *Secret Files* feature in the premiere issue of *Microzine*, children can create data bases using a computerized filing program. They can cross-reference, sort and retrieve information that has been filed, and they can code their files with secret passwords so that no one else can see them.

Using the *Secret Files* program, children can write many kinds of files, such as lists of movies they've seen (along with the films' stars and characters), and sports teams (with the names of athletes and their averages). *Secret Files* is the first in a series of useful computer tools that are expected to be a regular part of *Microzine*.

Kovacs said that *Microzine* has a threefold aim: to encourage children to learn about computers, to provide them with entertainment, and to challenge their learning skills—all at the same time.

The programs in *Microzine* have also proved to be entertaining and informative to parents, she added.

HAUNTED HOUSE: The ghost'll get you if you don't watch out!

Each issue of the magazine "will contain four programs which could stand on their own," said Kovacs. Each issue comes on a double-sided disk that's "really packed" with entertaining and educational material, she added. Both home and school subscriptions are available, she said, and the magazine is also being sold in computer stores.

Scholastic was founded in 1920, said Kovacs, and is the largest publisher of magazines and books for children in the English-speaking world—reaching more than 30 million school-age children each month in this country alone.

In 1979 the company began expanding into non-print media and started Scholastic Productions, a television production group. Three years ago Scholastic launched two more new projects—a magazine called *Electronic Learning*, directed toward school administrators, and a software catalog. Scholastic started publishing computer software about a year ago, and set up its Wizware division in January 1983. Wizware now produces educational and entertainment software for Apple and Atari computers, and is now developing software for personal computers manufactured by Commodore, Texas Instruments and IBM.

"Our philosophy is to offer computer programs that are interesting and easy for people to get into, and that offer kids and parents a chance to use computers in an educational and entertaining way," Kovaks said.

Added Richard Robinson, president of Scholastic: "Wizware is a natural outgrowth of Scholastic's experience in communicating with children through a wide range of media. The sense of discovery and challenge designed into each Wizware program will prove exciting to children being introduced to the computer for the first time and motivate them to use the computer as a learning tool. That's good news for parents making significant investments in computer systems."

Other products from Wizware include *Turtle Tracks*, an art-education program in which a child uses a "Turtle" cursor to create pictures and designs; and a new series of game programs being created by Tom Snyder Products, Inc., of Cambridge, MA. The first programs in the new game series are *Capture the Flag*, a contest in which two players team up against a group of computer-controlled robots; *Agent USA*, an action/strategy game set in train stations in 100 US. cities; and *Word Climber*, a word-recognition game.

Scholastic and Wizware are at 730 Broadway, New York, N.Y. 10003.

EPSON'S QX-10 HAS BRAINS

Company's Full-Size Model Is a Smart Machine

By Jonathan Sacks

It took a while for the Epson people, the venerable manufacturers of dot-matrix printers, to get into the full-size personal computer market. But when they finally did it, they did it with aplomb.

The company's first computer was the notebook-sized HX-20, which was rushed onto the market and suffered because of that. The portable lacked applications software, and sales were horrid. Epson was smart enough to develop additional software before re-releasing the HX-20, which is now a contender in the blossoming portable market.

The company was careful not to make the same mistakes with its full-size model. Called the QX-10, the home/business computer was four years in research and development. It shows.

What makes the QX-10 such a stunning achievement is that it is designed to be used by everyday people, not engineers or scientists or computer buffs. It does things everyday people might want to do with a computer, and it does them with everyday ease. Additionally, the QX-10 is an excellent value. With an integrated software package called VALDOCS, for "Valuable Documents," it sells for $3,000. And VALDOCS is really what the QX-10 is all about. More about that later, but first a little technical information.

The QX-10 is an 8-bit Z-80 microprocessor with 256K of read/write memory and two double-sided, double-density disk drives that each hold 380K. The screen is green phosphor, with good resolution. The machine is available with two keyboards—a standard computer keyboard with 103 keys, 10 function keys, cursor keys and a 19-key calculator keypad; and a specially designed keyboard designed to run with the VALDOCS software.

The VALDOCS keyboard performs one-keystroke functions the way all computer keyboards should. Anyone familiar with personal computers knows that getting the machine to do something, like delete a word, often requires striking two or even three keys in some order. To delete a word with the VALDOCS keyboard, one needs only to tap a delete key and then an arrow to tell the computer which way to delete. Yes, it will delete forwards or backwards!

This might all sound logical and straightforward to computer neophytes, but it shouldn't. On many computers it can take 20 hours or more just to learn the command structures. On VALDOCS, 20 minutes would be more in line.

VALDOCS, with its special keyboard, does not offer the entire universe of computing. The software system does four basic things:

- It is a wonderful—although somewhat slow—word processor that does most everything one might want to do with words. VALDOCS' greatest strength as a word processor is that written material appears on the screen exactly as it will print out on paper. To put a word in italics, one simply taps a button that says ITALICS. *Voila!* The word appears in italics on the screen (and later on paper). The same is true for boldface.

If you work with varying column widths, screen columns are exactly the same as printed columns. So are spaces between words and paragraphs.

- CALC allows the user to access a four-function calculator with memory. The calculator can be used in the middle of word processing, and the results of equations can be moved from CALC to any document.
- SCHED is useful for business

people and secretaries. It is an electronic appointment book with one page for appointments and another for notes. One can schedule years into the future and call up any date to see what is planned. And the schedule for any particular date can be printed out. There is also an address book that not only keeps the standard information, but also direct-dials through a modem for computer-to-computer communications.

• A chart key allows the user to make pie charts, bar charts and line charts. The charts can either be stored on disk or, with the right printer, inserted in printed reports. Not all printers can handle the graphics capabilities of the QX-10, however, so before buying, ask.

Epson included a couple of other nice touches in the QX-10. The system has a built-in clock that keeps track of day, date and time. The clock keeps working (off of an internal battery) even when the computer is turned off. When information is stored on a disk, the date and time are automatically added.

An extra nicety is that Epson designed the QX-10 to run CP/M in addition to VALDOCS. In fact, the machine is available without VALDOCS for $2,500. And if you buy VALDOCS you also get a CP/M master disk, meaning you have access to scores of business programs written for the popular operating system.

There is no such thing as a perfect computer, and as nice as it is, the QX-10 could stand some improvement.

Currently, VALDOCS doesn't do one thing that it should: It can't generate a data base-type mailing list. It would be useful if Epson provided an update to VALDOCS so that the address book would print labels sorted by groups, say by zip code. No such plans have been announced so far.

In fact, the only data base-type function provided with the system is built into the disk directory. When information is stored on a disk, it can be sorted by date or by a keyword. That means that every letter written on a given date can be listed on the screen, as can every letter written to Jane Doe. That's a start, but any small business really needs more.

Another thing Epson should have done—and it is reportedly being done at this time—is to make it possible to transfer information back and forth between the QX-10 and the portable HX-20. Right now that can't be done, but Epson insiders say there is a program in development called Epsonlink that, when completed, will make such transfer possible. That would be a boon to business people who travel or otherwise work away from the office.

Another potentially disturbing trait of the QX-10 is that it seems slow.

The nature of the machine's speed problems seems to be twofold. First, there is the matter of the time it takes for VALDOCS to switch from function to function and to save to disk. Slow, of course, is a relative thing, but there are times one feels a little antsy waiting for the QX-10 to catch up. Rumor is that the language VALDOCS is programmed in has something to do with this problem. Currently there is no solution, so if you can't live with the speed of QX-10's operations, you should get a different computer.

The second complaint about speed has to do with the time it takes the QX-10 to generate characters and words on the screen after they have been typed at the keyboard. For reasons that are still a mystery to outsiders, Epson designed the QX-10 so that the cursor is always locked in the middle of the screen. When the user types, the screen moves behind the cursor like a typewriter carriage. An alternative offered by many other computers is for the cursor to move across the screen like the ball of an IBM Selectric typewriter.

Because Epson chose the former method, the typist often waits what seems like several seconds before characters that have been typed appear on the screen display. When the screen catches up, a string of words that have been saved in a buffer as they were typed are stripped across the new line.

That takes some getting used to, but QX-10 owners report that it is nothing more than mildly annoying after awhile.

Overall, Epson has come out with one impressive machine. It seems to be the first of a new generation of computers that will have simple integrated functions designed for non-computer people. It's a fine machine at a fair price, and for anyone wanting a computer in the $3,000 range, the QX-10 is at least a must-see, and probably a best buy. •

Jonathan Sacks is a writer, computer hobbyist, and newspaper reporter.

SPECIFICATIONS

Type of Computer: Desktop keyboard with separate logic unit and separate 12-inch green monochrome monitor.

Microprocessor: Z80A.

Clock Rate: 4 MHz.

Operating System: CP/M or Epson's VALDOCS system.

RAM: 64K or 128K, expandable to 256K.

CMOS Memory: 2K RAM; includes calendar and clock with battery backup.

Mass Storage: Two 5¼-inch, double-sided floppy disk drives; capacity 380K per disk.

Interfaces: RS-232 programmable serial interface, synchronous or asynchronous, with DB-25 connector; programmable parallel interface; five option slots.

Software: Epson's VALDOCS (Valuable Documents) system; includes word processor, four-function calculator, electronic appointment book, address book, and graphics package. VALDOCS system is integrated with computer's operating system, and also with dedicated function keys on computer's keyboard. VALDOCS system makes computer extremely user-friendly. Computer also available without VALDOCS and with undedicated, rather than dedicated, function keys. Without VALDOCS, QX-10 is a standard-type CP/M-based computer.

Price: Under $3,000, including keyboard, logic unit, monochrome monitor, disk drive, and VALDOCS software.

COMMODORE 64: A GREAT VALUE

It's a Lot of Computer for the Price You Pay

By Richard Pinsky

Dozens of manufacturers now offer personal computers, giving the public a big selection to choose from, and the Commodore 64 is emerging as perhaps the premiere value to date. To be blunt, there may be more programs and add-ons for an Apple than for a Commodore, but at a fraction of the cost of an Apple IIe, you can't go wrong with a Commodore 64.

Not only is the 64 itself priced low (it's currently available for around $200), but an assortment of peripherals originally designed for the even less expensive VIC-20 can be plugged directly into the Commodore 64, providing even greater value. However, some trade-offs are involved.

The modem for the 64 presents no problem. For under $100, you're not likely to beat it. Not much larger than a pack of cigarettes, this nifty device plugs right into the keyboard and can give you access to all kinds of telecommunications services—including games, stock quotes, wire services, and more. Simply dial them on your telephone and watch them on your TV.

The Commodore disk drive, now available at under $250 (and also a value compared to the competition) requires one caveat: Be sure to buy the Model 1541, not the 1540, which originally was designed for the VIC-20 and requires a modification to be used with the 64. That's about all you need to know about the Commodore disk drive. It's the printer that presents the tough decision.

Commodore's budget printer—the 1525E, priced at under $300—is a deal, all right. Its data transfer is only 30 characters per second. In comparison, other dot matrix printers run at 80 to 160 cps, but cost upwards of $400. Moreover, if you want to use a faster printer—such as an Epson, an Okidata or a C. Itoh—you'll have to buy a special interface adapter for another $65 or so. Now, you may think 30 cps is fast enough. It isn't. You'll see. Try to buy a faster printer.

One of the risks in buying lower-priced computers is the chance that their manufacturers will abandon them for next year's sensational packages, and that you'll be left with a dead-end investment in a limited computer. But Commodore seems committed to the 64.

A good supply of software is now beginning to show up, and Commodore is about to introduce a new port-

able that's fully compatible with the 64. Called the Executive, it has a color monitor and a disk drive built in, and it will cost about $1,000. For more news about the Commodore Executive, keep reading *EHC*.

A plug-in CP/M cartridge for the 64 is also here at last. An abundance of software has been written for CP/M computers, and some of it should now start showing up for the 64.

And the future is also here. Commodore now offers plug-in accessories such as piano-style keyboards and drum pads, and advanced software such as the new Magic Desk package, billed as an answer to Apple's Lisa computer. With the Magic Desk, you use a joystick to choose a function from a group of programs graphically depicted on a screen. The Magic Desk program is reviewed in this issue of *EHC*.

SPECIFICATIONS

Type of Computer: Desktop computer; keyboard with built-in logic unit. Designed to be used with separate color or monochrome monitor.

Type of Keyboard: Full-stroke typewriter-style keyboard with 66 keys, including two cursor-control keys and four programmable function keys.

Screen Display: In text mode, 40 columns by 25 lines; 16 colors available for text and same 16 colors available for background, useable in 256 combinations. In high-resolution mode, resolution is 320 by 200 pixels. Eight programmable, independently moveable Sprites (21 by 24 dots with up to four colors each) available for use in programs.

Microprocessor: MOS Technology 6510; uses 6502 instruction set but has additional input/output lines.

Operating System: Proprietary; built-in modified Microsoft BASIC; plug-in CP/M cartridge optionally available.

RAM: 64K.

ROM: 20K.

Mass Storage: Can be used with cassette data recorder or with up to four optional 5¼" floppy disk drives.

Interfaces: Program or game cartridge slot, two game controller ports, TV connector, audio/video connector, user port for modem cartridge or RS-232C communications cartridge.

Special Features: Second-generation Video Interface Chip (VIC-II) handles all video-display processing, freeing central microprocessor for other tasks. Commodore 6581 Sound Interface Device (SID) expands the computer into a versatile 3-voice electronic music and sound synthesizing system.

Software: Many entertainment, educational, household management and utility programs available.

Accessories Available: Data/audio cassette recorder, 5¼" floppy disk drive, dot-matrix text and graphics printer, non-acoustic telephone modem, RS-232 interface cartridge, IEEE-488 interface cartridge, Z80 (CP/M) cartridge.

Price: List price $595; can actually be purchased for less than $200.

WHAT YOU GET

As s[illegible]as the 64 is removed from its bo[illegible]ompactness of its design is impre[illegible]o is the keyboard, which has a [illegible] bouncy response. And there[illegible] function keys that can be progr[illegible]as one-stroke commands that [illegible]hat you want. And each key c[illegible]nifted, so the number of possi[illegible]mands is eight.

On [illegible]de of the keyboard there are tw[illegible]e ports for joysticks, enabling [illegible]participants to play a competitive game.

Ports on the back panel include a cartridge slot for plug-in programs; a TV connector for use with an ordinary television set rather than a special monitor; an audio/video connector, for interfacing with a monitor and/or a stereo for superior sound; a serial port (you connect your printer and/or disk drive here); a cassette interface, for using an inexpensive data cassette recorder rather than a disk drive for data storage; and a user port, for inserting a modem.

In its text mode, the 64 has a 40-column by 25-line screen display. The text can appear in any one of 16 colors. In high-resolution mode, there's a 320-by-200-pixel display. The computer has 64K of RAM, offering plenty of room for sophisticated programs and lots of data.

Also inside the computer is Commodore's noteworthy SID (Sound Interface Device), which can be programmed to create three independent voices, each with a nine-octave range. That makes the 64 a versatile music and sound synthesizer.

Last but not least, the 64 has "Sprites"—multicolored, 21-by-24-pixel objects that can be created by the user and then moved independently around the screen. With Sprites, you can create animation. Not bad.

THE FIRST NIGHT

One complaint: The picture on the 64 may wobble disconcertingly. This is often due to interference between computer and TV. Try moving the computer around. If the problem persists, you may eventually have to buy a computer monitor. It's probably money well spent. To find out why, see the article on monitors in this issue of *EHC*.

The manual that comes with the Commodore 64 not only will help you get your computer up and running fast, but can also help you start learning about programming on the night you bring the computer home. By the end of the first week, you'll probably be exploring its music capabilities and doing computer animation using Sprites.

A WORD OF CAUTION

Somewhere there's an owner for every computer sold, and almost every one will tell you his is the one to buy. Don't let them frighten you. Owners of the Commodore 64 are saying the same thing. And chances are, so will you.

COMPUTERS

Continued from Page 41

as the joystick-equipped SV-318, the 328 offers 48K ROM expandable to 96K, 80K of RAM expandable to 256K, and a full-stroke, 87-key keyboard including a calculator-style keypad. Permanently installed in ROM are word processing, and telecommunications and "Help" programs. Since the unit is CP/M-compatible, there are many programs that will run in it with minor modifications. Its screen display measures 40 characters per line in text mode, with 24 lines available. An 80-character-per-line text mode will soon be available as an option. There are three sound channels with 8-octave ranges, and high-resolution graphics with Sprites are available.

The SV-328 accepts game cartridges and programs and is compatible with Spectravideo SV-318 peripherals such as stereo data cassette drives, disk drives, a printer, 1- and 7-slot expanders, a modem, a touch-sensor graphic tablet, an interface cartridge, joysticks, and 16K and 32K RAM expanders. The SV-328 will sell for less than $600.

Sharp PC-5000

Sharp's new PC-5000 computer seems quite versatile. It is fully portable, it's battery operated, and it has a built-in LCD display with 8 lines of 80 characters. It is based on a 16-bit 8088 processor and is thus compatible with IBM PC software. It uses nonvolatile bubble memory that can hold data and programs even when the power is off. The computer has 128K of RAM, expandable to 256K. Already in memory when the computer arrives are programs for word processing, spreadsheet processing, executive planning, and much more. An optional plug-in thermal printer and an optional autodial modem are available.

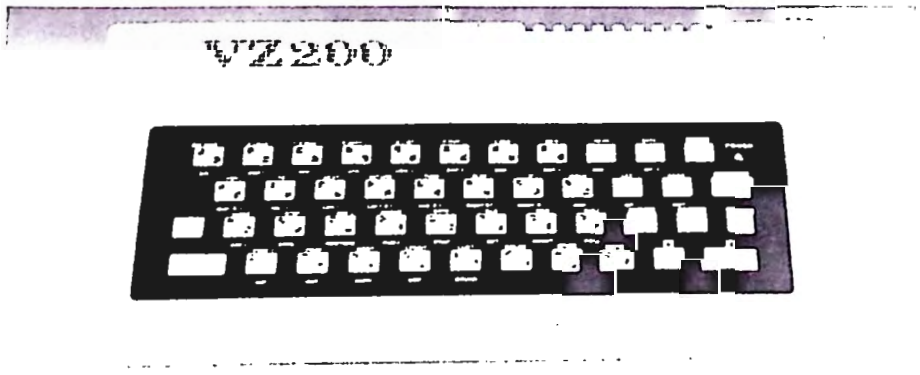
Timex-Sinclair 2000 Series

There are two new computers in the Timex-Sinclair 2000 Series, but the only difference between them is the quantity of user RAM. One has 16K of RAM and a suggested retail price of $149.95, and the other has 48K of RAM and a suggested price of $199.95. Both have 24K of ROM. They also are equipped for bank switching, a memory-management technique that gives them a theoretical capacity of 256 times 64K and opens up their program capacity enormously.

The computers have high-resolution color graphics capabilities and give the user a choice of 256 by 192 pixels or 512 by 192 pixels in their graphics mode and 24 lines of 32 or 64 characters in their text mode, in a choice of 8 colors. The units have a 42-key full-travel "Chiclet" (flat-top) keyboard with a repeat feature on all keys, along with a keyword system that speeds program entry. The programming language is Sinclair extended BASIC. Both models are capable of enhanced spreadsheet and word-processing applications.

Video Technology VZ200

The VZ200 is a beginner's machine with 12K bytes of ROM and 4K bytes of RAM, expandable to 64K with an optional plug-in module. The unit's language is Microsoft BASIC. It has a full-size keyboard with 45 automatic-repeat keys and single-keyword or standard typing modes of program entry. It connects directly to your TV set and gives you a choice of 8 colors plus black. Its sound generator has a single-tone output. Full on-screen editing is possible, and a cassette interface is built in. An optional printer interface lets you connect the unit to any Centronics-type printer and memory and peripheral expansion buses are built in. The VZ200's processing chip is a Z80A, and 45 software cassettes are available in four categories: education, games, business applications, and home management. Suggested retail price is under $100.



THE VIDEO TECHNOLOGY VZ200

Video Technology Laser 2001

The Laser 2001 is a personal computer and a video game unit in one package. It accepts software and games designed by Video Technology, plus games made for ColecoVision and the Atari VCS. Microsoft BASIC is built into the 2001's 16K of ROM, and the unit also has 64K bytes of user RAM and 16K bytes of display RAM. Memory is expandable to 144K.

The 2001's video display measures 36 characters by 24 lines in text mode, and 256 by 192 pixels in graphics mode. Its 48 keys permit text or keyword entry, and it has both monitor and TV set outputs. A cassette interface, a Centronics-bus printer port, joystick connectors are already in place, and a data cassette port and floppy disk controller module are optional.

Video Technology Laser 3000

The Laser 3000 is the heart of a comprehensive personal computer system built around a 6502A processor. The unit has enhanced Microsoft BASIC in its 24K of ROM, and is equipped with 64K bytes of user RAM, expandable to 192K. Its 81-key full-stroke keyboard includes a numeric keypad, and its display to a composite or an RGB (red-green-blue) monitor provides 24 lines of either 40 or 80 characters, selectable by software, in a choice of 8 colors. An RF modulator for use with a TV set is optional. The graphics display gives a choice of 280 by 192 pixels with either 6 or 8 colors, or 560 by 192 in 6 colors on a high-resolution monitor. Its 4-channel sound generator can span 6 octaves.

Cassette and Centronics-bus printer interfaces are built in, and RS-232, joystick, floppy disk controller, disk drives and CP/M cartridge are optional. An optional expansion box lets you use Apple-compatible peripherals

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FICTION BONUS

TUTOR

By Ray Dettling

6:30 AM. My mouth tasted like the Russian Army had just marched through it and the videocom demanded a response. Who in the hell would call me at this ungodly hour—on Saturday? Not wanting to wake Janis, I took the call in the other room. A man in his early thirties appeared on the screen.

"I'm trying to get hold of Dr. Marcus Floyd, the psychophysicist," he said with a twinge of urgency.

"This is Mark Floyd."

"My name is Rubin Stillman. I must apologize for calling this early, but after reading the article in yesterday's *Times,* I knew I had to talk to you as soon as possible."

I thought about the press release. "Look, we had some positive results, nothing conclusive. The story was blown out of . . ."

"Please Mr. Floyd, it's extremely important. Could we meet some time this morning to talk in person?"

Although my curiosity was getting up, I wasn't about to blow the whole morning on just any kook. And in the psychophysics business, you do get your share of kooks. Finally I told him, "Look, Mr. . . ."

"Stillman."

"Stillman—I'm afraid my time . . ."

"No, wait! Let me explain!"

I sat down and listened.

"I'm with AID—Artificial Intelligence Development. We make the most advanced computers in the world."

A flash of pride lit up Stillman's face. I listened patiently while he rambled on for a few minutes; then I started getting impatient. Finally, in an effort to force him to get to the point, I tried interrupting. But he stopped me.

"Please Mr. Floyd, I don't mean to be tedious. But believe me, it's all relevant."

I found myself apologizing.

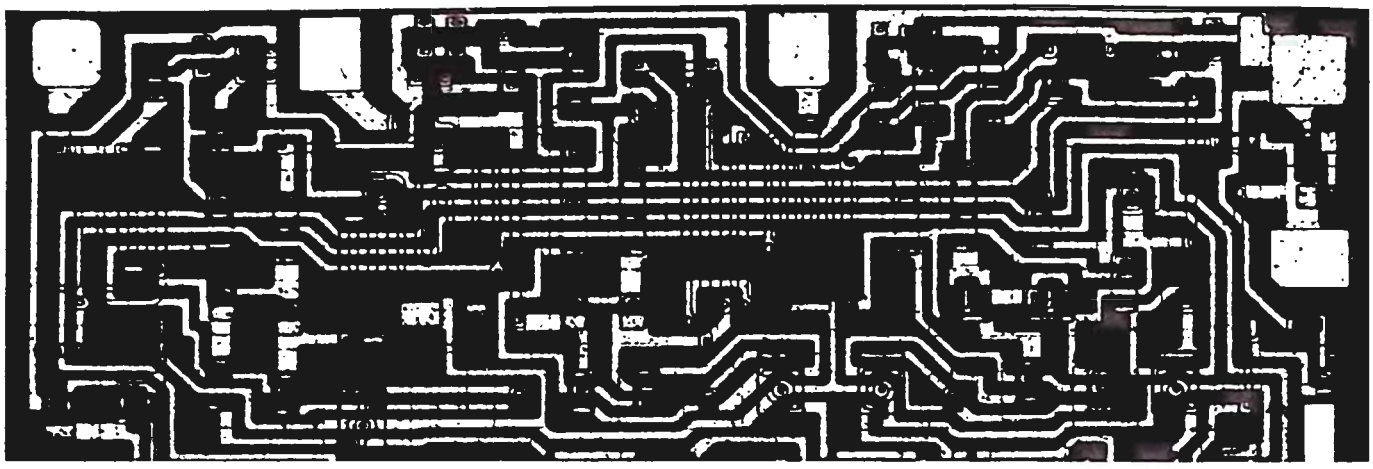
"Two years ago, AID began constructing the world's largest AI computer. Everything looked good at first. But then, two months after it was completed and debugged, funny things started happening."

"Like what?"

"Well, the output wasn't making any sense. It seemed unrelated to any input we had given it. Some of that is expected—I mean, that's what artificial intelligence is all about. At any rate, we programmed into this particular computer a strong desire, if you will, to receive raw information. It took the information, categorized it, then stored it as part of its experience—much like we do. Then it would solve complex problems by drawing on this data base and applying principles of logic. Sure it would stumble along, but it would never make the same mistake twice.

"It developed at an incredible speed, and soon it began to teach *us* a few things. At that time we decided to name it TUTOR. But then, in a very

Illustration by Robert Pasternak



short time, TUTOR's output started degrading. Finally nothing made sense at all."

"Look, Mr. Stillman, I know nothing about computers," I cut in. "Why are you telling *me* all these things? It sounds like you need a top-notch programmer to work out the bugs."

"Programmers, computer scientists, we have the best in the business." He paused for effect. "Mr. Floyd, we have created a sentient being. I've thought about this a lot, and you're the only one who can help prove it."

Now I was really beginning to wonder about him, and I still had no idea what he was talking about or where I was supposed to fit in. Obviously he was developing delusions about AID's creation. Understandable, under the circumstances.

"Surely this can wait till Monday," I said.

"No, it can't. My colleagues don't agree with me."

That was also understandable.

"They're convinced that TUTOR is malfunctioning. They're planning to shut it down and reprogram it unless I can convince them otherwise."

"Maybe this is a dumb question," I admitted, "but why not let them shut down and start over?"

I must have struck a sore spot. He nervously rubbed his forehead, obviously frustrated, and said: "What I'm trying to say is that TUTOR is a living intelligence—a conscious entity. I think we've stumbled onto something important. If they shut it down, it could all be lost. You understand the conscious mind as much as anybody. You know its limitations and capabilities."

our telepathy tests. All I could think of was to go through my records and check the details while Stillman wandered patiently around the room waiting for me to finish. Could the charts be faked? Impossible! Could Stillman have gotten inside information? Too many safeguards against that. Yet it was unthinkable that a *machine* could have picked up a telepathic signal.

"What got me was that TUTOR's latest message had more information; some of the old symbols were replaced by words. In other words, TUTOR is getting smarter!"

A few minutes later, much to my dismay, I had concluded that every one of the charts corresponded precisely with a similar set of charts we had used in our experiments several weeks ago. There were only two exties and I believe you can prove that TUTOR is alive."

Stillman must have sensed he was losing me. Before I could say no, he held up his ace in the hole. "Does this mean anything to you?"

The question was ludicrous. Within half an hour, Stillman and I were on our way to the institute.

* * * *

"Where did you get these?" I asked while shuffling through the charts Stillman had shown me.

"TUTOR made them."

I recognized every one of them from

planations: TUTOR was psychic or somebody had gotten hold of inside information. As insane as it sounded, TUTOR had to be tested.

Stillman had other ideas. "What we've just done was confirm my suspicion that TUTOR can pick up thoughts. I suspected this all along, but I wasn't completely convinced until I saw your records. What I need now is an explanation of these."

Stillman reached for his briefcase and pulled out more charts. "These are what we've been getting during the last two weeks."

I looked them over. There was an assortment of words, symbols and pictures, about twenty lines per page. After five and a half lines, the pattern was repeated.

I'm afraid I can't help you on this," I said, though somewhat intrigued by the pattern. "We haven't been conducting any new experiments." Most of the last two weeks had been spent preparing final reports and the like.

Stillman seemed genuinely disappointed. "Are you sure? Could someone else . . . who else is doing telepathy studies?"

"I can assure you that no one *here*—or in the immediate area—has done anything," I said.

I walked across the room and poured a cup of fresh-perked coffee. I offered Stillman a cup, but he was too upset to accept.

"I know this means something," he kept saying.

After optimizing the blend of coffee, cream and sugar, I took another look at the charts. "One thing I can say—if these had come from a human being, I would say he was trying to tell us

something—desperately. But it's just a machine . . ."

"It's *not* just a machine. It has a consciousness even more sophisticated than our own. How else could it have picked up telepathic signals? You use drugs to get your subjects to the right state of mind, but TUTOR does it all electronically. Don't you see? It can refine its own state of awareness to maximize its ability to receive even the feeblest of signals."

"Yes, Mr. Stillman . . ."

"Oh, hell, call me Rubin. And I *will* have that cup of coffee."

"Okay, Rubin. If TUTOR can receive telepathic signals, I, too, would not want to see it shut down."

I was beginning to realize there was much more to Rubin than the overzealous computer technician I had assumed he was. He had profound insight, and I liked that.

"First we must determine if TUTOR is really capable of receiving signals." There was no question about it as far as Stillman was concerned, but I still had my doubts.

Stillman didn't object, so after calling J. to tell her to count me out for any and plans, we started working on test. AID was only seven miles, so it was an easy operation to check on TUTOR's output. The first thing I did was call our best telepath, Victor Alvarez.

He arrived in his usual garb, a woolen turtleneck sweater and spotless, just-pressed beige slacks that were at least five years out of style. He was a large man in his early 20's, and one of the few people I know who still wore corrective glasses. He was very much an introvert, a trait which I always assumed had reinforced his psychophysical abilities.

"I hope I didn't spoil your weekend," I said while edging him in.

He shrugged.

"I'd like you to meet Rubin Stillman. He's quite interested in our work."

Rubin sprang over with his arm outstretched. Alvarez smiled and limply shook Rubin's hand. Outwardly they were as opposite as two people could be. Rubin was small, loud and hyperactive; Alvarez was large, reserved and lethargic. For the first time I looked at Rubin and decided he would be a lousy telepath.

I gazed at my notes and verified that the drug, Psycho-Tel 3, gave the best results. An hour later Stillman was on his way toward AID while the 3.1-cc, molar injection was taking effect on Alvarez.

TUTOR was still putting out its repetitive signal when Stillman called. He was ready to start the test.

From a stack of 30 different geometrical figures I selected samples at random and handed them to Alvarez. I also handed him a three-digit number supplied by the random number generator in a desk computer. The odds of just matching the numbers alone would be 999 to the 30th power—or one followed by ninety zeroes or so. Matching these with the right figures would increase the odds by an additional 30 factorial. But TUTOR picked up every one of them correctly.

"When we stopped putting information into TUTOR, it must have tried getting information by any means possible. It must have altered its state of consciousness."

By the time Stillman returned we had established one irrefutable fact. *TUTOR was telepathic.* And the more I talked with Stillman, the more I became convinced that TUTOR was much more than just telepathic. It was a machine that rivaled the human brain in complexity. All the subtleties of intuition, creativity and intelligence were manifested by TUTOR. And now, the mystery of those symbols deepened.

Needless to say, on Monday morning TUTOR was not shut down. In fact Stillman became somewhat of a hero at AID. The big question remaining was, "What do you do next?" And everyone was at a loss on that one.

For the next three days I learned as much as possible about TUTOR. It wasn't as large as I had expected. The real guts of the thing only occupied about half of the room, which was divided by a floor-to-ceiling partition of tinted glass. The central processor unit and a bank of holographic storage discs were on one side of the partition where the temperature was maintained at a cool 55 degree Fahrenheit. The lights were dim enough to make the multicolored backscatter from leaking krypton laser beams visible through the partition. The effect was warm. The I/O hardware was on our side of the partition.

Soon, no matter how repulsive the thought was, I was forced to believe that TUTOR was a true conscious entity—a childlife with enormous potential. With each new shred of input, no one could possibly follow the changes that took place in echelon over echelon of TUTOR's neuroelectronic hierarchy. The coordinated migrations of trillions of microscopic mobile filaments of light were no more predictable in TUTOR's core than the rush of synaptic orgasms in the human brain accompanying the formulation of a new concept. Stillman summed it up quite well. "If TUTOR is not alive, then we are all dead."

On the fourth day I began studying TUTOR's output from the time it started with its enigmatic repetitious display. At first I thought the content of each message was the same: two symbols, the word "on," another symbol, the word "spheres," followed by an unrecognizable picture, followed by "unpredictable," followed by four and a half lines of similar nonsense. But then I noticed the latest output was slightly different. The second symbol was replaced by the word "evolved," and the last symbol on the second line was replaced by the word "unstable."

No one considered the change significant, but something lurking in the dark corners of my mind told me those changes were important. They meant something.

The next morning I stopped at the institute to make sure our bread-and-butter programs were running smoothly. The first thing I did was stop at the coffee machine and deposit my thirty-five cents. As usual, the fluid poured more gray than brown. Just as I reached for my cup I spotted a manila folder someone had left on top of the dispenser. It belonged to Alvarez.

I saw him in the hall so I handed it to

him. He fumbled and a spiral notebook fell out. I picked it off the floor and couldn't believe my eyes.

"Where did you get these?"

Alvarez was stunned, confused. "The notebook?" he stammered.

"No? I don't care about the notebook—the symbols; where did you get those symbols?"

"Uh, I dunno; I guess I was just doodling or something."

"Doodling?" It was apparent that Alvarez was sincere, but he looked as though I had accused him of selling out the government's most important secret.

"I'm sorry, Hector. It's just that those—your doodling—may be the key to an important problem."

"I don't understand."

"You will; follow me." I led him back toward the lab, stopping at my secretary's desk on the way.

"Call AID and tell Stillman to get his butt over here A...S...A...P!"

"Yes *sir*," he answered sarcastically.

Before Stillman arrived, I had explained everything to Alvarez—who, until now, had known nothing of the nature or purpose of last week's test.

He remembered about the symbols. "The Psycho-Tel had already taken effect," he said. "I remember because I was feeling very relaxed, but you weren't ready to start testing yet. I remember picking up a pencil, and I guess I just wrote the first thing that came to mind."

Just then Stillman entered.

"What's going on?" he asked.

"Rubin," I said excitedly, "take a good look at this." I handed him the notebook. "Alvarez jotted these down right before we started last Saturday's test."

"It's the same—wait a minute. Are you saying Alvarez transmitted these signals to TUTOR?"

"No, of course not. He would have to have been sending continuously for the last four weeks or so to do that. Besides, the timing was too precise. No, it's quite clear that both Alvarez and TUTOR were *receiving* the input—from someone else."

"Hey, that's great! It clears up any doubt about TUTOR. It's picking up something *real.*" I chuckled inwardly after realizing that Stillman was talking about his own doubts—doubts he couldn't admit before.

"Yes, but from who?"

"Hector, do you remember what you were thinking about right before the test?"

Before Alvarez could respond, Stillman broke in. "This is not the same," he said, pointing to the notebook. "Some of the characters are different."

"I know; I was getting to that. Hector, try to remember what you were thinking about."

Alvarez's face wrinkled, then he shook his head. "I can't remember."

"Here, look at these." I handed Alvarez his notebook. "What were you thinking about? What were you doing when I called you Saturday morning? Try to remember. It's important."

Alvarez's expression brightened. "Yes, I was thinking about my astronomy paper. It was due Monday."

"Now exactly *when* were you thinking about your class?"

"By the time Stillman returned we had established one irrefutable fact. TUTOR was telepathic. *It was a machine that rivaled the human brain in complexity.*"

"While I was waiting for our test to start."

"Good. Tell us something else: Was there anything particular about the paper—*anything?*"

"No, not really, only that it was due Monday." Then, with some reluctance he added, "I guess I was a little worried about how much time I would have to spend here."

"Okay, just one more question. What made you finally remember? Was it something you saw on your notebook?"

"Uh . . . I guess it was a term from one of my lessons—the term 'main sequence star.'"

"Fantastic!"

I dismissed Alvarez, then started on Stillman, who was having trouble keeping up with me.

"What's fantastic?" he asked.

"Bear with me one minute. I think I'm on to something. Has TUTOR received any instructions on astronomy?"

"Why no, but . . ."

"Please, this is important."

"TUTOR did receive a packet on general science, but it was bare bones. We haven't gotten around to anything in depth."

I paused a few seconds to check my thoughts. Then excitement overtook me. "I've got it!"

"For God's sake, Mark, what the hell are you getting at?"

"Don't you see? TUTOR needs more information. Here, look."

I gave Stillman the notebook and the chart from TUTOR. "On the first line, where TUTOR used a meaningless symbol, Alvarez used the term 'main sequence star.' Without having a lot of knowledge on astronomy, there was no way TUTOR could have used that term. But on the other hand, looking at the fifth line, we see Alvarez used the term 'alive' where TUTOR used the term 'sentient'."

"Did Alvarez know the definition of sentient?" Stillman asked.

"Aha! I see you're getting the drift of it. That's exactly wht I wondered, so I asked him. He didn't. But since TUTOR knew both terms, we were reasonably certain that 'sentient' was more correct. . . . You see, even with telepathy, you have to know something about the subject, and you have to know the vocabulary in order to translate it into words.

"But the thing that really got things going was that TUTOR's latest message had more information; some of the old symbols were replaced by words. In other words, TUTOR is getting *smarter.*"

"Damn! I think you're on the right track. All we have to do is give it more information and the message should clear up. I'll be damned."

* * * *

We worked all weekend. My big concern was how to get more information into TUTOR without interfering with its output or with its telepathic function. It was Stillman's insight that put me at ease. We stopped at a local bar that evening. The *hors d'oeuvres* were free and the drinks were cheap. The Giants were about to take the National League pennant for the third year straight. I bought the first round

and reiterated my concern about TUTOR.

Stillman took a sip from his drink, then placed it at arm's length across the table. "Mark, you've got to remember TUTOR is programmed with a strong affinity for information, knowledge, call it what you will. I just didn't realize how strong. When we stopped putting information into TUTOR, it must have tried getting information by any means possible. It must have altered its state of consciousness millions of times until finally it picked up something."

"My telepathy subjects."

"Yes. It must have been extremely weak at first; but TUTOR could refine itself, like a blind man sharpens his hearing, until it was optimized to receive those signals. It's my guess that if we feed it information directly from the holodiscs, it will give up its telepathic reception—and that if we stop feeding it, its telepathic mode will return."

Satisfied with his explanation, Stillman reached for his drink.

It was a risky to me. "But how can we know?" I asked. "How do we know TUTOR could even find the right level of consciousness?"

Stillman smiled. "Remember that TUTOR never forgets, and that TUTOR never makes the same mistake twice. It won't even have to search the next time."

Three drinks later, the Giants had won the pennant, the *hors d'oeuvres* were gone, and Stillman had me convinced.

* * * *

By Wednesday afternoon, Stillman had prepared a holodisc on astronomy and physics and was ready to put the new data into TUTOR. After a final check he slipped the holodisc in the slot, pushed the feed button and paused. A ready light flashed with the words "INPUT STANDBY."

Stillman looked over at me, then pressed the key labeled "SEND."

With uncontrollable gusto, the laws of astrophysics were drawn into every corner of TUTOR's core. I could almost feel its personality changing, adjusting to its evolving consciousness.

The display was blank, as expected, while megabytes of data were being absorbed. An amber rectangular light glared below the screen with the words "INSTRUCTION MODE." Two minutes and forty-three seconds later, the light turned off. TUTOR was now an astrophysicist.

But the screen remained blank, and for the first time in days Stillman looked dumbfounded. "I don't get it. Why hasn't the message returned?"

I tried to imagine how I would react if suddenly fed an excessive amount of information.

"Maybe TUTOR needs time to soak everything up." I said.

Stillman grunted behind a frown.

"I think it will come out of it," I added.

Half an hour, later nothing had happened. Several hours after that, still no change. Then, when I was on my way to the coffee machine, Stillman yelled, "Mark! It's starting."

I changed directions in midstep and rushed to the terminal.

"A stargate was opened —a new window to the Universe. Alvarez sent pictures, each word a thousand words, and each returning word was worth a thousand pictures."

The excitement escalated to utter shock.

"My God," Stillman gasped. "I don't believe it. It's coming from *outer space—a star!*"

I felt overwhelming excitement mixed with anxiety. I don't know exactly why, but my heart pounded so hard I thought it would crack. Then I had an uncontrollable compulsion to laugh out loud.

Stillman watched me like I was mad—and indeed, for the moment. I was.

"Mark, what's wrong? This is *fantastic!*"

"I know," I said with difficulty, wiping water from around my eyes. "It's beyond fantastic."

Then Stillman started laughing.

There were still a few unexplained symbols, but the remainder of the message was quite clear.

FIRST LINE:
(SYMBOL) . . . EVOLVED ON TWO WORLDS ORBITING MAIN SEQUENCE STAR 18.2
SECOND LINE:
EARTH LIGHT YEARS AWAY. (SYMBOL) . . . NUCLEAR REACTIONS PRODUCED UNSTABLE
THIRD LINE:
STELLAR CONDITIONS . . . (SYMBOL) . . . PERISH SOON
FOURTH LINE:
LOCAL SPACE TRAVEL . . . (SYMBOL) . . . NO ESCAPE TO OTHER
FIFTH LINE:
SYSTEMS. (SYMBOL) . . . CAN ONLY COMMUNICATE WITH SENTIENT
SIXTH LINE:
LIFE.

A star was going nova and a world was about to die. The whole thing was too incredible. Stillman grabbed a book on astronomy, and sure enough he found a suitable star—Sigma Draconis, 18.2 light years away.

* * * *

It never occured to me until a week later that the message demanded an answer. I called Stillman.

"It's no use," Stillman insisted, "We'd never get an answer to them in time."

"I'm not so sure. The last line's the grabber. It's a request to communicate—perhaps just an offer . . ."

"Or a warning?"

Stillman's comment surprised me. Was there a chance the sun would . . . No, I thought, TUTOR had already considered that possibility. Conditions weren't right. The sun would remain stable for several billion years. But what about Sigma Draconis? What happened to it? Suddenly I was worried.

But then there was another possibility.

"Rubin, have you ever read any science fiction?"

"Yes, quite often."

"Well there was a story, either by Asimov or Clarke, I can't remember for sure, but the name of it was 'The Star'."

"Yes, I remember," Stillman inter-

rupted, "It was Arthur C. Clarke—won a Hugo, I think."

"It was about a star that went nova, or rather supernova; and a civilization that was compelled in a desperate attempt at immortality to preserve a record of its achievements."

"I remember the story."

"But the important thing was that the civilization had to communicate. They could face death, but not oblivion. They had to tell someone about their accomplishments. Maybe we're witnessing the same thing here."

Stillman shook his head. "I hear you, but so what?"

"We've got to try and communicate back. That's all there is to it."

"Dammit, Mark, it's futile. It'll take 18.2 years for a signal to reach it, and 36.4 years for an answer to reach us."

"An electrical signal, but maybe not telepathy."

Stillman frowned. "What are you getting at?"

"Suppose we can communicate back by telepathy?"

"Telepathy!"

"Look, why would the message *expect* an answer if it was impossible to get an answer there in time? Maybe, just maybe, telepathic signals travel faster than light!"

Stillman shook his head. "You tell me how to get TUTOR to send a telepathic signal out and . . ."

"Not TUTOR." I said. "Alvarez."

"Alvarez!"

"Sure, why not? We know Alvarez can send and TUTOR can receive."

"Mark, you're a genius!"

It seemed somewhat ludicrous to expect the signals from one man to span 18 light years of space. Surely it must require an amplifier of some kind. But what kind of amplifier? We didn't even know the nature of the signal yet. All we knew was that it was a manifestation of intelligence. We had to try.

I made it to the institute early Sunday morning. So did Alvarez. It was a good thing because it gave us a chance to talk. There was much I had to tell him. I had to make him understand the significance of the test—and, most important of all, to achieve any directionality or focusing of the signal, Alvarez had to know everything there was to know about Sigma Draconis.

Alvarez began punching the videocom keyboard. A channel opened and data instantly flashed across the screen. SIGMA DRACONIS: SPECTRAL TYPE . . . G9, DISTANCE . . . 5.52 PARSECS (18.2) LIGHT YEARS), MASS . . . . At the same time Stillman and I had prepared a message. It was written with words, but Alvarez was only to send impressions of the words—thought pictures, each one in itself worth a thousand words.

The message was simple:

WE HAVE RECEIVED YOUR SIGNAL. WE UNDERSTAND PART OF IT. WE WISH TO KNOW ABOUT YOUR CIVILIZATION. ARE YOU IN DANGER?

One thing that was nice about telepathic communication; it transcended language barriers—a fortuitous situation under the circumstances. Through telepathy, totally alien cultures could communicate with greater understanding than that of the most learned philosophers of the same tongue.

"What I'm trying to say is that TUTOR is a living intelligence—a conscious entity. I think we've stumbled onto something important."

* * * *

Four hours later, Alvarez knew as much about Sigma Draconis as anyone. We were ready to start the test. He seemed nervous. The Psycho-Tel 3 should reduce that somewhat, I thought.

"Hector, I'm going to give you four cc instead of the usual three. I think the extra cc will help you relax."

Alvarez agreed.

Stillman helped calibrate the electronics while I attached the EEG to Alvarez, then gave him a final set of instructions.

His head sank into the cushioned back of the recliner and his eyes closed. I spoke softly while Stillman watched from a distance.

"Think about Sigma Draconis teeming with intelligent life—trying desperately to reach your thoughts. Feel them. Experience them. Let your thoughts reach out across the light years and touch theirs. Let our message project outward. Then dwell on each thought until you can feel it reach them. Until you can see it enter their consciousness. . . ."

Alvarez seemed relaxed, his eyes still closed, his breathing slow and constant.

"Take all the time you need," I reassured him in a nearly inaudible voice.

To eliminate any distraction, Stillman and I quietly left the room and watched the videocom. For several minutes TUTOR's display screen showed the same cryptic message. Suddenly its output fluttered. Fragments of Alvarez's thoughts began interfering. The interference increased until the output looked like random noise. Then in a fraction of a second, everything went blank.

I felt danger. My first impulse was to go to Alvarez, but Stillman stopped me. "I think TUTOR is getting something," he said.

For a few solemn moments I looked wide-eyed at the screen, afraid to blink. How could we even dream of success? It seemed far too much to expect. We were already stumbling on two remarkable breakthroughs. But then again, perhaps we could hope. After all, the breakthroughs would inevitably lead to a string of corollary events.

Suddenly my thoughts were broken. The screen came alive with electrifying reality. An endless chain of words—words describing an alien culture, leaving no question as to their origin. A stargate was opened—a new window to the Universe. Alvarez sent pictures, each worth a thousand words, and now each returning star word was worth a thousand pictures.

And the pictures were within TUTOR—electrons and photons in strange symbiosis coalescing and dissipating into patterns of inconceivable complexity within TUTOR's labyrinthian microstructure.

And across the glass door, something entirely unexpected. A man stiffened in a recliner, eyes glazed with panic, ecstacy. There was no question about it. The pictures were in Alvarez too. . . . ●

COMPUTER CALENDAR

SEPTEMBER

September 12-16: Los Angeles: **CSR Seminars.** For technical, supervisory and systems personnel. Cost, $1,280.00 Linda Barcikowski, Computer Systems Research, Inc. 40 Darling Drive, Avon, CT 06001. (203) 678-1212.

September 13-15: Chicago: **Midcon/83 & Mini/Micro-Midwest/83.** Topics covered include computer simulation, energy management, laser applications and printed-circuit-board technology. Electronic Conventions Inc., 8110 Airport Blvd., Los Angeles, CA 90045. (213) 772-2965.

September 13-15: San Francisco: **Peripherals '83.** Cahners Exposition Group, Cahners Plaza, 1350 East Touhy Ave., P.O. Box 5060, Des Plaines, IL 60018. (312) 299-9311.

September 15-18: Minneapolis: **Second Annual Twin Cities Computer Show and Software Exposition.** Features microcomputers including business computer systems, home and personal computers, and video games, plus business, personal, educational, and entertainment software, accessories, publications, services and peripherals. Northeast Expositions, 822 Boylston Street, Chestnut Hill, MA 02167. (800) 841-7000 or (617) 739-2000.

September 15-16: Indianapolis: **Second Annual Indiana Computer Expo.** Designed for business end-users interested in mini and microcomputers, software, word processing, graphics, services, and peripherals. Ernie Kerns & Associates, Trade Show Department, Suite 201, 2555 East 55th Place, Indianapolis, IN 46220. (317) 259-8111.

September 16-18: San Antonio: **First Annual Heart of Texas Computer Show.** Emphasizes small-business systems for financial and inventory control, agri-business, education, and personal needs. Robin G. Mann, Heart of Texas, P.O. Box 12094, San Antonio, TX 78212. (512) 226-4636.

September 21-22: Boston: **Business Expo.** A showcase for office equipment ranging from computers to coffee machines. Business Expo, 702 East Northland Towers, 15565 Northland Dr., Southfield, MI 48075. (313) 569-8280.

September 22-24: Denver: **Second Annual Rocky Mountain Computer Show & Software Exposition.** Features microcomputers including business computer systems, home and personal computers, and video games, plus business, personal, educational, and entertainment software, accessories, publications, services and peripherals. Northeast Expositions, 822 Boylston Street, Chestnut Hill, MA 02167. (800) 841-7000 or (617) 739-2000.

September 26-28: Kansas City, MO: **Maecon/83.** Aerospace electronics, computer peripherals, laser technology, and personal computing are some of the topics explored at this electronic show and convention. Electronic Conventions Inc., 8110 Airport Blvd., Los Angeles, CA 90045. (213) 772-2965.

September 26-30: Arlington: **Delivering Computer Power to End Users.** Technical papers and panel sessions that address a variety of computer and computer-network issues are the features at this show, sponsored by the Institute of Electrical and Electronics Engineers (IEEE) Computer Society. Compcon Fall '83, P.O. Box 639, Silver Spring, MD 20901. (301) 589-8142.

September 28-29: Ottawa, Ontario, Canada: **Ottawa Computer and Office Automation Show.** Industrial Trade Shows of Canada, 20 Butterick Rd., Toronto, Ontario M8W 3Z8, Canada. (416) 252-7791.

September 29-October 1: Boston: **CP/M '83 East.** This is an International Conference and Exposition for the CP/M industry and CP/M users featuring manufacturers, independent software developers, OEMs, venture capitalists, software publishers, distributors, and dealers. Northeast Expositions, 822 Boylston St., Chestnut Hill, MA 02167. (800) 841-7000 or (617) 739-2000.

OCTOBER

October 4-6: Boston: **PC '83 Boston.** Included in the PC '83 program are informative discussions exploring PC applications, technical information and general sessions designed to show users how to get the most from their IBM PC. Show hours—10:30 a.m. to 5:30 p.m. Cost—$10.00 for one-day exhibits-only ticket or $25.00 for a three-day exhibits and conference ticket. Northeast Expositions, 822 Boylston St., Chestnut Hill, MA 02167. (800) 841-7000 or (617) 739-2000.

October 10-13: New York: **Info '83.** The Tenth Information Management Exposition and Conference will offer more business computer products and suppliers to choose from than any other Info show. (212) 370-1100.

October 10-14: Dallas: **CSR Seminar.** See September 12-16.

October 28-30: San Francisco: **Applefest/San Francisco.** The largest Apple-specific computer show in the country. It features seminars, tutorials, application workshops, advanced user workshops, and software/hardware spotlights. Cost—$25 for three-day exhibit and conference ticket or $10 for a one-day exhibits-only ticket. Northeast Expositions, 822 Boylston St., Chestnut Hill, MA 02167. (800) 841-7000 or (617) 739-2000.

October 31-November 4: Atlanta: **CSR Seminar.** See September 12-16.

NOVEMBER

November 17-19: Boston: Fifth Annual Northeast Computer Show and Software Exposition. The largest annual end-user computer event in the East. Features nearly 500 displays and exhibits of microcomputers, accessories, peripherals, and software. Cost—$7.50. Northeast Expositions, 822 Boylston Street, Chestnut Hill, MA 02167. (800) 841-7000 or (617) 739-2000.

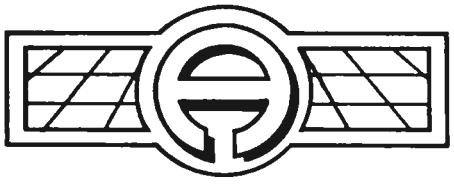
1984

February 21-23: New Orleans: **Softcon.** For trade only. An international conference and trade fair for the software industry. Will feature nearly 1500 displays, over 100 seminars, panel discussions, conferences and workshops. Cost—$20. Northeast Expositions, 822 Boylston Street, Chestnut Hill, MA 02167. (800) 841-7000 or (617) 739-2000.

FEELING AT EASE WITH COMPUTERESE

By Michael Fine

The electronics revolution has brought about profound changes in many aspects of our lives—in the way we work, the way we spend our leisure time, even the language that we use. Everywhere you turn these days, you hear computer terms—words like bits and bytes, RAM and ROM, interfacing, debugging, and many more. But most computer words are so new that most people don't really understand them. And that's why EHC publishes, on these pages each month, this little glossary of computer terminology. Read it—you may need it in this electronic era.



Accumulator—A microprocessor memory register that temporarily stores the results of arithmetical operations.

Address bus—A communication line inside a computer along which the memory locations of data are sent.

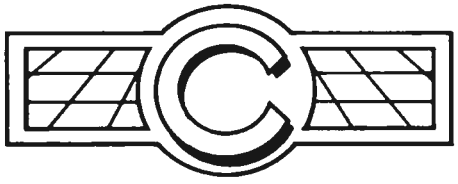
Arithmetic/logic unit (ALU)—A microprocessor register that performs arithmetic and logical operations.

Asynchronous transmission—The sending of information one byte at a time, with a start bit and a stop bit surrounding each character. Simplicity and reliability make this method desirable.

Benchmark program—A program designed to be "typical" so that a user can run it through different computers to compare their characteristics and capabilities.

Bubble memory—A solid-state memory capable of storing large amounts of information in an extremely small area.

Buffer—A temporary storage area for computer data. A buffer is often used to compensate for differing speeds between devices—for example, between a computer and a printer.



Carrier wave—A broadcast wave that carries a radio or television signal.

Clock—A circuit in a computer that produces precisely timed signals to ensure proper timing of the operations of all other circuits.

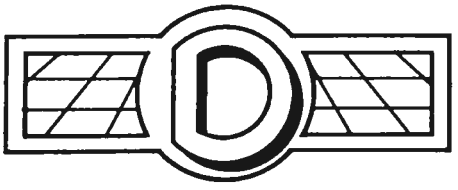
Concatenation—The connecting of two or more text strings to form a single longer string.

Control bus—A communication line along which control data flows.

Control information—Information that controls functions of devices.

Cursor tracking—The manipulation of a cursor on a screen using a stylus and graphics tablet.

Cycle time—The time needed by a microprocessor to complete a "cycle"—i.e., a certain function—in a program.



Data bus—A communication line that transports program data.

Debugger program—A program that helps a user locate and correct programming errors. The debugger stops an execution at points preselected by the user (break points). This makes inspection for errors more efficient, as the program can be tested a portion at a time.

Degausser (bulk eraser)—A device used to demagnetize a magnetic tape.

Demodulator—A device that separates a TV signal from its carrier wave so that a TV picture can be produced. Demodulators are used in TV sets, but are not needed in computer monitors, since monitors don't receive broadcast signals.

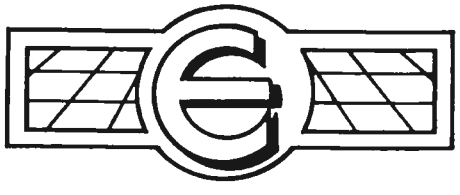
Directory—Information on a floppy disk that tells the computer where on the disk a program is located. Directories also give the user easy reference to files.

Disk operating system (DOS)—The operating system that must be used when disk storage is used. The functions of a DOS include keeping track of files, controlling space allocation, and saving and retrieving files.

Double-density disk—A disk that can store twice as much information as an ordinary (single-density) disk because of increased storage density.

Dual-sided floppy disk—A floppy disk with two usable sides to increase storage capacity.

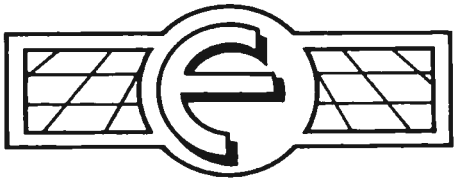
Dumb terminal—A monitor-and-keyboard module that looks much like a microcomputer but can be operated only when connected to a mainframe computer, since it cannot perform computer functions by itself.



Editor program—A standard program (in ROM or external storage) that lets users enter corrections, insert

or delete information, move text, etc., while inputting programs.

Embedded command—Text characters that do not print but instead instruct a computer to perform some task. Embedded commands are used in word processing and other applications. For example, the instruction may be to begin a new page.



File gap—A space used at the end of a file to indicate to a computer system where the file ends.

Fixed-head disk system—A disk system that uses one head for each track of information on a disk. The position of the heads are therefore fixed.

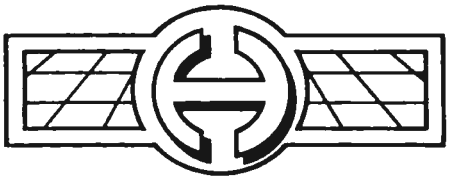
Floating-point representation—A system used for translating decimal numbers into binary numbers so they can be processed by a computer.

Flowchart—A programming aid that illustrates problem-solving procedures (algorithms) step by step. Standard flowcharts use geometrical shapes such as rectangles (for operations), diamonds (for testing conditions), etc.—along with arrows—to illustrate procedures clearly.

Full duplex—In telecommunications, a two-way transmission mode.

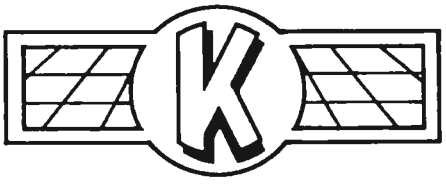
Glitch—An undesirable variation in an electrical flow that can cause errors in a program or other failures in a computer system.

Graphics tablet—An electronic writing tablet used to convert shapes, drawings, etc., into the digital form needed for computer storage. As a special stylus is moved across the tablet (to trace drawings, for example), the shape shows up on a display screen and is entered into the system.



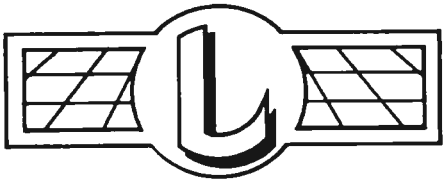
Half duplex—In telecommunications, a one-way transmission mode.

Handshaking—A brief interruption in a program's execution so that a computer can perform some other task.

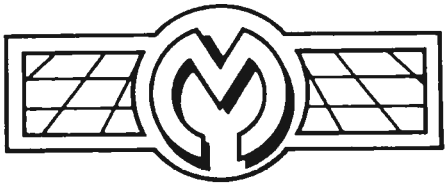


Key stations—The number of input terminals in a multiple-user system.

Keyword—In a computer language, a word that has a specific meaning and therefore cannot be used as a variable name.



Laser writer—A printer in which electrostatically charged paper attracts dry ink powder to form images that are baked onto the paper. This method offers excellent quality and high speed, but at a high initial cost.



Machine-dependent—Capable of being used only on a particular machine.

Megabyte—One million bytes.

Modulation—The altering of a signal to allow it to be broadcast. For example, a TV signal is modulated by being combined with a carrier wave.

Monitor program—A program that controls simple, frequently performed tasks such as inspecting or changing the contents of locations in memory, loading or storing programs, etc.

Monochrome monitor—A video monitor with a single-color display.

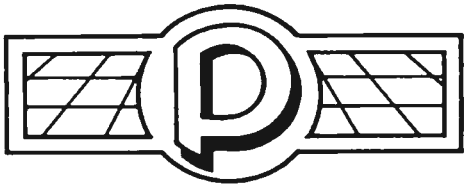
Mouse—A device that rolls on wheels and is used to move a cursor on a screen.

Multiple key rollover protection—A keyboard feature that stores typed characters temporarily when several keys are pressed almost simultaneously on a keyboard. Then, when a pause is detected, the characters can be printed. This technique prevents loss of data.

Multiprocessor—A computer with more than one microprocessor chip.

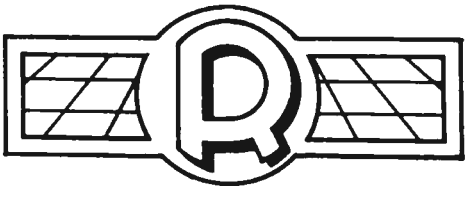
Overflow—A number, produced through an arithmetic operation, that is too large for a computer's register.

Overlay—A technique used when programs are too large for a system's memory. One part of the program is executed, and additional routines are brought in later, taking the place of the program segment that is no longer needed.



Program counter—A memory register in a CPU that stores the sequence of a program's instructions as they are executed.

PROM (Programmable Read Only Memory)—A memory circuit that can be programmed (unlike ROM) with an inexpensive PROM programmer. It cannot be changed after being programmed.



Raster—The horizontal lines on a video screen which are scanned and

illuminated by the electron beam.

Refreshing—The constant regenerating of information that decays or fades when left idle, such as the phosphor on a video screen. The image would fade if not for the electron beam.

Registers—Memory locations in a microprocessor in which information is processed.

RGB monitor—An ultra-high-resolution color video monitor with separate inputs for red, green and blue video signals. Gives excellent color graphics but is expensive and requires a computer with special outputs.

Sector—Individual portions of a circular track on a disk, providing easy retrieval of information by locating sector and track number. A typical sector contains 128 bytes.

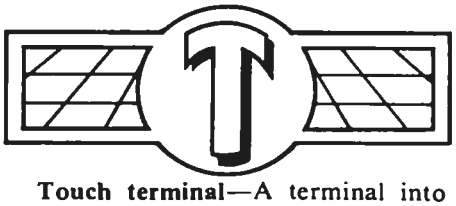
Serial (sequential) access—The searching for data by going through information in the order it is stored on the disk. The slowest of all access methods.

Smart terminal—A peripheral, usually consisting of a combined video screen and keyboard, that has its own microprocessor and can therefore perform some computer functions. Its main role, however, is interfacing with a computer.

Static memory elements—Memory devices that retain their contents indefinitely (without refreshing) as long as power is provided.

String—A sequence of letters, numerals and other characters. String length refers to the number of characters a string contains.

Synchronous transmission—A method of sending and receiving information in which careful timing is needed for characters to be decoded. This method provides high speed but requires expensive equipment.



Touch terminal—A terminal into which the user writes information by touching his finger to a screen, rather than by using a keyboard.

Turtle graphics—Line drawings created in the LOGO programming language by moving the cursor. The term "turtle" is derived from the triangular cursor used.

Typewriter interfaces—Devices that allow a computer to employ a standard electric or electronic typewriter as a printer.

VLSI (Very Large Scale Integration)—A chip that contains the equivalent of thousands of semiconductors (five times more than the 20,000 or so on a large-scale integrated chip, or LSI).

Volatile—Computer memo quiring current to retain inform such as Random Access M (RAM). The contents of RAM pear when power is turned off.

Write-protection—A technique used to prevent the accidental erasure of information by writing over data on a disk or other storage medium. To write-protect a floppy disk, a user attaches a special tab to the jacket that covers a notch in the jacket.

Wafer—Also "silicon water." A piece of silicon on which integrated circuits are made. The wafer is later cut into individual chips.

Wait state—The state a microprocessor is when it is not processing data, i.e., when it has idle time.

Winchester disk—A hard disk with higher storage capacity and much shorter access time than a floppy disk.

Word wrap—The automatic placement by a word processing system of a word on the next line if it doesn't fit within one line. ●

Apple*, Commodore*, Timex/Sinclair* . . .

by William B. Sanders

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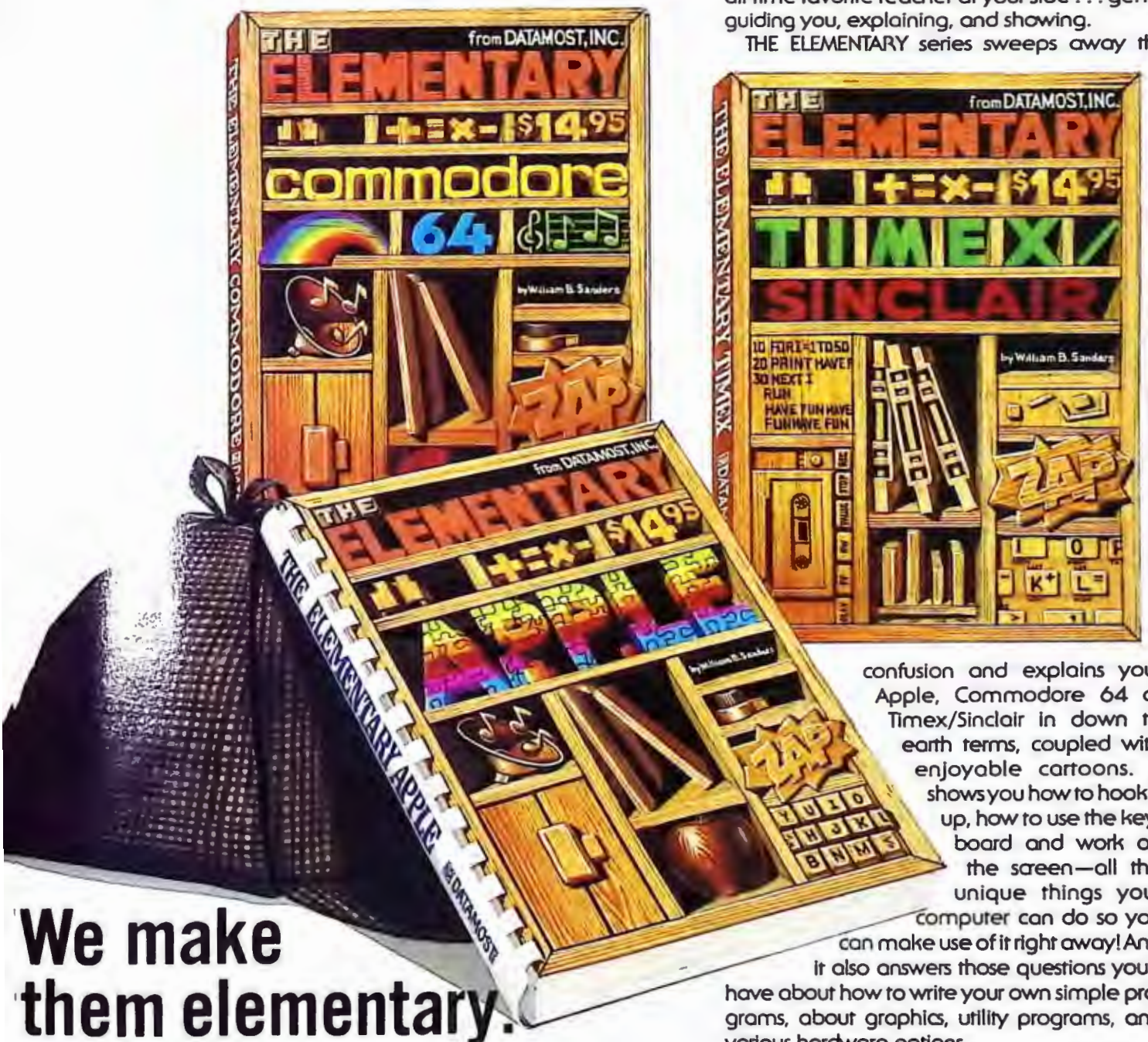

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