apple

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THE NEW LEARNING
BY ISAAC ASIMOV

PLUGGING INTO COMMERCIAL DATA BASES

PERSONAL TELECOMMUNICATIONS

Riding The Data Highways

apple

VOL 2, NO 1

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About This Issue

"It is better to know some of the questions than all of the answers," James Thurber once wrote. With similar introspection, a new staff began several months ago to put together this fifth issue of Apple Magazine.

Eventually we saw our theme in terms of a horizon, and what lay on it. Where were personal computers heading? The idea of one person, one computer was still central. Now there was also the potential for links, connections, communications between personal computers, data bases, and people—"Personal Telecommunications," as we called it in the lead article. Our writers soon brought back evidence that there was not just an experimental trend afoot, but a full-fledged movement—particularly in business, research, and education—which in some areas, such as stock market tracking and analysis, was already catching fire.

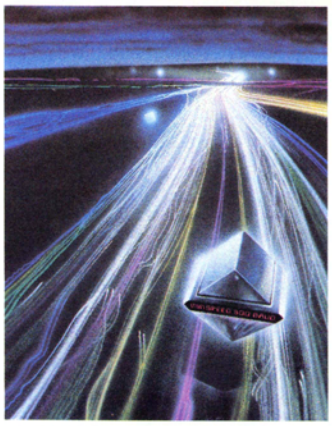
Speaking of our writers, we think you'll notice the diversity and high caliber of the group behind this issue's articles. We are especially proud to present Isaac Asimov, appearing in Apple Magazine for the first time with his article "The New Learning." Future issues will showcase other well-known authors who are particularly qualified to present their views on different subjects.

Of course, the most important people behind this issue are the users themselves. Apple Magazine's mandate is to spread the word about personal computers and how they are changing and enriching our lives. To do this effectively, we need to hear from our readers about how you're using your Apple—so please write or call.

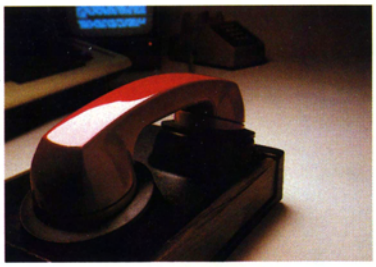
As this issue goes to press there are nearly 200,000 Apple owners in the world, each using an Apple in some personal and unique way. That's enough material for quite a few more issues!

Monte Lorenzet
Editor

Our Cover



One reason why telecommunications is such an exciting application area for personal computers is the potential for individuals to access enormous amounts of data. This is analogous in a way to the potential for travel which we all enjoy, thanks to the vast highway systems linking us with locations everywhere on a continent—and hence our theme, "Riding the Data Highways." Stanley Watts created this airbrushed painting of a futuristic "data highway" heading toward a network interchange.



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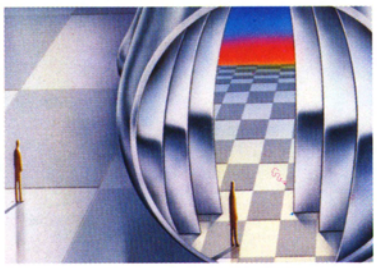

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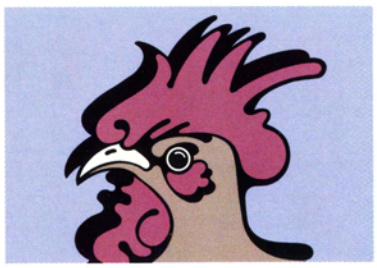

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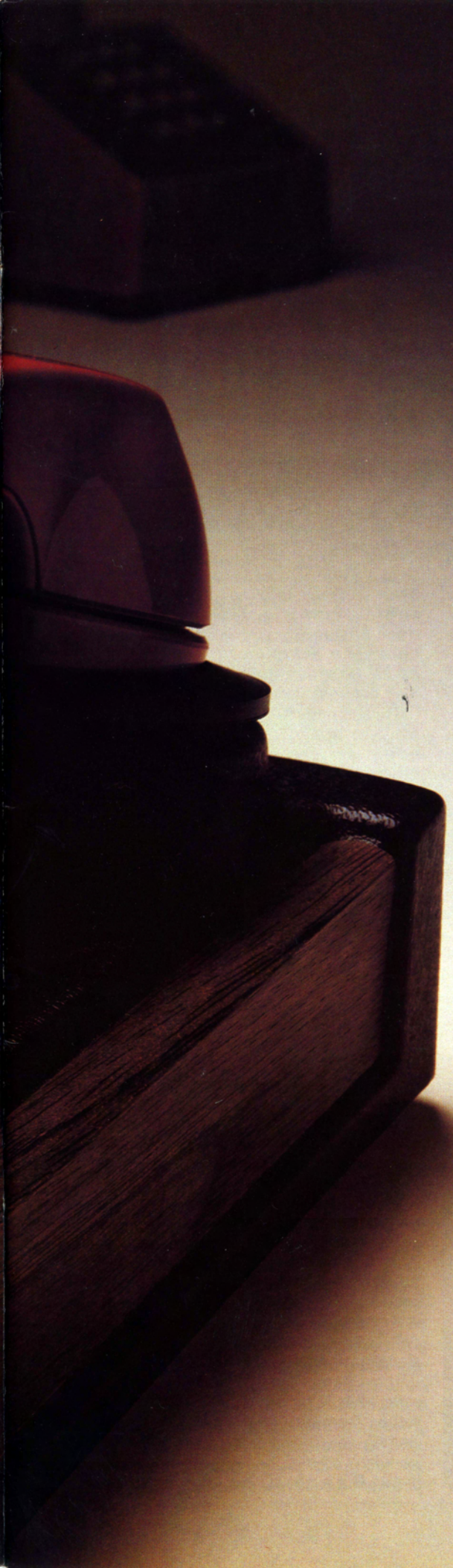


PERSONAL TELECOMMUNICATIONS

BY CLIFF BARNEY & ART KLEINER

The Network Nation is a realm without space, inhabited by a new caste of "superliterates," who are actually no more literate than anyone else but possess the key to new tools with wider information bandwidths.

On the data highways of the Network Nation you can visit with friends, send and receive mail, store facts or shuttle them from remote file to remote file, search libraries, take part in conferences, rent a car, select and pay for a TV set, run your own business, monitor stock and commodity prices, query data bases on subjects from abortion through zoology, play games, and even publish a novel.

There is nothing you couldn't do by other means, but here you are one step closer to the information, having "transdimensionally" by-passed libraries, newspapers, and other information gatekeepers. You can take what you want, according to your own requirements.

But chasing down blind alleys costs just as much as purposeful use of the networks, and there is a definite learning curve associated with network access, just as there is for learning any new system. To further that process, we describe in this article some of the network services available to Apple owners, and tell how to procure them.

DATA BASES

Just what is the Network Nation? A term coined by Murray Turoff and Starr Roxanne Hiltz, authors of a book with that title, the Network Nation is the world of personal telecommunications made possible by using communication lines (notably the telephone system), computer terminals or personal computers, and data bases.

The number and variety of data bases now available over public networks is impressive. Your Apple is a link to hundreds of libraries that you may search at will, without ever leaving your home. And because these libraries are electronically updated, their information is always current.

A number of guides to data bases have been published, including the highly accurate Directory of On-Line Data Bases, available for $60 per year (4 issues) from Cuadra Associates, Inc., 1523 Sixth Street, Suite 12, Santa Monica, CA 90401. But perhaps the best starting place for searching is your public library, where reference librarians either search data bases themselves or know people who do. (Searching is such a complex skill that it's wise to watch others in action, or to take some training before beginning; otherwise you can use up many dollars in connect time just learning your way around.)

Random slices from another reference, the Lockheed Dialog catalog, give some idea of the variety in data bases. Topics include "embryology, employment, enamels, endangered species, endocrinology, energy"; or "plastics, politics, pollution, poultry, production." Chemical Abstracts is available on-line. There's also a Philosopher's Index, and even a thoroughbred racing data base named "Horse."

Probably the most popular publicly available data base by far is Dow Jones. Apple offers two software products for accessing Dow Jones data. The Dow Jones News and Quotes Reporter allows the user to call up all the published and unpublished stories filed for the past three months, as well as quotations for more than 6000 securities on the major exchanges. The Dow Jones Series Portfolio Evaluator maintains up to 100 stock portfolios per diskette, letting the user analyze each for short and long-term gains and losses, as well as for current values.

Apple dealers report that following the stock market constitutes one of the most widespread uses of Apple computers for communications. One owner in Marin County, California, logs in at six every morning, calculates buy and sell signals on 300 stocks with a tailor-made program, and then calls his broker; all before shaving.

COMPUTER MESSAGE SYSTEMS

In addition to data bases, there are real people out there. Communication between people, as distinct from communication between a person and a data base, is only now beginning to be promoted widely.

Sending messages on computer networks is a satisfying way of keeping in touch with other people. You pick up your messages when you're ready, and you leave messages without worrying whether the person will be home to receive them. There isn't the paper-bound limitation of the mail, either. You can send messages to as many people as you wish with one command, and keep a list of people on file, all under one name, to contact with a group message whenever you wish.

Electronic messages can be as personal as face-to-face talk. People form friendships, explode in anger, crack jokes. But accents, physical handicaps, age and sex are all invisible. One 18-year-old MIT freshman startled his professors when his name showed up on their class lists—he had done programming on the ARPANET when he was a high school student, and they'd assumed he was one of their colleagues.

Although computer networks have been supported by the government, they have not been used to the same extent as data networks have by either government or business. ARPANET, developed by the Defense Advanced Research Projects Agency and available only to defense contractors, has been a pioneering communications network for ten years. But the Defense Department itself is only now evaluating a computer message system. (Until one is installed, the link between the highly sophisticated Autodin satellite communications network and the Pacific command center, CINCPAC, will remain a system of printed papers traveling through a pneumatic tube.)

Telenet and Tymnet, the two public packet networks, both offer computerized message systems called "electronic mail." But computer communications is so new and so powerful that the business world is only now beginning to work out acceptable social rites and conventions for its use—and no one is yet certain how to market it.

NETWORKS AS PUBLISHING MEDIA

A computer communications network is more than an elaborate message system or bulletin board. Casual messages are a minor aspect of its benefits. The main benefit of a computer network is its ability to transfer files from one computer to another.

In effect, networks are publishing media, and the text they publish can be edited, printed, filed, formatted, commented upon, updated, indexed, quoted, folded, stapled, or mutilated by any user, with any kind of computer, and still be pristine for the next user. Ted Nelson, visionary prophet of "computer lib," calls material available in this form "hypertext," because it exists as a vast, seamless body of source material that may be manifested in infinitely different forms.

Ten years ago only the ARPANET elite—who routinely read the New York Times data base—sent their mail electronically and published scientific papers "on-line." Today those privileges are more widely available, although not always in a single package. The method of access to nearly all networks is the same (except for "local" network configurations that employ privately installed cable)—the telephone system.

The telephone company provides the technical communications link between your Apple and the host computer. AT&T does not—yet—offer any network services itself, but soon may with the FCC's blessing. And classified ads are just one of the services possible from AT&T, which is planning a communications package called Advanced Communications Services (ACS) that will parallel many of the services now privately marketed over its lines. Other corporations in this field are Xerox (with XTEN and Ethernet, perhaps the most technically well-developed of all large-scale computer network plans), IBM, Exxon, and General Telephone and Electronics (GTE), which owns Telenet.

PLUGGING IN

If you have an Apple system and a telephone, all you need is a modem (MOdulator/DEModulator) and controller to access a computer network. (For the controller, see Apple's Communications Card in the mini catalog at the back of this issue.) The modem is a device that translates electrical signals into sounds (and vice versa) suitable for sending over phone lines. The modem costs between $200 and $400, depending on how many functions, such as dial-up and user identification, it will perform automatically.

These prices are for modems that operate at a speed of 300 baud (30 characters per second). Professional, 1200 baud modems are available in the $800 range.

With this equipment, you apply for citizenship in the Network Nation. Your carte d'identite is an account—or accounts—on various host computer systems. Here are several available.

HOME INFORMATION UTILITIES

Most home computer owners know about the Source, and Micronet (now known as Compuserve Information Service). Both are expanded time-sharing systems, piggybacked onto business computers that aren't used much in off-hours when rates are low.

Micronet and the Source offer a wide range of information and communications services, accessible through a series of different commands. Users can send messages to others on the network; store messages and other text in files, and do rudimentary word processing; download computer programs from the network files into their own machines (although it should be noted that neither the Source nor Micronet's BASIC programs are written in Applesoft or Integer BASIC); and search through data bases, including the Dow Jones stock statistics and general news services.

The Source also offers the UPI news wire, while Micronet offers a composite of stories from 11 different news sources. Getting your news from a computer network isn't as direct as picking up a newspaper. But it allows you to follow specific

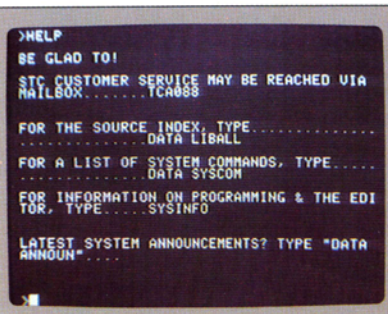
A NETWORK THAT USES A NETWORK

When Quebec held a provincial referendum about whether to seek separate sovereignty last May, the French-language TV network Tele-Metropole used IP Sharp's computer network and Apple graphics to display the tabulated results.

Demographic and electoral statistics were stored in an Amdahl computer. As election results from the 110 provincial election districts (known locally as "ridings") were phoned in, the data was entered into the Amdahl system. Then, when a station in a particular Quebec region needed a graph of election results measured against previous votes or demographics, it simply requested the information through an Apple BASIC program. The station's local Apple II system pulled the statistics out of the central Amdahl computer through the Sharp network—then generated a full-color graph which was displayed on the TV screen.

"We needed 15 graphic displays for one evening," said the IP Sharp network's local manager, Walter Keirstead. "We could have bought 15 considerably more expensive Hewlett-Packard terminals, but the Apples were everything we needed. We're still using them to develop more sophisticated graphics display systems for the next election."

A GUIDE TO THE NETWORKS*



The Source. Telecomputing Corporation of America, 1616 Anderson Rd., McLean, VA 22102. The first and largest home information and mail network. 8,000 members. $100 entry fee, $4.25 per hour non-prime time, $15 per prime-time hour.

Compuserve Information Service (formerly Micronet). Information Service Division, Compuserve Incorporated, 5000 Arlington Blvd., Columbus, OH 43220. Home information and electronic mail network. 4,500 members. $9 entry fee, $5 per hour non-prime time, $22.50 per prime-time hour. $2 per hour surcharge for use of Telenet or Tymnet in those cities where Compuserve's own transmission lines don't reach.

Electronic Information Exchange System. Computerized Conferencing and Communications Center, New Jersey Institute of Technology, 323 High Street, Newark, NJ 07102. An experimental computerized conferencing system. 800 members. No entry fee, $75 per month, $5 per hour, specially programmed communications structures available at extra cost.

Comet. Computer Corporation of America, 575 Technology Square, Cambridge, MA 02139. Easy-to-operate electronic mail. Several thousand members. No entry fee, $60 per month (including 9 hours connect time and 5,000 messages), $7 for each additional hour, 2 cents for each additional message, $5 per hour for Telenet or Tymnet.

IP Sharp. IP Sharp Associates, 145 King Street West, Toronto, Ontario M5H 1J8 Canada, or 1200 First Federal Plaza, Rochester, NY 14614. Most used for financial programs, but also offers an electronic mail system. Good overseas communications links. 2,000 members. No entry fee, $1 per hour, $.60 per 1,000 characters typed in, $.40 per CPU unit. Also allows Apple users to program in APL.

Community Bulletin Board Systems (CBBS). Independently updated CBBS/ABBS lists, $1 each from: Micro Software Systems, 7927 Jones Branch Dr., Suite 400, McLean, VA 22102; People's Computer Company, PO Box E, Menlo Park, CA 94025; AMRAD, 524 Springvale Avenue, McLean, VA 22101.

Nestar Systems, Inc. 430 Sherman Avenue, Palo Alto, CA 94306. Distributed cable networks for Apple computers, limited to one building, with sophisticated file transfer and shared resources. Approximately $5,995–9,995 for disk subsystem, $395 for communications card for each Apple in the network, $25 per 5 meters of connection cable.

*Costs, prices, and other information listed are subject to change. Check network or company for current data.

stories with a depth and immediacy that isn't possible any other way, and to see items that might not otherwise meet a local editor's criterion as "newsworthy."

In addition, both the Source and Micronet offer the beginnings of home education and shopping systems. So far, these services have been limited to rudimentary mail-order credit card functions and some educational information systems. One other new network, Compu-Card, offers an indexed shopping guide. You type in the keywords for what you want, and the appropriate products in their catalog print on your screen.

Which network to join depends largely on the network used by the people with whom you want to communicate. The Source currently has more members and is owned by Reader's Digest, which can supply the financing needed to improve performance. The Source also has a reputation for openness towards its members, making it easy for them to write programs or to make suggestions for improving the network. Micronet is known for its better technical reliability, and fast response time. Micronet's commands are slightly more difficult to learn, but more versatile.

CONFERENCING SYSTEMS

You might instead elect to join a conferencing system, such as Murray Turoff's Electronic Information Exchange System (EIES).

EIES developed from a series of National Science Foundation research projects on computerized conferencing, and was for a time funded by the NSF. Its background accounts for the large number of researchers and academics among EIES's 800-odd members.

EIES is now self-sustaining, and its activities are changing. Both people and community oriented, its members often belong to groups and conferences organized around particular topics.

COMMUNITY FACILITIES

On a less formal basis, Apple owners can often access community bulletin boards—grassroots personal computer services. These are loosely-formed, dial-up networks that carry want ads, greetings, and graffiti. They are currently beginning to be organized around specific topics, which should improve their information "signal-to-noise" ratio.

Community Bulletin Board Systems (CBBS) are usually installed by individuals or small businesses on their own personal computers. They're made freely available through phone lines, and financed out of contributions, or out of the owners' pockets.

Apple computers can connect to any CBBS system. The Apple Bulletin Board Systems (ABBS) are simply CBBS systems which are established on Apples. For a list of current ABBS phone numbers, contact your local Apple users group.

(A program for setting up your Apple as an ABBS system is available from The Computer Merchant in San Diego. The program includes facilities that let people call in and receive private messages. The cost depends on the type of system, but runs about $200 to $250.)

WORK AT HOME

If much of your office work could be done through a terminal, you may be able to connect to your firm's computers through the telephone lines—using your Apple as a terminal—and save yourself a commute several days a week. Some programs are available—such as the "VT100 Emulator," from Apple's Special Delivery Software—that allow your Apple to emulate or imitate terminals recognized by large mainframe computers.

Up to 65 Apples in a single building can be networked through a distributed processing system made by Nestar, which designed its Cluster/One Model A specifically for Apple computers. In such a network, any computer can exchange files with any other. Most of the Apples in a Cluster/One system function essentially as intelligent terminals; others maintain disk drives that serve the entire system, and can even dial up remote sources.

Because networks are so young, users have an unusual opportunity to influence how they develop—both by their subscription choices and by making suggestions to the network managements. After all, in the Network Nation, you make your own connections. That's something no one has been able to do, until now.

Cliff Barney and Art Kleiner first met electronically on the EIES network they describe in their story. Barney edits Computer Network News, a business newsletter covering the emerging network marketplace. Kleiner is a computer journalist who publishes his reports via computer networks, and in CoEvolution Quarterly.

THE NEW LEARNING

BY ISAAC ASIMOV

The computer is the most efficient educational device ever invented, because it makes it impossible for you not to learn.

Suppose you buy a computer that can play chess with you. You can punch in your move and it will indicate a countermove.

It may not occur to you, when you do so, that you are holding in your hand something that could symbolize a greater change in society than anything the steam engine was responsible for.

Follow it through.

You like to play chess. You're not very good at it, but you enjoy it. With the computer you can play chess and have a little fun. That's fine, but fun is all you have. It's just a game. What's so important about it?

But consider that for the first time you can play when you want to; whenever you want to. You don't have to persuade someone else to play a game because you want to—or fight off someone's importunities when you don't want to.

The computer is at your service and has no will of its own. It doesn't sigh and look pained when you make a dumb move, or sneer when you lose, or make excuses when you win. Nor does it get petty and refuse to play if you lose too often—or win too often. It doesn't even sarcastically ask you if you intend to move before dying of old age when you take a few moments to think out a knotty combination.

You've never played chess under such favorable conditions before. You can take your time. You can even put a game aside and return to it later, for the computer will wait. And if the computer's program makes it no better a chess player than you are, you will win half the time.

Illustration by Stanislaw Fernandes

In fact, you will catch on to some of the computer's ways of playing, and you will get to be better yourself as you learn by experience. Then, when you begin to win most of the time, you can get a better program for your computer.

In short, while you're having fun and while you're playing a game, what you're really doing is learning how to play chess better. It is impossible to engage in any activity with an intellectual content, in an interested and concentrated manner, without learning. When a computer makes it possible for you to engage in such activities on your terms—in your good time, in your way, in an interested and concentrated manner—then how can you help but learn?

The computer is the most efficient educational device ever invented, because it makes it impossible for you not to learn. Teachers can be insensitive, books can be dull, but computers produce a system in which only you count. And you cannot be insensitive or dull to yourself.

At the present rate of computer advance, the time will soon come (always assuming our civilization does not crumble through our own folly) when any household can have a personal computer, with a complex and thoroughgoing system for information retrieval. This implies a number of things.

You can get what you need for daily life—weather information, the specials and prices at local stores, news and sports headlines.

You can get what you need for daily business—stock market reports, office data, letters received and sent out. You can stay home and still do your work at the office or plant, electronically, or even hold conferences by closed-circuit television if your system is complex enough.

Most important, you can get information that you just happen to want for no other reason than that you want it.

The last is the most important factor of all. All the other things a computer system can do merely make easier something we have always been able to do less conveniently. We could always make a telephone call, or buy a newspaper, or go to the office or plant.

But casual information? Curiosity information?

You might have books, but surely not every book in the world. You might go to the library, but it won't have every book either. And trying to find one that might be helpful, and then working through it, could be a difficult enough task to kill the curiosity.

Yet the day will surely come when the world's libraries, the world's entire store of information will be computerized; when elaborate retrieval systems will be established so that key words can, with little delay, produce reference lists and, for that matter, the reference content itself, if the request is specific enough.

If you want to know when Peter the Great was born—or what the Donation of Constantine was—or what Bessel functions might be—or what the latest information on Saturn's satellites is—or who holds the record for the total number of no-hit games pitched in a career—or how much 562 divided by 75 is—

Why not?

Moreover, one thing will lead to another. An answer may well give rise to further curiosity and take you off on side issues.

Isn't this what a teacher is for at school?

Isn't this what books are for?

No. A book can only tell you what it tells you. If something in it stirs a question within you that the book doesn't deal with, you must find another book that does, and this you may not be able to do.

With your own computer connected to a global computerized library, though, your first innocent question may lead you to longer and longer searches for information. You may end with passages from half a dozen books, which you could preserve as printouts for re-reading at leisure. And even then, you would only deal with the significant portions of books, as the computer, prodded by your questions, referred you to this book and that to suit your needs.

"Learning is something that someone else wants you to do according to a curriculum imposed upon you at a place, time and speed also imposed on you. At least, that is what we have been trained to think learning is."

To suit your needs.

You will be learning without even knowing you are learning, because we don't call it learning when we are doing something we want to do, anymore than we call it work. Learning is something that someone else wants you to do according to a curriculum imposed upon you at a place, time and speed also imposed on you. At least, that is what we have been trained to think learning is.

Will computerized self-education work?

There's no way it can fail to work. Self-education has worked in the past for highly-motivated, unbearably-curious, unendingly-ambitious people. Using only occasional books and incredible drive, the Michael Faradays, Thomas Edisons, and Abraham Lincolns of the world have risen to great deeds.

But where is the cosmic law that says the process must be made so difficult that only top-rank geniuses can overcome the obstacles?

Suppose everyone has a chance at any book or at any piece of information just by signalling for it. People with infinitely less on the ball than the Faradays, Edisons and Lincolns could get somewhere, do something. They would not be geniuses, but they would at least work more nearly at their top, and that might well be very good.

But how many people would want to know anything at all? Aren't most people just blanks?

Not so. People resist learning because they rarely have any chance to learn on their own terms. Youngsters in school are taught unimaginatively, and by rote, matters about which they are not even curious; or matters about which they might be curious, were it not that curiosity was never aroused; or, worst of all, matters in which they were curious, but in which that curiosity was killed.

But then—if people use computerized-information to learn exactly what they want to learn and no more, who's to say that such learning will be of any importance whatsoever? What if hordes of people are curious only about baseball scores, or about the private lives of movie stars?

Even so, one thing leads to another. Baseball scores may lead to an interest in how one throws a curve, which may then lead to a curiosity about the physics of moving bodies. The private lives of movie stars could lead to a serious interest in the dramatic arts.

And if it doesn't?

Then at the worst, we have lost nothing, because all the effort to teach people "worthwhile" things goes for nothing in any case, if the people being taught don't want to learn. Look about you! Every person you see went to school and studied mathematics, history, geography, literature, and all the time-honored subjects—and the chances are, you couldn't scare up enough knowledge among all of them put together to pass a fourth-grade quiz.

Will computerized education create an ingrown culture in which everyone will hunch over computer terminals and be interested only in what they are interested in so that all inter-human contacts are lost?

That can't be. In the first place, not all the things one is curious about can be obtained from information already frozen. There are some subjects that require the outside world—laboratory work, field work, public speaking, drama, sports.

Computer-teaching will not utterly replace conventional teaching, therefore,

nor should it. Indeed, students will welcome human interaction more, because it will not be the only mode of instruction open to them. They will find the classroom more interesting, knowing that anything that arises out of it that piques their curiosity might be amplified by the computer.

In the second place, even if conventional teaching did not exist, computer-teaching would not necessarily build a wall around a student fascinated by his own curiosity. That is not the way it works. We already have a device that is capable of building a wall around a person. The television set has its devotees who will sit passively watching for hours every day. Will this prevent human interaction? It could—but not necessarily.

Few programs have so caught young peoples' entire imagination as "Star Trek." It has become a virtual cult—but it spawned conventions. The first of its kind was thought by its organizer to be likely to attract 250 people: it brought in 1,400. The second was geared for 2,000 and attracted 4,000—all of them excitedly interested in each other, because they all lived in the same fantasy world.

The enthusiast is sure to be a missionary. Any youngster who, through his exploration of the world of information, finds some esoteric fact, will look for others equally fascinated. Failing to find them, he will try to teach and convert.

That this should be so is exciting indeed. Given enough time, any student who finds he has wrung from a field all that the computer can find, will start trying to make contributions of his own. If interest is sufficiently fierce and curiosity sufficiently unbounded, research will begin.

Yet even after all of this we haven't plumbed the deepest significance of computer-education.

Earlier in the article I said that the advance of computer-educaton depended on the hope that our civilization would not crumble through our own follies.

One of the follies that would inevitably destroy us all would be that of continuing to allow the population to increase in number indefinitely. Four and a quarter billion people are now on the Earth; and with declining reserves of food, water and energy, the population is still increasing by 185,000 each day.

The world is coming to realize the danger, and the cure. It is necessary to lower the birthrate. Western Europe has practically achieved zero population growth. The United States is approaching it, and China is fighting hard to achieve it. Even the Third World is waking to the peril.

Suppose we do reach the cure. If we have a low-birthrate world-society for the first time in history, and combine it with high technology and advanced medicine, we will also have—again for the first time in history—a quickly aging population. We will have the largest-ever percentage of people who have reached the autumn of post-maturity, and the smallest-ever percentage of people in the spring of youth.

It is something that some might fear, for it is part of popular wisdom that old people are crotchety, querulous, dull and without vision. Only the young, supposedly, are brave, strong, creative, driving, and productive. Will the world, then, having escaped destruction through the bang of overpopulation, retire to a slower and perhaps more harrowing death through the whimper of old age? Are those the only two alternatives that can possibly exist?

I think not. Our opinions of the old are the product of our system of education, which is confined to the young. What's more, this system treats the young so inefficiently that they are repelled by it, escape from it as soon as they can, and then never return to it, viewing it as a hated childishness they have outgrown. We create millions of old people this way, who have no more experience with education than a distorted and hated memory of their childhood. And even if there are old people who somehow would like to learn something—anything—we do not have strong social institutions to accommodate them.

"Personal computers are with us. We are growing more familiar with them and learning even better how to use them; and they will be connected more and more thoroughly to the varieties of information potentially available to people."

But how will it be with the computerized education that is now dawning in the world?

If it becomes possible for youngsters to satisfy their curiosity by making use of the world's accumulated knowledge through a device that culls that knowledge and retrieves specific items on command, why should it be only youngsters who will use that device? Or even if it is only youngsters who do so at first, because those who are no longer young have been ruined past reprieve by conventional education, why should the young stop doing so at some fixed age?

People who enjoy golf, or tennis, or fishing, or sex, when they are young do not willingly stop because they reach the age of 35, or 40, or 50, or any age. They continue with undiminished enthusiasm for as long as they are physically able to do so.

So it will be with learning.

It may seem strange to place learning in the class of pursuits which we associate with fun and pleasure, but learning is fun. For those who, even in our own inefficient educational system, find themselves enjoying it, learning is the greatest pleasure in the world and outlasts all the others.

How much more so would it be when education is completely under one's own control, when one can learn what one wants, when one wants, where one wants, and how one wants; when one can learn something today and another thing tomorrow at will; when one can follow the track of curiosity, at one's own speed and choice, wherever it might lead?

While a mind is exercised and refreshed with new interests, it will not age. Death comes at the end, when the physical machinery of the body breaks down and the mind dies with it, still active and vigorous.

Personal computers are with us. We are growing more familiar with them and learning even better how to use them; and they will be connected more and more thoroughly to the varieties of information potentially available to people.

The result?

There will be greater intellectual depth and variety to humanity than the world has ever seen. It will be an exciting world, a bubbling and effervescent world in which hosts of interests will compete with each other, and human beings will race each other to be the first with a new discovery, a novel idea, a better book, a more illuminating truth, a cleverer device.

They will look back on everything that existed before the age of the personal computer as a time that belonged to the infancy of the human species; and they will consider the personal computer the path to adulthood for humanity.

But when? How much will we have accomplished of all this by the year 2000?

That depends on how much we will allow ourselves to accomplish; on whether we have the good sense and the will to allow our civilization to continue.

If we choose correctly, however, then what change does occur, large or small, will inevitably be (it seems to me) in the direction I've indicated.

Remarkably prolific, Isaac Asimov has authored (at last count) 225 books, as well as a great number of stories and articles, ranging from commentaries on Shakespeare to science fiction short stories. "I like to write," he says, "and people seem willing to let me."

GETTING PERSONAL:

Interviews With Architects of the Personal Computer Revolution

BY MIKE MALONE

In a world as fast moving as the personal computer industry, the future is never more than a blink away—and the leaders in this new field must constantly keep one eye cocked toward the misty future for guideposts and markers.

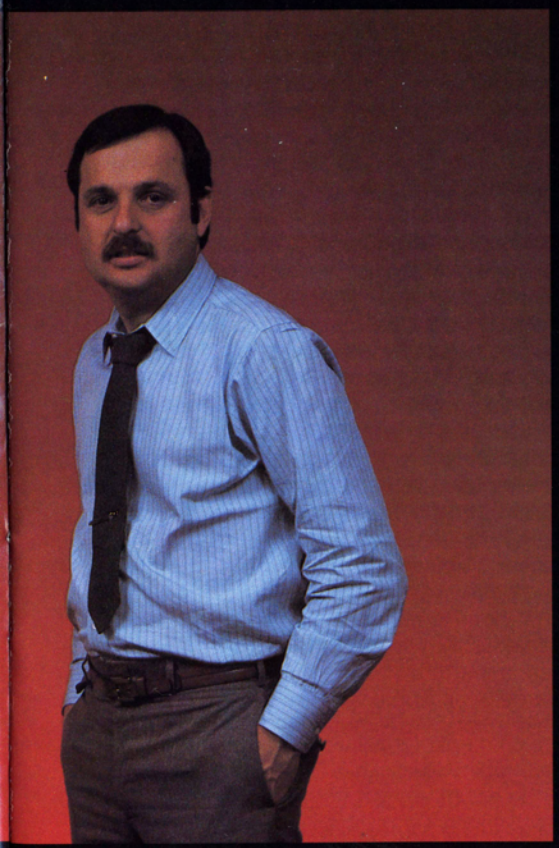
At Apple is a cadre of individuals who have not only helped personal computing grow from birth, but who also hope to lead a maturing industry into the next century.

It probably comes as no surprise that these individuals are uniformly optimistic about the future of personal computing. Their optimism is tempered by a healthy appreciation of the obstacles that must be overcome. Five years in the business have not diminished these executives' dreams, but only added a greater understanding of the rigors of the marketplace.

Apple's co-founder, Steve Jobs, best captured the excitement about the future when he predicted that the advent of personal computing will not only change the way we live, but actually be the catalyst for a new era of creative growth.

"Society advances a notch every time a new, free source of energy is made available," said Jobs. "The question that needs to be asked about computers is whether they will reduce the amount of energy wasted on drudgery. In other words, will they increase the amount of human energy that can be spent on creative work?

Steve Jobs, Vice Chairman of the Board



"I believe they will. I think we're about to see another world renaissance—this one brought on by the revolution in information processing."

Jobs' comments were echoed by fellow Apple founder, Steve Wozniak. "I think that personal computers are going to free people from the mundane things," Wozniak said. "They will allow people's minds to work at a higher level.

"Let's face it: it's healthy to learn basic concepts such as arithmetic and logic, but there is just no point in having to solve the problems over and over every day. It's a waste of time. There is no need in the world to have to draw a chart by hand, or spend an entire day comparing columns of numbers. Machines can do that stuff and leave us to think about more important things."

Both of these pioneers have believed in the enormous potential for social change promised by the personal computer, ever since the day they built the first Apple system. Jobs has developed a metaphor to explain this process.

"The history of computers is a lot like that of electric motors," said Jobs. "Originally, all electric motors were huge and could only be used for very large tasks. That's similar to the early years of data processing, when the only computers were monolithic mainframes.

"But that all changed with the invention of the fractional horsepower motor. Suddenly it was possible for the man with the small task to have his own motor. It meant lower costs and increased flexibility."

"Personal computers are the fractional horsepower motors of data processing. Their applications have only just begun."

Apple's Don Bryson agreed. "We have no idea just how many ways personal computers can be used," said Bryson. "People are constantly discovering new uses for personal computing.

"As a result, the Apple computer is constantly changing its usefulness. And that process will accelerate through the next few years as personal computers evolve into standard tools. Kids who will grow up with personal computers will not be intimidated by them, but will view them as an essential part of their lives."

But we won't necessarily have to wait for today's children to grow up to harvest the fruits of the personal computer revolution. By the mid 1980's a crucial developmental step in personal computing will have occurred: the interlinking of personal computers to one another, and to the immense data bases in the world's largest computers.

"The first step," said Jobs, "is local networking, in a single office or building. That will happen on a large scale in the next three or four years. Included will be all the things in the so-called 'office of the future'—word processing, electronic mail, and so forth.

"Logically, the next step will be to bring that networking into the home; first through phone lines, but ultimately through the bi-directional cable network that carries television and radio signals. At that point, the home may again become the center of one's life.

"Traditionally, buying a home has been the pinnacle of personal achievement. Yet, in modern life, you spend most of your time away from it. Personal computers and the telecommunications network that will connect them will finally enable many people to work at home. The corporate office may be much smaller in the future, and employees may only come in on rotation, one or two days a week."

Networking, with personal computers acting as household terminals, has profound implications for the future, the Apple executives agree.

"When a large number of people have personal computers that are communicating with one another," said Wozniak, "the next step is to form an *ad hoc* electronic mail system. It eliminates the need for paper, stamps, and a drive to the post office."

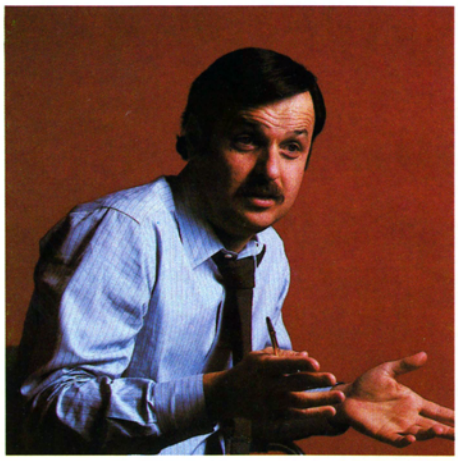
Wozniak predicts that we'll be able to bring entire libraries into our homes, not to mention in-depth information on all current events. "You won't have to go anywhere, but will be able to read everything you want in your own environment."

But this information will not be free, Jobs warned. "People aren't used to paying for information. So, society is going to have to wake up to the fact that information costs something.

"For that reason," Jobs continued, "I think that people will be more demanding and selective of what information they want. And the expense will be worth it, because while the cost of information will go up, the cost of finding it will go down even faster. Computers will become the cheapest way to gather knowledge, whether it be from the daily news, transcripts of Congressional hearings, or the latest novel."

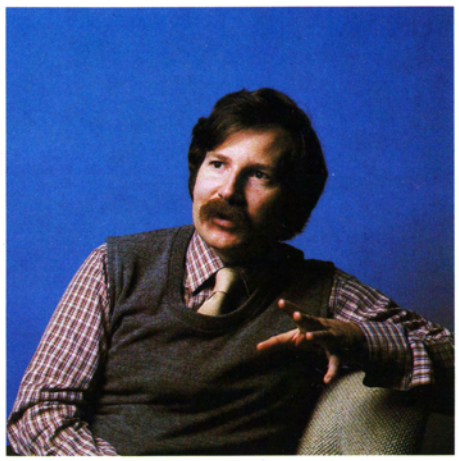
Achieving this scenario will not be as easy as simply adding new features to personal computers and letting society take over from there. At Apple, as well as elsewhere throughout the electronics industry, there is a growing appreciation of the social cost of innovation in terms of training and customer support.

Says Wozniak, "Today's personal computers are the right machines for the job, but there is a built-in inertia in society that must be overcome. There is a pattern to activities done at home that has developed over tens of thousands of years. Those in-



John Couch, General Manager, Personal Office Systems Division

Steve Wozniak, Apple Fellow



Don Bryson, Product Marketing Manager

stitutions are not going to be overcome by personal computers in just a few years."

For Wozniak, the crucial variable in the assimilation of personal computers by society is software. He believes that general acceptance of personal computing will not occur until software becomes almost transparent, of no concern to the user. The user must be able to find the computer as accessible as the daily newspaper or a television.

The whole question of the development of future software creates a special dimension within the personal computer business, the four executives agree. It adds an elusive subjectivity to a business that traditionally has been extremely objective and engineering oriented. How personal computer firms deal with this problem may very well decide their fates as businesses.

What will the software of the future look like? According to Apple's John Couch, it won't look anything at all like traditional programming languages.

"Future software will be unlike any programming language found now in the computer industry, even among the giant mainframes," Couch said. "It will have no complex, procedure-oriented programming languages. Instead it will so accurately mirror real-life activities that, outside of a minor amount of training using the keyboards and other controls, it will be instantly familiar and comfortable to the user. It will not only enable the user to look up information considerably faster than it could be found in a book, but will actually require no more skill or training than that. Its interface will emulate the user's environment, and not require the user to change the way he or she does things."

Couch points to software such as VisiCalc™ as simple pioneering efforts in the right direction—tools enabling nontechnical users to develop forecasts, budgets, and income projections far faster than could ever be accomplished otherwise.

Wozniak agrees. "We find that software like VisiCalc actually sells computers, instead of the other way around."

Describing the traditional concept of software design, Wozniak compared it to art. "Good programmers are like artists, hitting upon the best combinations sooner than anybody else."

From the beginning, Wozniak said, Apple has kept a look out for talented programmers. And thanks to an exciting product and market, Apple has been able to hire some of these "artists" for its software staff.

But both Wozniak and Couch note that most people aren't programmers at all—nor inclined to become them. And yet, these nonprogrammers comprise the real market that the personal computer industry must reach and serve.

"Future software will be unlike any programming language found now in the computer industry, even among the giant mainframes."

"We need to shift our emphasis," said Couch, "from providing only the traditional, procedure-oriented languages—such as BASIC, Pascal, FORTRAN, and the rest—and move towards providing new, interactive tools which are specification-oriented, and don't require any formal programming knowledge to use."

Couch has even coined a word to describe the kind of tools he is talking about. He calls them datagrams, as opposed to programs; by extension, using them is datagramming, rather than programming.

For the nontechnical user, such a shift toward the datagramming concept will literally unlock the power of the computer. Instead of having to know BASIC or Pascal or another traditional programming language in order to write or modify programs for his personal needs, the user will be able to work with datagram templates and other quickly understandable, easy-to-use tools that closely emulate his own environment.

"The people who write software for their personal use will be the ones who come up with the most creative solutions to their own problems," said Wozniak. "These are the people who buy an Apple and learn how to use it from the manual. They might not know the 'rules' of programming, but they know what they want to do—and all they need is a set of tools they can use."

Developing the datagramming approach will neither be cheap nor easy. One of the paradoxes of the computer business is that the easier a computer is to use, the more expensive and internally sophisticated it must be. And breaking away from the traditional modes of programming, developed over the last 30 years, also carries with it a sizable challenge.

"You might look upon the computer business as being a minefield," said Couch. "We are over here and a successful future is on the other side. One of the quickest and safest ways to get across is to step in the footsteps of your predecessors—that is, use the old, traditional programming tools developed by the maxi, mini, and micro computer companies.

"Well, we're betting that there's another and better way across that minefield, using new, non-traditional tools. It's not the conservative way to go, but we think that the risk is worth it, because the potential rewards—for Apple and for personal computer users—are immense."

VisiCalc™ is a trademark of Personal Software, Inc.

Mike Malone is a freelance writer who, as a former business reporter with the San Jose Mercury-News, has written about many companies and executives in Northern California's electronics-intensive Silicon Valley.

PLUGGING INTO COMMERCIAL DATA BASES

BY BETSY GILBERT

Increasing numbers of Apple users are creating or enhancing businesses by accessing specialized data bases over the telephone.

Not so long ago, access to on-line data bases was effectively limited to a small group of large corporations. Who else, after all, could afford the equipment and the time charges? Besides, the few data bases available tended to be highly specialized, concentrating on the needs of a few corporate customers.

Today, there are more than 600 on-line data bases in the United States, serving a variety of professional groups from farmers to attorneys. And with only a personal computer or terminal and a telephone interface, anyone can access most of them.

Data base production has become a big business. For every firm that compiles a new bank of information, hundreds of groups and individuals line up to access that data.

It makes sense. Getting information from a data base takes only a few minutes. Getting the same facts from printed sources takes hours of searching, scanning, and copying.

The convenience can still be expensive. Fees for data base services are as varied as the information covered, ranging from a flat $25 per hour to $64,000 per year plus hourly rates.

Despite the high cost of using some data bases, an increasing number now accessible through personal computers are relatively inexpensive. And more Apple users every day are taking advantage of these specialized data bases to enhance their business operations.

ON-LINE DATA FOR TODAY'S BROKER

Successful investing in the stock market depends on two things: a thorough understanding of stocks, and exceptionally good timing. Two stock market data bases now available to Apple users—Dow Jones and Microquote—enhance both.

There are no slow days in the market. In order to make the best buy-and-sell decisions, a successful broker has to stay a step ahead of the trends. In the not-so-old days, a broker got to the office early, tore frantically through the Wall Street Journal, charted his clients' stocks on paper, then got down to the hectic business of buying and selling. He used up precious time with this morning routine and often recognized an opportunity too late to cash in.

"In order to run a farm profitably, the farmer must master many professions: accountant, livestock expert, commodity broker, chemist, and—too often —gambler. Farming is a risky business, and poor guesswork has led to failure for many farmers."

"I'm using every advantage I can to stay ahead of the game," says Tom Bocock, a stock broker with Wheat First Securities in Norfolk, Virginia. One of his advantages is an Apple II accessing the Dow Jones News/Retrieval Service. He keeps the Apple at home, updating his clients' files and making important decisions in the morning before work and in the evening after dinner.

The Dow Jones software is available from Apple (See the "Apple At a Glance" section at the back of this magazine). Bocock uses the News Retrieval program to obtain up-to-the-minute news for the past 90 days on any stock that interests him. Then, using the stock quotes program included in the same software, he updates his point, figure, and bar chart technical analyses.

Denys Wortman shares Bocock's philosophy of using every advantage available. A broker with the Boston firm of Moseley, Hallgarten, Estabrook and Weeden, Wortman bought an Apple two years ago to eliminate some of the drudgery of charting stocks manually.

"I'd been doing technical analysis charting for some time, but I was able to get through only about 10 stocks a day," Wortman recalls. "After I got the Apple, things improved slightly. But I was still typing the data from the Wall Street Journal into the computer, and that took time."

Then Wortman met Arthur Gutterman, a programmer who helped him completely automate his charting method. By logging onto both Dow Jones and Microquote, Wortman was soon charting up to 290 stocks a day. (Microquote, a service of Compuserve, lists information on 32,000 stocks, bonds, and options back to 1973.)

"I get up-to-the-minute price and volume figures from Dow Jones, and historical information from Microquote. It cuts an incredible amount of time from my routine," Wortman says. "My business volume has increased dramatically, and I just bought another Apple for use at home. It comes on at 7:05 each evening, dials up Dow Jones, logs on, and updates all the stocks I'm tracking. What could be simpler?"

In Northern California, Jack Burrows uses his Apple computer, the Dow Jones News/Retrieval Service, and a program called Stock Tracker to make buy-and-sell decisions on a portfolio of some 60 stocks. Stock Tracker is based on the "On Balance Volume" investment theories of technical market analyst Joe Granville (see accompanying story), and is available from H&H Trading Company of Pleasant Hill, California. It calculates buy-and-sell recommendations on the basis of trading dates, volumes, and closing prices.

During one single-month period, Burrows said, he was able to achieve 24 highly profitable trades out of 25 transactions, through decisions made with his Apple. To update quotes he simply calls a local number and connects the Apple via modem to the Dow Jones data base. It takes only 4–5 minutes, and costs about 60 cents a day.

"For me, poring over the figures in the Journal is a thing of the past," says Burrows. "The computer does all the monitoring, giving me more time to think about how I'm going to act."

THE COMPUTERIZATION OF FARMER BROWN

To many city slickers, farming is synonymous with "getting back to nature," returning to a simpler lifestyle. But today's farmer knows better.

In order to run a farm profitably, the farmer must master many professions: accountant, livestock expert, commodity broker, chemist, and—too often—gambler. Farming is a risky business, and poor guesswork has led to failure for many farmers.

The introduction of AGNET (AGricultural Computer NETwork) in 1975 eliminated much of the guesswork and has helped change the face of farming throughout the West. Developed at the University of Nebraska in Lincoln, AGNET provides information on every aspect of running a farm, from irrigation schedules to harvesting equipment.

AGNET was designed for easy access via personal computer, and using it requires virtually no programming knowledge. After logging into the service, a farmer can call up a program simply by typing in the name from a reference list. For example, SOILLOSS estimates soil erosion loss from cropland east of the Rocky Mountains; EWESALE lists sheep for sale throughout the United States; and VITAMINCHECK checks the level of vitamins and/or trace materials in hogs. More than 80 programs are already on-line, and others are under development.

When Eddie Neiman read about AGNET in an agricultural newsletter, he wasted no time getting his Apple II hooked into the network. "I bought the Apple primarily to help out with crop analysis and budgeting," Neiman says, "but since I plugged into AGNET, the computer has been working overtime."

Neiman and his brother manage a 3,000-acre grain farm outside Paoli, Colorado, about 170 miles northeast of Denver. "Running a farm the size of ours takes a lot of planning," Neiman points out. "You don't just throw seeds on the ground and wait for the crop to come in. AGNET gives us concrete facts and figures we can work with to operate this place more efficiently."

By accessing AGNET's soil analysis program, the Neiman brothers can determine which crops grow best in the various soils on their farm. They consult the market trend analysis service for updated market reports and comments by specialists. Before buying new machinery, they survey their options using the equipment analysis package.

Through Neiman's work with Paoli's agricultural service, other farmers in the area are discovering the advantages of owning a personal computer and using the AGNET service.

"We were the first people in the area to buy a computer for the farm," Neiman says. "But I don't think it'll be long before farmers everywhere will have them."

"A New Orleans-based organization called the Personal Computer Commodity Analysis Group has developed computer programs which automatically access the data base, download and file commodities data, and execute a variety of trade routines."

COMMODITY TRADING THE EASY WAY

Dealing in commodities requires access to timely information while it's still timely. Buy-and-sell decisions made in seconds have lasting effects, and the successful commodities broker has to make the right decision at the right time.

Until recently, these traders had little to rely on, save quickness of mind and a lot of luck. Manual charting was the only game in town, and it often required hours to do correctly.

But now Commodity Systems, Inc. in Boca Raton, Florida, offers commodity traders the same service that Dow Jones and Microquote offer the stock broker. The data base contains both daily and historical information on all major markets in the United States, Canada, and Great Britain. It includes detailed coverage of futures prices, volumes, open interest, and cash prices—information the trader needs to make profitable decisions.

The commodity trader can save a considerable amount of time by interfacing his personal computer with the data base. A New Orleans-based organization called the Personal Computer Commodity Analysis Group has developed computer programs which automatically access the data base, download and file commodities data, and execute a variety of trade routines.

Tom Allen, president of Tom Allen Investments in Austin, Texas, logged onto the Commodity Systems data base more than a year ago. First, he consulted the Personal Computer Commodity Analysis Group. The computer the group uses is the Apple II.

Tim Slater, coordinator of the Personal Computer Commodity Analyses Group.

STOCK CHARTING ON YOUR APPLE

Many people think investing in the stock market is like betting on horses—to win, you need a little know-how and a lot of luck.

Maybe so. But some 12,000 investors who subscribe to an investment theory called "On Balance Volume" have been winning for years—and as far as they're concerned, Lady Luck hasn't had a thing to do with it.

On Balance Volume was developed by now-famous stockmarket technical analyst Joe Granville in the early 1960s. It is a method of making buy-and-sell stock decisions based not on share price, but on the volume traded.

For those who strictly adhere to the principle "Buy low, sell high, and strike while the iron is hot," On Balance Volume is hard to swallow. But it also appears to be one of the surest ways to make money on the stock market.

The theory is simple. The investor follows the market by recognizing its tops and bottoms. (Through the use of several market indicators, The Granville Market Letter has called every major top and bottom in the Dow Jones Industrial Average since October, 1974.) Then to pick stocks, the investor establishes a running volume total (or "on balance volume") of each of the stocks he's following. If a particular stock closes higher than the previous day, he adds the volume to his running total; if it closes lower, he subtracts the volume. Over a given period of time, he charts the on balance volume and compares it to the prices. His buy-and-sell decisions are based on accumulation or distribution, which he's plotted, and the relationship to the price variance.

"This is really the only way you can play the stock market successfully," says Blanchard Granville, Joe Granville's son and manager of The Granville Market Letter, a newsletter started by his father in 1963.

"In 1957, my father was a successful technical analyst with E.F. Hutton," Granville relates. "He developed his theory while working there, then left to go out on his own. The newsletter was his way of getting the word out to brokers and investors."

Blanchard Granville joined the newsletter in 1978. At that time, it was produced by a staff of four and was reaching fewer than 3,000 people. Today, a staff of 18 gets the weekly publication out to over 12,000 subscribers around the country and abroad.

In mid-1978, anyone using the On Balance Volume charting method had to do all the plotting manually. Then Blanchard Granville began to hear of people taking his father's concept one step further and putting the charting method on computers.

"Legally, there was no way to stop anyone from computerizing our trademarked indicators, so I figured, 'If you can't beat them, join them.' "

He did just that, teaming up with Denys Wortman, Russ Lewis, and Arthur Gutterman of Stockmarket Software in Ashland, Massachusetts. Since that time, he has been using the Apple computer to help pick the stocks for his own portfolio.

"Charting has become much more sophisticated since the Apple was brought in," Granville said. "Now our subscribers have instant access to the data they need to make their decisions, and they have something that can monitor hundreds of stocks for them even while they're sleeping."

According to Granville, investors subscribing to On Balance Volume need never fear a downward trend in the market.

"Most people think that the only way you can make money is when the market is going up," Granville said. "We've proven over and over that investors can also make money when the market is going down." This is accomplished through short selling. More people are beginning to realize that you can make money as the market swings in both directions, and they've come to accept On Balance Volume as the definitive market guide."

"I got in touch with the New Orleans group, then went out and bought my Apple almost as soon as I hung up the phone," Allen says.

Before he logged into the network, Allen says, his work day was both tiresome and frustrating. "Every morning was the same," he recalls. "I sat down at my desk with my worksheets spread out in front of me. On one side I had the Wall Street Journal; on the other, my calculator. Then I went to work with my pencil."

Allen used to spend more than an hour every morning charting only four commodities. By the time he finished, the market was already into its second hour of trading. Now he lets his Apple do all the pencil work.

First, Allen dials up Commodity Systems and gets the market's opening and closing prices and the highs, lows, and both estimated and actual volumes for the dozen or more commodities he's following. Next, using a data diskette, he automatically updates the information, then uses a separate analysis diskette to plot the chart. An analysis diskette, supplied by the Personal Computer Commodity Analysis Group, contains approximately 20 trading routines, including On Balance Volume. Allen selects his plotting and charting routines from a "menu" displayed on his screen monitor; he activates his choice by pressing a single key. Allen finally makes his trading decisions based on the computer's analysis.

"Automating the data-gathering process has made the charting easier," Allen says. "Having programs that analyze the charted information makes the decision process easier. And that makes my life easier."

Tim Slater, coordinator of the Personal Computer Commodity Analysis Group, expects to see more companies like his bringing microcomputers to commodity and stock traders.

"This is the modern way to do business," Slater says. "The cost of buying a personal computer is relatively low, and these newer data bases are gearing themselves to traders who don't have huge amounts of money to spend. You log onto a data base and get information that you otherwise wouldn't get in a million years. Any costs you incur seem justified within a brief period of time."

A freelance writer and former reporter for the Shreveport Times and the Atlanta Constitution, Betsy Gilbert currently operates her own public relations firm in Palo Alto, California.

EDUCATION ON-LINE

BY NEIL FITELSON

Personal computers are beginning to be used in networks by students and teachers to access whole new worlds of resources and capabilities.

Microcomputers are dramatically changing the economics and the potential of computer education.

"They can be handled on today's budgets," says Art Luehrmann, director of computer research for the Lawrence Hall of Science in Berkeley. "The priority right now is to get them into schools." Luehrmann estimates that the hardware costs amount to less than one percent of the operating costs of the schools.

Meanwhile, a number of education networks have sprung up, offering special programs, data bases, research, and services to growing circuits of users. And some schools have set up their own localized "networks" that link together the microcomputers on their campus into a centralized hard disk storage system.

The National Science Foundation, working with the U.S. Office of Education, began awarding grants to regional computer networks as far back as 1968. Dartmouth College, the Triangle Universities Computation Center (for Duke, North Carolina State, and the University of North Carolina), and the Illinois Institute of Technology were among the earliest remote computing centers funded by the foundation.

Until recently, these distributed network hosts were accessible in schools only through the use of interactive computer terminals. Now personal computers can interact on-line with host mainframes. Because of their local processing power, they also offer "downloading" (transferring programs and/or data files from host to microcomputer) and "uploading" (transferring programs and/or data files from microcomputer to host) capabilities as well. This amounts to a great advantage over an interactive terminal, which would have to create the programs or files on-line at considerable expense.

A NETWORK ON CAMPUS

You'd expect to see students charging out the classroom door at the end of the school day. But at Saratoga High School in Saratoga, California, many of those students are charging into—not out of—the classroom, jockeying for position to get on one of the school's 15 Apple computers.

"It happens here at the end of every day," says teacher Hal Dueck. "Their enthusiasm is really something. We practically have to force them out later when it's time to go home."

Saratoga offers the system to its teachers and students for everything from classes in computer literacy to computer-assisted instruction for noncomputer classes.

The computers are networked together into a 10-megabyte hard disk system located at the school. The hard disk system allows users to develop a central library of programs that can be accessed by any of the Apples at any time.

Existing floppy disk programs designed for the Apple can be transferred directly onto the hard disk; additional program files are added by teachers and students. Most of the programs on the system are easy to use, even for the computer novice. Advanced programs are protected by passwords that are only given to students who prove some computer proficiency. The system manager has access to all files and to the output of any of the students working on the system.

Teachers like the computers, explains Dueck, because the educational programs are easy to adapt for their classes. "Our teachers have adapted Apple's Shell Games

"We chose the Apple II because the systems are dependable, because there's a good selection of educational software that's been designed for it, because of the high-resolution graphics and the availability of the Pascal language in addition to BASIC, and because Apple has shown more interest in developing the educational market than other companies."

Students at Saratoga High School in Saratoga, California, can't get enough of their Apple Computers.

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for classes ranging from sociology to physics. A Spanish teacher is even changing one of the adventure-type games so that the students have to learn Spanish commands to get around in the adventure."

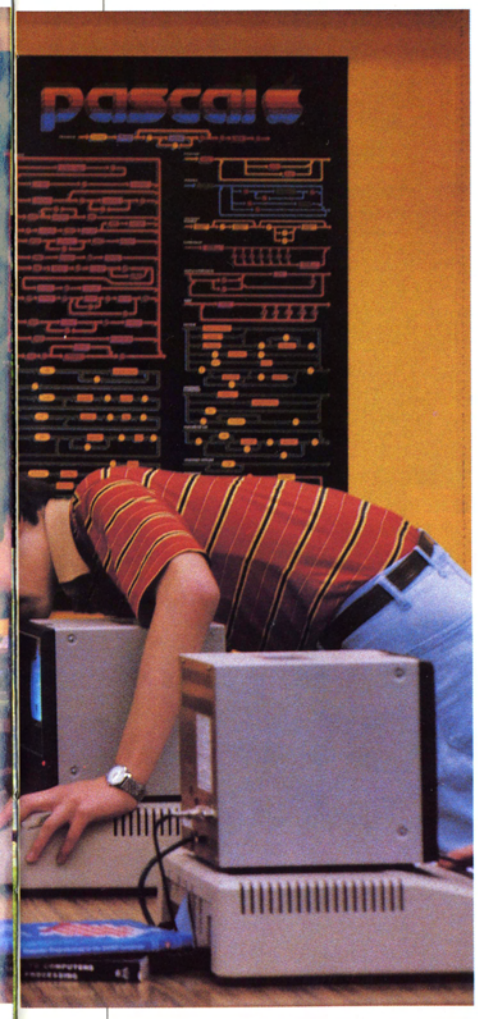
Why did they select Apples? "We chose the Apple II because the systems are dependable, because there's a good selection of educational software that's been designed for it, because of the high-resolution graphics and the availability of the Pascal language in addition to BASIC, and because Apple has shown more interest in developing the educational market than other companies."

UCSD PASCAL™ LAB

The Pascal Lab at the University of California at San Diego is used for teaching UCSD Pascal programming, as well as computer literacy courses. Designed by Dr. Kenneth Bowles, it is a local network of 25 interconnected Apples hooked up to a hard disk. Two students share each Apple.

The major advantage of the network is efficient course management, which is enhanced by the central disk system. "Because files are transferred electronically via hard disk, the mishandling and recopying of floppy disks is eliminated," Dr. Bowles says.

The UCSD network also queues and processes printer requests.



EDUNET

Apple computer system owners are now accessing EDUNET, an international, nonprofit network for higher education and research. Established in 1979, EDUNET has a number of host computer "suppliers" (currently 17 American universities) and a membership of over 150 "client" schools and nonprofit organizations located in Canada, in Europe, and across the United States.

Membership in EDUNET affords access to a wide variety of computer-assisted instructional materials, comprehensive data bases, and advanced research software. Resources available from suppliers include: electronic mail and conferencing systems; tutorial programs in the humanities, sciences, and professional studies; statistical packages; subroutine libraries; computer-assisted instruction authoring languages; graphics software; planning and analysis models; and information storage and retrieval systems.

"Before EDUNET, people were limited to the resources available on their local campuses," says Joyce Straight, EDUNET network services consultant. "Now the resources of 17 campuses are available to them."

Technical and liberal arts colleges, graduate schools, seminaries, schools of law and medicine, and nonprofit research organizations all take advantage of EDUNET services. Both interactive terminals and Apples are being used to connect to suppliers. "EASy" software, specially developed for the Apple II Plus with the Pascal Language System, allows the computer to act as an interactive terminal, and to download and upload files.

A wide variety of programs are available through EDUNET, including the following:

METRO-APEX (Cornell) is an urban simulation game that allows participants to play the role of elite decision-makers—politicians, planners, land developers, industrialists, pressure groups, and news media. In two- to eight-hour class sessions, players hold public meetings, form coalitions, exchange money and influence, and make decisions in response to an urban scenario generated by the computer model. Participants experience first-hand the diversity, complexity, and frustration of urban affairs.

LAW/CAI Programs (University of Minnesota) are computer-aided exercises in legal education that provide 19 modules ranging in subject matter from the use of intent in tort law to federal rules of evidence. The programs are currently being used by many law schools across the country.

WISE/ERIC (University of Wisconsin) is an easy-to-learn, inexpensive-to-use information search and retrieval system for bibliographic data bases. Employing convenient commands, WISE can handle complex search strategies, employing Boolean searches that isolate sets of citations from ERIC files containing 300,000 documents related to many areas of education.

EIES (New Jersey Institute of Technology) or the Electronic Information Exchange System is a sophisticated, electronic conferencing system designed and documented for use by people at all levels of computer experience. Its features include: messaging, conferencing, notebook space for composition and joint authorship, public publication space, and an on-line directory of people using EIES. Support functions include text processing, on-line consulting, and group voting.

THE FUTURE

"Over the next three to four years, 98 to 99 percent of computer education dollars will be spent on the acquisition of microprocessors to use with kids," notes Art Luehrmann, director of computer research for the Lawrence Hall of Science in Berkeley. Once schools are equipped, though, Luehrmann foresees an eventual trend toward clusters of personal computers connected to a central disk and printer.

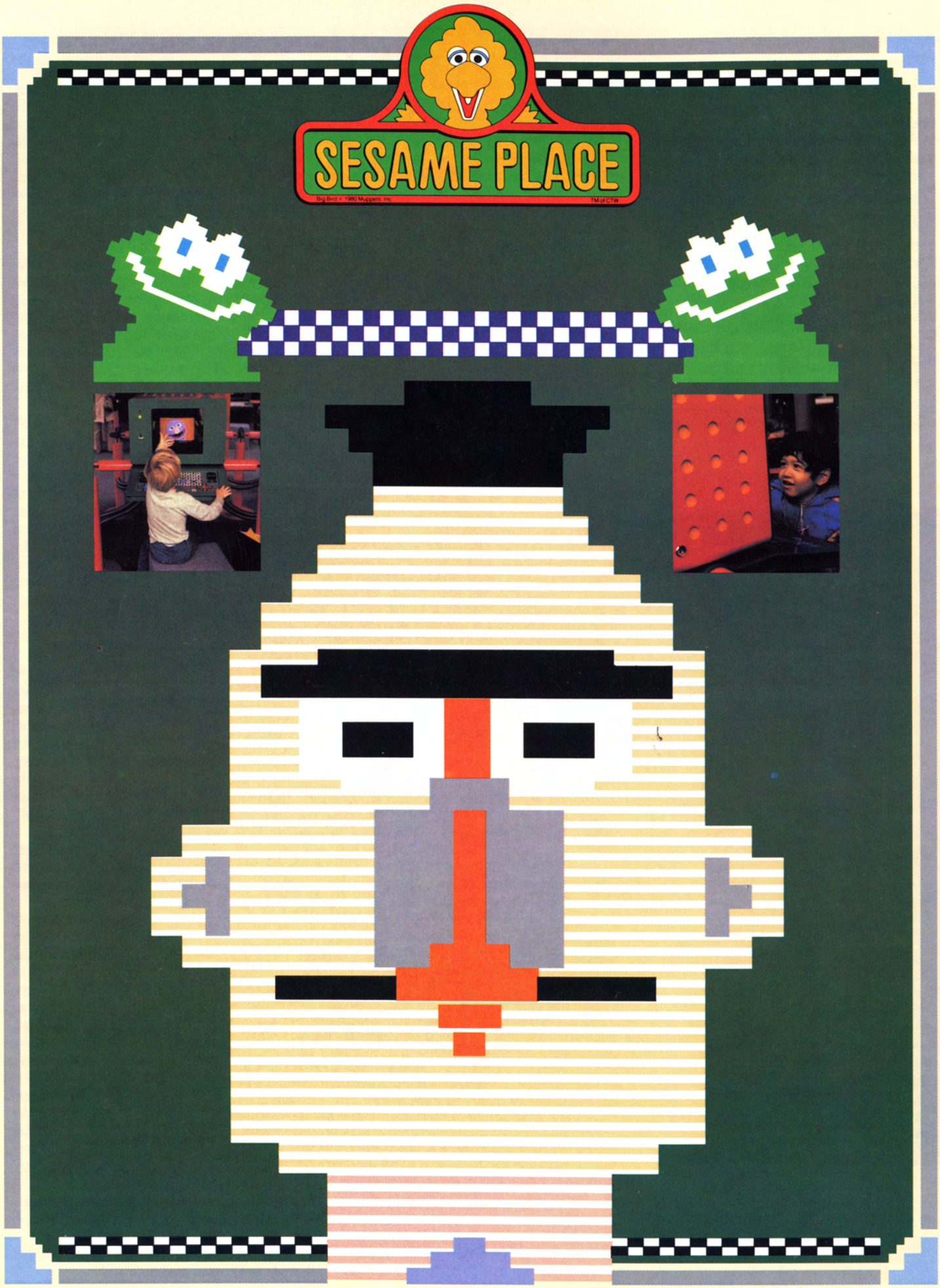
Networking in colleges and universities, on the other hand, is growing by leaps and bounds, according to EDUNET Coordinator of Information Services Cevia Rosol.

"EDUNET makes available the computing facilities of 17 major universities. Through the network, smaller institutions with limited computing budgets can gain access to countless computer resources." Rosol foresees the day when anyone, anywhere, can enroll in an on-line college. "People will be able to get a college education sitting at home at a terminal, and have the credit recognized," she says.

How soon will this happen? Some authorities see these opportunities becoming available to people on a mass scale by 1990. Others think we're about to see large-scale changes in teaching and learning by computer in just the next few years.

One thing is for certain: educational networks are on-line.

Neil Fitelson is a writer on the staff of Apple's Editorial Services Department.


SESAME PLACE
Big Bird © 1980 Muppets, Inc.
TM of CTW

SESAME PLACE JOINS MOPPETS, MICROS, AND MUPPETS

GO GO

BY MIKE CASHMAN

Bytes don't make Big Bird any less loveable, and Oscar the Grouch doesn't change his mood in output mode. So what's all the fuss about the Muppets riding a digital bus?

At the computer gallery just inside the main gate to Sesame Place in Langhorne, Pennsylvania, children don't watch the award-winning Sesame Street Muppets, as they have for the last 11 years on television. They get to play with them, using dozens of Apple computers and specially designed keyboards. More than 30 different computer games are on hand to entertain children ages 3 to 13, with kids of any age more than welcome to join in.

Sesame Place is one of the most original collections of educational computers in the country. The games—far from frivolous—were designed by educational experts, then run past groups of school children so researchers could assess the interaction between child and computer. (Apple's DOS Tool Kit software was used to create the high-resolution graphics—see the "Apple At a Glance" section at the back of this magazine for details about the DOS Tool Kit.)

All told, 700 students in New York, Pennsylvania, and California helped develop the games in weekly three-hour sessions. The results are impressive: 35 fully tested games designed to teach children reading, music, logic, creative writing, social studies, and hand-eye coordination.

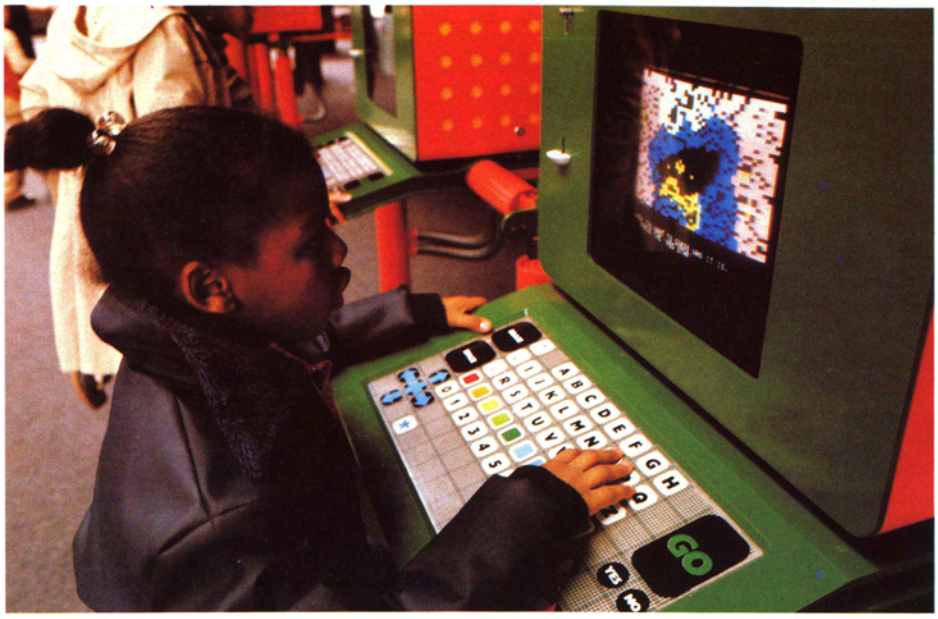
And more games will soon be at work—and play—at Sesame Place.

Sesame Place is a joint venture of Children's Television Workshop (CTW)—the company that developed and produces "Sesame Street"—and Busch Entertainment Corporation. Since grants are iffy in today's world, CTW is always on the lookout for ways to generate funding to support its children's programming, not only "Sesame Street," but also "The Electric Company" and "3–2–1 CONTACT." CTW approached Busch with the idea of a Muppet-oriented theme park. Three years of research and planning later, Sesame Place opened in Langhorne, Pennsylvania, between Philadelphia and Trenton, New Jersey.

Because it is unique, people have trouble describing Sesame Place. Some simply call it the playground of the future; one enthusiast calls it "a high-intensity participating environment." Whatever its description, the 2.5-acre park has more than 40 "play elements" and activities, and not one is passive. The aim is to stretch children's muscles along with their minds. "Play elements" at the park include Safe Cargo, an array of cargo nets strung four stories above the ground for children to cavort on; Just Clowning Around, a hall of mirrors that gives a first-hand lesson in kaleidoscopes and mirrors; and the Count's Ballroom, where children "swim" through 80,000 plastic balls agitated by a moving foundation.

Just inside the main entrance is the Computer Gallery, a good place for anyone to stretch his or her mind. Inside the two-story, airy gallery are 56 Apple II computers ... though even an Apple employee would have trouble identifying the equipment as Apple's own. There's a reason for that, as the coordinator of the project, Joyce Hakansson, explains.

"The media have given computers horrible press, with movies like 2001: A Space Odyssey, Demon Seed, and others, while the computer community itself has perpetuated the "white-coat" mystique. As a re-



sult, people have become intimidated by the computer. We'd like to change that, and at Sesame Place we've tried to show that computers can be very simple, easy-to-use, rewarding tools that are fun to play with."

Enticing children (and adults) to sit down and use the machines required some careful planning. The computers were packaged in special cabinets that made them look more like arcade games than scientific marvels. Since most children don't know how to type, the designers installed special keyboards with one-inch square letters, numbers, and special symbols, including color identifiers. Originally designed for use by the handicapped, the keyboards have large, colorful keys. The letters are arranged in A–Z order, making them readily useable by children.

The games range in difficulty to suit various age groups. At the easy end, there's "Mup-O-Matic," which prompts children to enter the name of the Muppet character being assembled on the screen. When the child has an answer, he or she pushes a red "Stop" button, then enters the name of the Muppet. If the answer is incorrect, the computer continues assembling the character until it is complete... or until the child interrupts with another guess.

If the answer is correct, the child receives a congratulatory message, and is challenged with another Muppet character to identify. Parents or teachers may have to help preschoolers, who can push the "Stop" button but usually need help keying in their guesses.

Other games invite creativity and ingenuity:

- "Art Beams" lets the user create a six-color video design, then stretch it, squeeze it, or flip it over.
- "Lemonade" puts the child in charge of a refreshment stand, which will prosper or meet financial ruin, depending on the child's decisions.
- "Reflect" lets the player make a rose bud bloom by bouncing a light beam off a "mirror" at various angles.
- "Tune In" invites a child to compose melodies by arranging pre-programmed musical phrases.
- "Layer Cake"—the author's nemesis—is a variation of the Oriental puzzle Towers of Hanoi. The player must move a three-layer cake one layer at a time, from one table to another, using only three tables ... without ever placing a larger layer on a smaller one.

Each Apple II contains 48K bytes of memory. That is sufficient for some games, which are stored locally on the Apple. Other Apples offer two or three games, which can be loaded through a network provided by Nestar Systems, Inc. The Nestar Cluster/One Model A (for Apple, of course) enables up to 65 Apple II computers to share common disk storage. The heart of the Nestar Cluster/One is an Apple, acting as a disk controller.

Games are held in 33 megabytes of "Winchester" technology disk storage. This high-performance disk system can supply games to the individual Apple II computers in seconds. The computer games are programmed in BASIC, with an occasional module written in assembly language.

Project coordinator Joyce Hakansson jumped—or rather flew by airplane—at the chance to do the Sesame Place project. The computer gallery was the brainchild of Chris Cerf, a creative consultant to CTW, and a self-avowed computer games freak. Cerf contacted Joyce because of the work she had done while coordinator of the Computer Education Project for the Lawrence Hall of Science at the University of California at Berkeley. There, she conducted workshops to introduce computer technology to the public, especially children, women, minority groups, business executives, and the elderly. One of her projects was the Apple Van, a travelling workshop equipped with 12 Apple computers.

Unfortunately, the Sesame Place project was developed in mid-town Manhattan, 3,000 miles from Hakansson's home in California. "The solution wasn't an easy one, but it worked. I commuted from California. I thought this project was an excellent chance to do some positive educational work using computers. It has been worth it."

One of the things Joyce learned from the Apple Van project is that some children will take over a computer, restricting access to it by others. Thus, the computers at Sesame Place are coin operated, "more to control access than anything else," says Hakansson. "We give the kids a 'friendly' four minutes, meaning that if the game is anywhere near completion, we can wait."

It was Joyce who settled on Apple equipment for the project. "I kept an open mind about the equipment selection; the installation had to be reliable, or it would result in more bad press for computers. In the end, I chose Apple gear over other equipment for its comprehensive graphics capability, and because of the machine's reliability." She is overjoyed at the reception the gallery and Sesame Place have gotten from local school districts, which daily deliver bus loads of children to the theme park for educational field trips.

The reason for the educator's enthusiasm is apparent from the activity inside the 5,700-square-foot gallery. Children race to the computers and begin figuring out what each game does. Parents are in tow... if for no other reason than to supply tokens, at three for a dollar.

The children's enthusiasm soon pulls the adults in to the games, too. As it turns out, adults can be useful for more than supplying tokens to outstretched hands; they can help children understand how to use and enjoy the games. Adults are encouraged to use the equipment, too. "We were fully aware going into this project that using this equipment would be the first hands-on experience with computers for many parents," says Hakansson.

With the crowds that attend Sesame Place (admission costs $3.95), more computer galleries like the Langhorne prototype are bound to follow. You may just want to check out the Twenty-First Century equivalent of the penny arcade, complete with Bert, Ernie, and Big Bird in full-color graphics. You might even want to take a child along.

A southern California-based freelance writer, Mike Cashman has worked with and written about computers for over 17 years.

A COMPUTER'S PLACE IS IN THE HOME

BY PATTY WINTER

Will the home of the future wake us gently in the morning; clean, press, and lay out the clothing we have chosen; and prepare our favorite breakfast while we shower? Probably not. But it's clear we'll be using computers for more and more domestic chores.

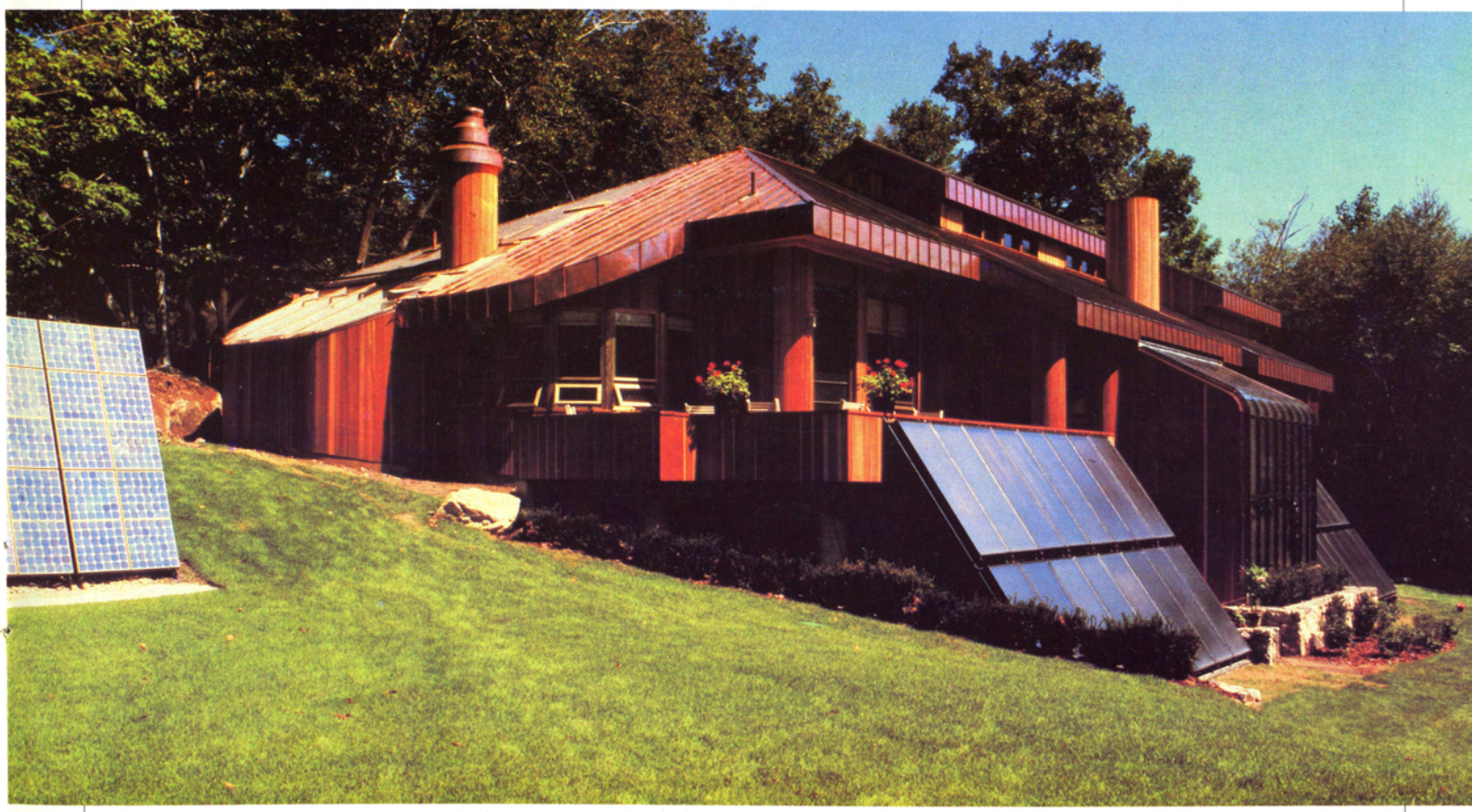
Many of us already take for granted the computerized bank tellers that allow us to do our banking at night and on weekends—a service less than a year old. This will probably be the way computers win their way into our homes, one function at a time, as we learn what they can do, and decide for ourselves which of our needs they can appropriately fill.

A step forward has just been taken in Fairfield County, Connecticut, where the Copper Development Association has built the Sun/Tronic Energy House. An advanced blend of active and passive solar and traditional energy systems has been combined—with the help of two Apple II Plus personal computers—to create a developmental house that shows the potential for computerized homes.

Imagine for a moment that you live in the Sun/Tronic House. What could you call upon the computer system to do?

At nightfall you might want to close the house's electrically-operated shutters for the evening. You could go around to each one—or, you could go to the main computer in the library and have it close all of the shutters and shades at once. (In the morning there will be no need to come downstairs to open them, because the computer is also accessible from a remote keyboard in the master bedroom.)

Meanwhile, since it's early evening and you're starting to use indoor lights, it might be more economical to supply the house's electrical needs for the next few hours from its own resources—stored during the day in batteries charged by a large photovoltaic system. Just ask the computer to check its data banks and access energy availability. If you do want the power source changed, the computer will obediently carry out your instructions. In fact, you could order it to switch systems automatically every night at the same time.



This view of the south, energy-producing side of the Sun/Tronic House shows part of the 150-square-foot photovoltaic array, which provides part of the electrical needs for the home.

This energy-use information will be stored as part of the Copper Development Association's on-going data collection for the Sun/Tronic House. The combination of active and passive solar heating systems, and the photovoltaic back-up electrical system, will be studied thoroughly. Eventually, the computer system will have access to enough data about the house and its inhabitants' energy-use patterns to make decisions about which heating or electrical source should be used at any given time. And it will be able to implement those decisions automatically.

Now let's talk about the other Apple system, in the family room. Would you like to balance your checkbook, see if anyone has left a message for you, or play Space Invaders on a 45-inch TV screen? Go ahead—that's what the computer is there for. Or perhaps you'd like to make sure there are enough steaks in the freezer for Sunday's barbecue. Or write, edit, and print out a business report. Or determine how your budget will be affected if you buy that new car you've been wanting. Or...

The computers of the Sun/Tronic House are at your command, ready to entertain and inform you, to help you with your work or school, to remind you of appointments, to protect your home and run it efficiently. They are there to make your life easier.

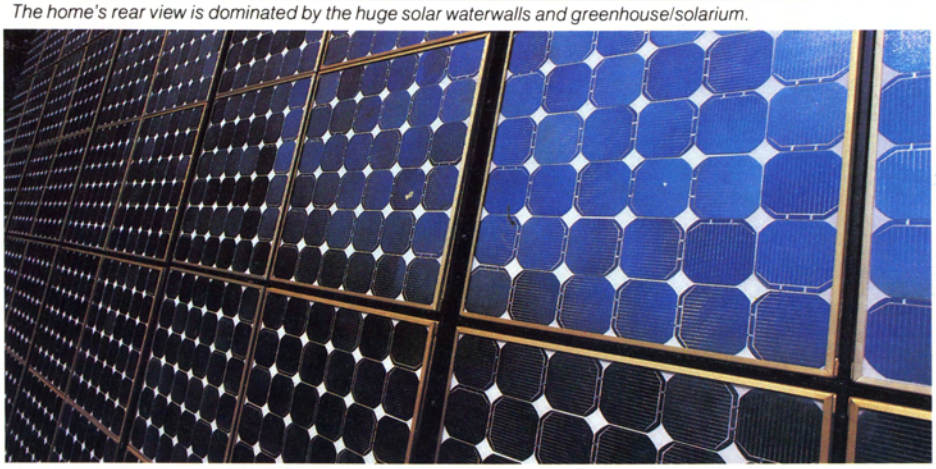
Right now the Sun/Tronic House is unique, but Paul Anderson of the Copper Development Association stresses that it is not an unrealistic type of home for future building. "We wanted to use materials that were readily available. There was no new technology needed—although we are stretching existing technology to its limits."

W.W. Gaertner Research, Inc., of Stamford, Connecticut, provided the system design and software for the Apple II Plus systems, as well as all custom interface hardware. Dr. Wolfgang Gaertner relates that he had originally planned to use a standard minicomputer, "but by the time all the functions that were necessary were planned, it became very expensive, to the point where—between the acquisition cost and the subsequent maintenance costs—we felt it was impractical to do this for a residence. We felt it wouldn't be a viable approach for builders to take in the future.

"Another consideration was that—especially for the alternate uses of the personal computers for entertainment, education, and the office-at-home—there were no software packages readily available for standard minicomputers."

An Apple demonstration at an electronics association meeting convinced Dr. Gaertner that personal computers could do the job. "Since the costs had been mounting and mounting for a minicomputer-based system, when we saw the capabilities of the Apple, we said, 'Well, this really makes more sense.'"

The home's rear view is dominated by the huge solar waterwalls and greenhouse/solarium.



These solar panels satisfy a portion of the house's electrical needs.

Is the Sun/Tronic House a harbinger of the future, or just an interesting novelty? People directly involved in the project, and others doing research in the field, believe that the computer-controlled home will be with us eventually, if not within the next few years.

"People like gadgets—automatic gadgets, programmable appliances," says Dr. Gaertner. "And partially, it's status." But it will take more incentive than fascination or snobbery to fill the country with computer-controlled homes.

Paul Anderson believes that computers will be brought into homes when people realize they can do a lot of things. "There probably isn't any single function that will sell the idea," he says.

The Yankee Group of Cambridge, Massachusetts, is continuously researching this very question. Bob Wells, manager of the Home of the Future Planning Service for Yankee, notes that people have already shown a willingness to adapt to new things that save them time or money. This is especially evident in the booming sales of personal computers to small businesses.

Wells points out that interactive cable television systems are becoming a selling point for builders. Systems that include computer-assisted police, fire, and medical alerts are already proving especially popular. Information systems are also gaining in popularity, and not just for rapid and easy news delivery. One survey shows that current users of timesharing services

Is the Sun/Tronic House a harbinger of the future, or just an interesting novelty? People directly involved in the project, and others doing research in the field, believe that the computer-controlled home will be with us eventually, if not within the next few years.

spend approximately 25 percent of their time on personal telecommunications with electronic mail.

All in all, as Bob Wells points out, "it must be viewed as inevitable that some kind of a computerized command and control system will be a feature of homes that are built from scratch in the future."

Dr. Gaertner is somewhat less optimistic. Noting that "the spread of computers through the building industry will probably be inversely proportional to their cost," he is concerned about what he views as a trend towards high-end personal computer systems aimed at small businesses.

"The price of personal computers will affect their chances of being used in medium-priced residences. The very trend which makes the personal computer successful in the small-business area, tempts manufacturers to come out with more sophisticated and expensive packages which, in turn, put the personal computer out of reach of the hobbyists or the people who would want to offer it as a standard, relatively low-cost 'appliance' for the home."

The trend is clear, though: computers are becoming more and more a part of our lives, and people are rapidly taking the advantages for granted. A small but growing number of white-collar workers are even able to work from their homes, using their personal computers as terminals to access their main office computers. This leads Paul Anderson to speculate that people living in the suburbs of large cities will be the first to appreciate the benefits of the office-at-home, since it will free them from daily commutes.

Acceptance of computers is even more pronounced among children. Many grade schools now have personal computers for their students to use. Roger Ameden, programmer for the Sun/Tronic House, believes that "our children—who are learning programming in the third and fourth grades—will use home computers the way I use a calculator."

So why don't we all have computers in our homes already? The unavailability of sophisticated interfacing hardware hurts. And—as Bob Wells notes—that lack of "tailored, marketable, turnkey software" for the computer-controlled home is a major hindrance to the process of change. More importantly, he feels that most people still don't feel comfortable with computers.

"I think the big concept emerging now is the notion of the friendly user interface—having a combination of software and hardware that people really feel comfortable with, that they can converse with in their own language, rather than in a programming language. I think that's an extremely important factor."

And when Wells refers to "using our own language," he means exactly that.

"It's a fairly limited portion of the population that is attuned to sitting down at an alphanumeric keyboard. So, if you're talking about computers really becoming a mass-market item, I think speech recognition and speech synthesis will be significant factors."

Besides voice synthesis, Wells believes other outputs from the computer need to be more acceptable to people. "I think that, down the road, the development of a good, cheap, in-the-home facsimile device is important, because it's just too big of a shock for people to adjust from reading newspapers to reading CRT's.

"I think for most people, the computer is a transparent factor. What they're after are not computers—they're interested in security systems; they're interested in information delivery; they're interested in games."

As Paul Anderson concludes, "What you're selling is the Good Life, not machines."

Patty Winter is a freelance writer who has written numerous articles for microcomputer and astronomy publications.

INSIDE THE SUN/TRONIC HOUSE

What makes the Sun/Tronic House run? Here's a list of the two Apple II Plus computer systems' components.

The first Apple II Plus includes a Language Card and has 64K of Random Access Memory (RAM). This is the main control computer in the library. It has the following peripherals:

- two RS-232 interfaces: one for the two remote keyboards (in the master bedroom and the kitchen); and another that accepts information from the home's security system, and sends out instructions to the window and door shutters and shades, and to the energy systems;
- an analog input card with 8-channel input (multiplexed to 64 channels), which receives readings from temperature sensors indoors, outdoors, and on the photovoltaic panels;
- a clock-calendar card that provides real-time monitoring of the security systems, and a time/date display for record-keeping;
- a modem used to access the computer from outside the home, and to allow the Apple to communicate with other computers;
- two Apple Disk IIs (one with controller) which provide the operating system software and storage for the main computer;
- an Apple Silentype thermal printer and a letter-quality printer, for hard copy;
- a color television set used as a monitor.

The second Apple II Plus has 48K of RAM. The peripherals used with this computer are:

- an Apple Disk II with controller;
- an RS-232 interface that will be used to control this computer from the remote keyboards;
- a joystick for playing electronic games;
- two color televisions, one of which has a 45-inch screen.

COMPUTERS FOR THE HANDICAPPED

BY SUE LUTTNER

Using technology, people can fly without wings and breathe underwater without gills. Now, using personal computers, people without voices are speaking and people without hands are typing.

Researchers are still writing the programs and redesigning the hardware, but personal computers are already being used to write letters, answer the phone, turn down the radio, and perform dozens of other tasks that can make independent living tedious or impossible for the severely handicapped.

"It's easy to get excited about what is being done," says Gregg Vanderheiden of the Trace Center at the University of Wisconsin-Madison. "But it's important to remember what has yet to be done." Vanderheiden is holding out for a system that takes notes while answering the telephone, runs any piece of standard software, and adapts to the abilities of persons with different physical handicaps.

"There are simply too many different kinds of people with too many different types and degrees of disabilities for us to approach this on a case-by-case basis," he says. "A lot of what exists can be useful... but it's still a long way from where we have to go."

C2E2

Probably the most versatile computer system package yet designed for the handicapped is the C2E2 (Control, Communications, Education, and Entertainment) system developed at the University of Alabama in Birmingham.

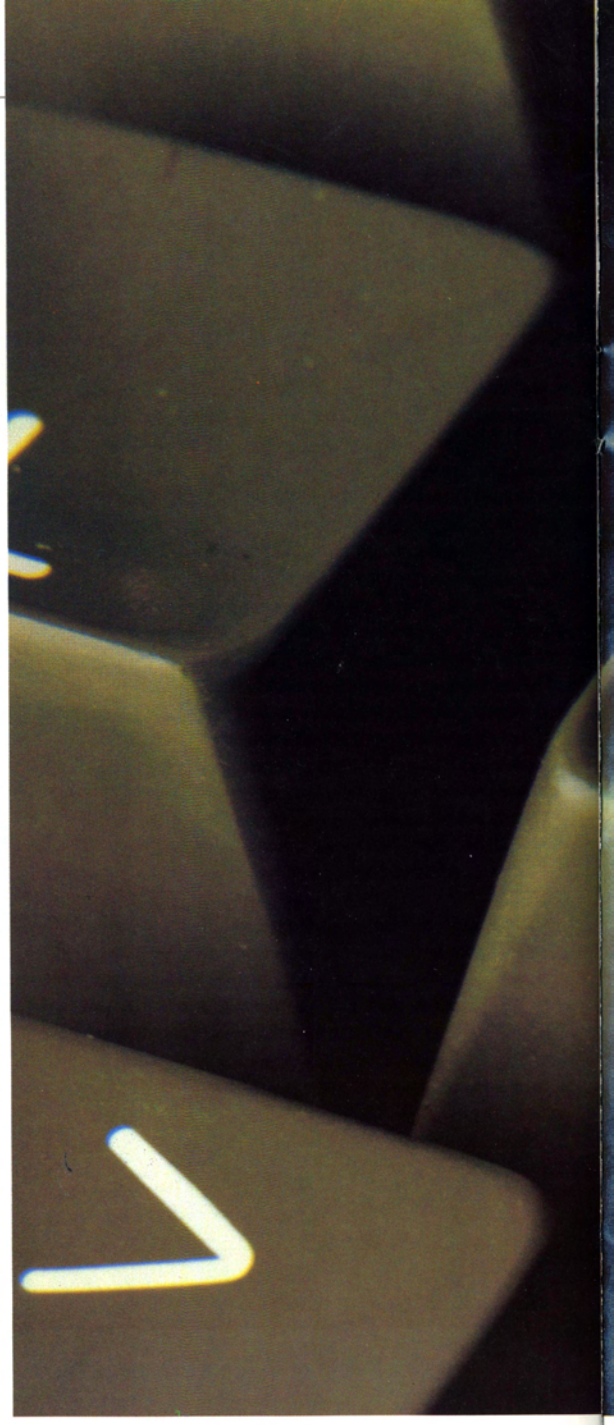
C2E2 was designed to operate on voice commands, but it will also accept switch and joystick input from users with speech difficulties. It can translate motion as slight as the movement of one little finger into control over electrical appliances, computer programs, a telephone, and even a music synthesizer. C2E2 can be used by a person with any of several disabilities to operate almost any appliance that runs on 110-volt AC power.

"You really couldn't achieve the versatility that this system allows without a programmable computer," says C2E2's designer, Jim Rogers. This versatility makes C2E2 economically feasible by minimizing expensive custom modifications.

The C2E2 system includes an Apple II with two Disk II drives, two CRT monitors, a Heuristics Inc. speech interface, and a printer. The only custom hardware is a simple "black box," which connects the Apple system to the user's telephone and appliances. Rogers is confident the box is "simple enough to be built by a person having a minimal electronics background."

Dr. Russ Fine, director of the research at the University, said "We wanted an alternative to custom-made environmental control units, which are inordinately expensive to build and often impossible to have repaired."

Fine expects C2E2 to make certain aspects of independent living much easier for the severely disabled. "If you have this equipment, you don't require a separate communication system. You don't have to rig up special controls for your television and lights and locks. You don't have to find someone to type your letters. We've got an operational system that addresses some very basic requirements of persons with severe physical limitations."



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ALPHA MENU

Bill James of San Antonio, Texas, has developed an Apple-based communication system he calls Alpha Menu. His program displays letters, numbers, and punctuation marks in a matrix on a video screen. Using any of several different input devices, the user chooses characters one at a time, to build a message at the top of the screen.

The computer will accept many different inputs, making Alpha Menu accessible to those quadriplegics who are unable to operate word wheels. Because the inputs are easy to control, the system assembles messages faster than any mechanical device. And because the monitor displays several lines of text at a time, it can be used to carry on complex conversations. The listener does not have to remember a long sequence of letters and words, and does not have to pay attention to the often slow generation of the message.

James has designed Alpha Menu to be compatible with a wide range of input devices, including a light pen, a skate controller, and several different switches. The light pen is a slim, lightweight pointer which mounts on a head or mouth stick. When the user touches the pen to a letter on the screen, the computer adds that letter to the message.

The skate controller is a free-moving "bug" that can be either held or strapped to the user's arm. As the skate moves across a board or table, a cursor on the screen moves across the character matrix.

Other devices can be a button, a lever, a "puff and suck" straw, or any other switch the user can operate. In this variation of Alpha Menu, a cursor on the screen scans first the rows and then the columns, waiting for a switch signal from the user. The program automatically adjusts its scanning rate to the user's response time.

James wrote the Alpha Menu programs to run on an unmodified Apple II Plus, with standard Disk II drive and monitor. The various input devices plug into the Apple's game paddle sockets. Alpha Menu can produce hard copy if its computer is hooked up to a printer.

After giving only a few demonstrations at schools and clinics, James has already been deluged with requests for information, advice, and software. He is struggling to keep up with the demand, while still working to improve his programs and explore other rehabilitation applications.

"I've come up with so many different applications using the Apple computer that I can't keep up with them all," he says. "I have a lot of work to do."

PLAYMATES AND PERSONAL COMPUTERS

Although neither of them had any computer experience until two years ago, Hal and Mary Ann Glicksman are pioneers in the field of personal computers for the physically handicapped.

In 1978, the Glicksmans bought an Apple II system for their son, John Duganne, who has cerebral palsy and a severe communication handicap. At the time, they could find no software, no counselors, and no state funding to support their idea.

So, Hal sat down with a manual and taught himself to program. He wrote new games and altered commercial games so John could run them with a joystick and minimal typing.

"Our problem as parents was to find ways to communicate with John, to educate him and to create stimulating play situations that he could succeed in without frustration. We were familiar with various communication boards and mechanical devices, but all these were single-system devices. For a lower cost, we found we could buy a personal computer that would have numerous applications, and could provide varying, built-in rewards," the Glicksmans recall.

Using Hal's programs, John quickly began improving his skills with letters, numbers, and colors. Until then, the Glicksmans had feared that John had perceptual problems because of his reluctance to respond to color and number games. "When children are really young and have physical disabilities, it's very hard to assess their mental development," explains Mary Ann. "What John needed was a way to control things so he could demonstrate his abilities."

Two years later, John's favorite activity is still using the computer. He uses it to interact socially with his able-bodied playmates and to augment his school work.

"He has kids over here all the time now," Mary Ann says. "They go fishing down at the pier, and they've come up with all sorts of other things he can do with them. But they would never have gotten to know him without the computer."

Hal has translated some of John's school work into programs that John can run, but he is a long way from his goal: software that is easy enough to alter that John's teachers can put lesson plans onto the diskettes.

"We've been begging and borrowing programs wherever we can get them," says Mary Ann. "We are anxious to obtain more help with programming or to have a clearing house for the exchange of programs."

Now that experienced programmers and rehabilitation researchers have caught up with the Glicksmans, this help is on the way. The accompanying article outlines some of the programs that have already been written and some of the goals that researchers are aiming for.

John Duganne and friend.

HANDITERM

John Giem has developed a communication program for his son Chris, who has cerebral palsy. Giem's original design used a joystick to control a cursor on the screen, picking out letters one at a time from a matrix.

"That worked out great for Chris in the training stages," says John. "But it pretty quickly got to the point where his capabilities required more speed." Chris is now using an oversized, 10-key board which he can operate with elbow or balled fist. He can add one character to the message with two key punches, one for the row number and one for the column number of the character.

"He can whip things out in nothing flat now," says Chris's mother, Linda.

Like the other communication systems that use matrix displays, Giem's Handiterm program can display only a few lines of text. That's adequate for 10-year-old Chris, who never needs to write more than one sentence at a time. But as he gets older his needs will expand, and Giem wants to have a system that can keep up.

"By the time he starts writing paragraphs in school, I'm going to have to have a text editing system ready for him," Giem says. He plans to replace the matrix display with a reference card which sits next to the monitor, freeing up most of the screen for text.

MICROCOMMUNICATOR

Grant Grover's Microcommunicator programs were designed for rapid communication. The "Make A Sentence" program displays an entire sentence at a time, in response to just a few key strokes. The program calls up "nested" or interlocking menus, with the most urgent messages—"I'm in pain. Call the doctor."—in the most accessible locations.

The "Make A Message" program allows the user to build sentences one word at a time, using only two or three keystrokes for each word.

Grover spent months studying speech patterns, trying to determine which words to include on the disk and how to organize them. He finally settled on 50 words for each letter of the alphabet. He put the 10 most frequently used words at the beginning of each list, and arranged the remaining 40 alphabetically.

When the user types in one letter, the computer starts listing words starting with that letter. One or two keystrokes will then add the desired word to the message. The program also includes lists of specialized words, such as foods and first names, and a blank menu for the user's additions.

COMPUTER SPEECH

Jay Hewitt at the University of Missouri

has come up with an Apple-based communication system that actually speaks out loud. With this equipment, a person with speech difficulties can say up to 20 words at a time, drawing on a stored vocabulary of 5,000 words.

To make the program accessible to people with little motor control, Hewitt has arranged the word lists in nested menus. Typing two letters into the computer brings up a list of all the words in the system starting with those letters. The user then needs to type only the number of the desired word. This minimizes the required typing and allows children to use words they can recognize but can't spell.

The program will accept switch or joystick control, but works more slowly with them. Hewitt encourages his clients to use the keyboard directly if they can. A "key guard," a plastic frame with finger holes over the keys, gives many people the control they need to hit only one key at a time.

Hewitt's system uses an Apple II or Apple II Plus with monitor. But instead of the standard floppy disks and disk drives, it requires a Corvus hard disk and drive. This accessory costs about three times as much as the computer itself, and makes the system more economically feasible for institutions where many people can use it.

GAMES

Computer games for people with physical impairments can be much more than mere entertainment. Bill James, designer of the Alpha Menu, feels that the quality of the software he provides is probably more important than the elegance of the hardware.

"Functional as a given combination computer and apparatus may be, if it is not fun for the user, it will not be used," says James. "Programs with seemingly no utility whatsoever may be vastly more rehabilitative than the most ingenious utilitarian programs."

Applying his own philosophy, James has come up with a series of computer games which can be easily modified to run at various levels of difficulty. Children or newly disabled adults can play with these programs until they have mastered the use of a joystick, switch, or other input device. Once they can play the games, they are ready for the hard work of using the computer for communication and environmental control.

Judy McDonald, a communication disorders specialist in Seattle, Washington, has reached the same conclusion in her work at the Maplewood Handicapped Children's Center.

"You and I prepared for talking by babbling," she explains. "These kids need a chance to play with the movements they have, before being asked to use them in the very specific and demanding task of communicating."

Maplewood's programmer, Paul Schwejda, has developed a series of motor training games guaranteed to be fun for children with or without physical handicaps. At Maplewood, these games have the double job of training the children to use the computers and of allowing the therapists to assess the most natural movements available to each child.

McDonald emphasizes this assessment process. "The tricky thing about providing a child with a communication device is that you have to find the most appropriate motor movement the child can use. This is of concern for two reasons. First, you don't want the child to be frustrated because the movement is too difficult or too inefficient; and second, the extended use of an abnormal reflex pattern may actually lead to physical deformity."

At Maplewood, physical and occupational therapists are an integral part of the assessment process, to make sure that the movement reflected is the optimal one for the individual child. Once the children have demonstrated motor control with games, they begin using specialized programs in communication and academics, also designed in the Maplewood project.

Another challenge to providing a child with a communication device is finding the most flexible system that the child can understand and use. At the age of five, an average child has a working vocabulary of about 5,000 words, well beyond the limits of any mechanical devices a five-year-old can operate. And communication systems adequate for a five-year-old will be too limited—and probably too small—for an eight-year-old.

"It's hard to convince an insurance company that the device they paid for three years ago is no longer doing the job," points out Chris Thompson at the Trace Center for the Severely Communicatively Handicapped. "After all the years we've had to use specialized equipment that has to be replaced periodically, we are very pleased to see the microcomputer come along." Thompson says she sees the Apple as very useful as an assessment and training tool for children, whose communication needs change almost daily.

Thompson is working with Gregg Vanderheiden, who envisions some basic improvements in technology which he thinks could revolutionize efforts in this area.

Vanderheiden explains his goals with one of his many metaphors. "We've built the equivalent of go-carts for these kids now. A go-cart is mobility, and it's a big improvement over nothing. But—at least here in Wisconsin—nine months out of the year a go-cart doesn't do you much good. What we have to do is get these kids into cars if we expect them to move with the rest of us."

Vanderheiden says that two improvements are imperative before personal computer systems for the handicapped can begin to fulfill their potential: the systems must be able to run standard software unmodified, and they must be able to perform many functions at once.

All of the communication programs now available translate specialized user input into standard characters which the computer can process. By including a translation system in the software, a handicapped person can program an Apple to keep the accounts, play games, write novels, or anything else. But since the computer can run only one program at a time, a user without keyboard ability cannot run standard, off-the-shelf software.

"If you have to write custom programs for each application, you're going to be very limited, because it takes a lot of time to write good software," Vanderheiden points out. The Trace Center is now compiling a registry of programs for the handicapped. For more information, write to Trace Research and Development Center, University of Wisconsin, 314 Waisman Center, Madison, WI 53706.

Existing systems are also limited by their inability to perform more than one function at a time. "What if you're sitting there writing a letter, and the phone rings?" Vanderheiden asks.

"If we're going to make any real impact on people's lives, we're absolutely going to have to solve these problems," insists Vanderheiden. "We can't afford to stop and solve them for any one client, but once we find the solutions it will make things considerably easier and cheaper for everybody."

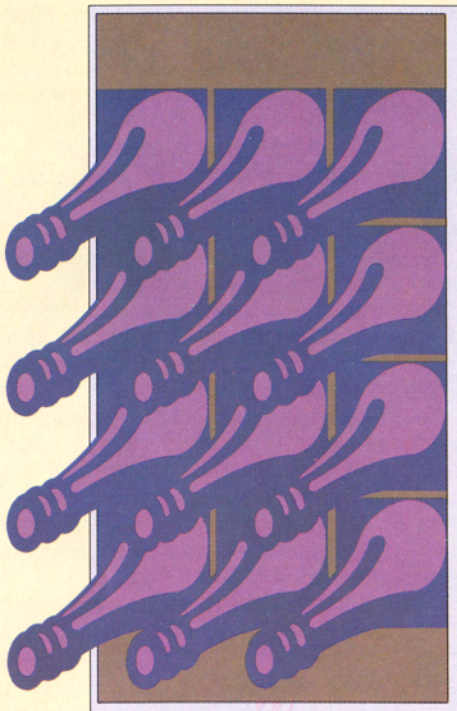
Sue Luttner writes on the staff of Apple's Editorial Services department.

NEW RESOURCE GUIDE

Apple Computer has compiled a resource guide on personal computer applications for the handicapped. The booklet summarizes the work that has been done and describes continuing projects. It includes both a bibliography and a list of people and institutions willing to give advice.

For a free copy of *Personal Computers for the Physically Disabled: A Resource Guide*, write to Resource Guide, Marketing Services Dept., Apple Computer, Inc., 10260 Bandley Drive, Cupertino, CA 95014.

apples on: WINE



We heard it through the grapevine: Steven J. Stadler, senior vice president of GenRad in Concord, Massachusetts, is a wine connoisseur who has transformed his Apple into a personal wine steward.

He bought the computer about a year ago, using it at first to develop business plans, then for basic household applications, including maintaining an address list and balancing the family checkbook.

Now, no matter what the occasion—birthdays, wedding anniversaries, Chateaubriand for two—Stadler can consult the computer and make an appropriate selection from his sizable (250-bottle) wine collection.

Stadler's system uses a 48K Apple II, a black and white monitor, two Apple Disk II drives, and a data base management system. He lists wines by region and vineyard, then ranks them according to dryness, year, and oenophile Hugh Johnson's ratings. (Johnson publishes an annual guide that catalogs wines by vineyard and country, indicating good or bad years for each wine.) A Centronics 779 Printer allows Stadler to print out updated lists. The system is extremely useful to Stadler and his wife, both gourmet cooks.

For instance, they might be preparing scallops of veal with sauce Bearnaise, and want to serve the finest Pinot Blanc in the house. By stipulating "Pinot Blanc" and "Johnson" parameters, Stadler can have the program sort through the data base and display his inventory of Pinot Blancs, each rated from one to four, according to Hugh Johnson's standards. (Four is the best.)

"I suppose I could accomplish all this with file cards," says Stadler, "but with the computer I avoid all that disarray. It's much, much easier to keep the list current this way.

"Plus, it's a hell of a lot more fun!"

B E E S

If bees ran the world, everything would be on time.

Bees are amazingly punctual. They learn what time of day different flower species produce nectar, then time their rounds to hit each flower at its peak. "They are rarely more than 15 minutes early, and they are never late," attests James Gould, professor of biology at Princeton University.

Gould is using an Apple II-based system to figure out how they do it.

Since bees can maintain their strict schedules without any light cues, Gould has hypothesized that they tell time by monitoring the daily fluctuations of the earth's magnetic field. To test his theory, he surrounded a hive with an electrically generated field, and left laboratory lights on 24 hours a day to eliminate primary time cues. Gould's equipment simulates the magnetic day (from data stored on an Apple disk), slowly expanding or contracting the length of the cycle.

In order to maintain an accurate field around the hive, the Apple acts as a digital control loop, regularly measuring and compensating for external fields. "The Apple's ability to calculate the loop transfer equations is a critical issue," says William Hostetler of Interface Corporation, Princeton, New Jersey, who designed Gould's system. "Whenever the Apple sees an external field produced by a solar storm or an electrical circuit in the building, it adds a new component to its calculations, introducing an orderly correction."

"You also have to be very quick about it," adds Gould. "The total change in the earth's field is about one percent over the course of a day, but you get a much bigger change than that every time a truck drives by. The important thing is to minimize transience." The Apple updates the strength of the experimental field only once a minute, but it adjusts the generating coils every second.

When Gould started planning this series of experiments, his big concern was how to move the minicomputer he was using, first into the bee lab and then outdoors for studies of other animals. He asked Hostetler to help him solve the problems of portability, power supply, and magnetic field interaction.

"It quickly became clear that he would have to spend about ten thousand dollars moving this thing around, hooking up a generator for it, and adding an analog-to-digital subsystem," Hostetler says. "The generator alone would have cost more than the whole system we put together with the Apple. Now he has a computer he can carry under one arm and operate from a car battery."

The system uses a 48K Apple II with two Disk II drives, a monitor, a clock card, and a custom interface card. A low-field fluxgate magnetometer measures a small band of direction and intensity values around the hive, feeding this information to the computer through a 12-bit, analog-to-digital converter on the custom card.

The Apple controls three pairs of four-foot Helmholtz coils through the card's 17-bit, digital-to-analog channels. By controlling each coil separately, the computer can compensate for fluctuations in the direction as well as the strength of the experimental field.

When the bee experiments are finished, Gould plans to test the effects of magnetic fields on birds that navigate by the angle of the sun. He will surround the cages with an electrically generated field, then drive to a remote spot where he can release the birds and observe their flight. Gould expects the computer to maintain the prescribed field, even during the drive.

Because the truck will be passing quickly through outside magnetic fields, Hostetler plans to increase the number of field adjustments to 10 per second. He will also mount the cages and coils on a lazy Susan and program the computer to keep the orientation constant. When the truck turns left, the equipment will rotate right.

"This would be a nightmare with a larger computer," he says. "But we can just put the Apple in the cab of the truck, and it can control everything from there."

APPLES ON CHICKENS

When a lightning storm hits in the middle of the night, Stephen Herbruck, manager of the Herbruck Poultry Ranch, stays in bed. There was a time when he would get up to inspect the ranch's seven henhouses, then wait out the storm to make sure there was no power loss.

But now, with an Apple-based, "Natural Language-Systems On-Line Animal Housing" (NOAH) system monitoring his 500,000 chickens, Herbruck knows the computer will wake him up if anything out in the henhouse needs his attention. In fact, he knows the system will alert him any time something goes wrong.

The remote terminal in Herbruck's home takes a lot of worry out of managing the ranch. "It's an important function, because if we lost power in one of the buildings and didn't know about it, we could lose the whole flock in a few hours," he says. Last summer an electrician's error caused a ventilation system to shut down in the middle of the night. Without the warning system, Herbruck says, "We would have gone out there the next morning and found 200,000 asphyxiated hens."

Donald Black of Natural Language Systems in Kalamazoo wrote the programs for the NOAH system to Steve Herbruck's specifications. "It gives the Herbrucks a real handle on what's going on in the chicken coop," Black says. "They get a lot more information than typical poultry ranchers would have."

"It sits there 24 hours a day and tells me if the conditions we've set for production are being met," Herbruck says with satisfaction.

The system controls and regulates the henhouses, turning lights on and off and activating and deactivating the feeding lines. It automatically produces hourly reports on food and water consumption, and it can provide print-outs for every 10-minute interval.

"The advantage is that we can do our business through a terminal," Herbruck says. "I can tell instantly what's going on in each building, without taking several hours to inspect the equipment and animals."

The NOAH system not only makes day-to-day care of the chickens more reliable; it also gives Steve Herbruck an accurate accounting of costs and laying rates for each henhouse. "A normal operation doing this by hand would require at least one secretary working full-time, and then you wouldn't get the information as quickly," he says.

Because NOAH provides complete and timely reports, Herbruck can apply some sophisticated management techniques that would be infeasible without the computer. For example, Herbruck recalls, "Before the monitoring system was installed, a person would climb to the top of the bin at the end of the week and estimate that he had used two shipments of feed." There was no accurate measure of how much protein each bird was consuming. But with the hour-by-hour accounting generated automatically by the NOAH system, Herbruck can actually adjust his feed mix to provide a perfect balance of amino acids.

"A bird needs so many units of protein per day," he explains, "but it's going to eat different amounts, depending on a number of things. If it's eating just to stay warm, and I have a high-protein feed in there, then I'm wasting feed—and money."

Now that the NOAH system is working smoothly on their own ranch, the Herbrucks are offering a similar package to other ranchers through a company called Poultry Management Systems, in Saranac, Michigan.

NOAH's designer, Donald Black, says he often uses Apple computers in systems for users like the Herbrucks. Black's partner, Preston Britner, estimates that in the past two years Natural Language Systems has installed 20 Apple computers in as many different applications.

For the NOAH system, Britner designed a custom, uninterruptible power supply and some hardware to interface the Apple II Plus to a data-gathering remote board, a printer, and the remote terminal in Herbruck's home. "The custom hardware is very simple," Black says. "Much of what used to be handled by hardware was instead implemented in software."

The NOAH system is designed to be used by people with no computer experience. "The system cannot rely on any computer sophistication on the part of the user," Black explains. "It has to work by itself, and it has to communicate in the user's language, not computer language." It also has to run unattended 24 hours a day.

Black says the final version of the system has performed "admirably" during its first year of full-time operation. "The Apple II has proved to be a very reliable computer system, with sufficient capabilities for producing a commercial quality solution for a management problem."

APPLES ON BUTTERFLIES

Using an Apple II Plus and years of accumulated data, University of California entomologist Richard A. Arnold is studying strategies to save the rare El Segundo Blue butterfly from extinction.

The largest surviving colony of El Segundo Blues lives on the sand dunes at the end of the Los Angeles International Airport runways, apparently undisturbed by the roaring jets overhead. Once the butterflies ranged over 36 square kilometers of dune land, sipping nectar from wild buckwheat flowers and laying their eggs on the petals. Now they are restricted to this 304-acre remnant of the dune system—what Arnold calls "a habitat island, surrounded by a sea of urbanization."

In 1976, the El Segundo Blues and five other species of California butterflies were the first insects to be named to the U.S. Fish and Wildlife Service's endangered species list.

"Virtually nothing was known about the biologies and ecologies of these species at the time of their listing," Arnold says. "I devised a plan of field and laboratory research to assemble a data base on each."

Arnold searched out eggs, counted pupae, and observed predators. Armed with a net and a felt-tip pen, he captured, marked, released, and recaptured adult butterflies. He recorded every kind of information he could glean from the insects and their environment.

Four years, 8,000 specimens, and a mountain of raw data later, Arnold used his Apple II Plus and a single disk drive to prepare population profiles, and to calculate the dispersal, life-span, and mortality rate of each endangered species. Now he is running computer simulations to figure out what kind of preserves will save them.

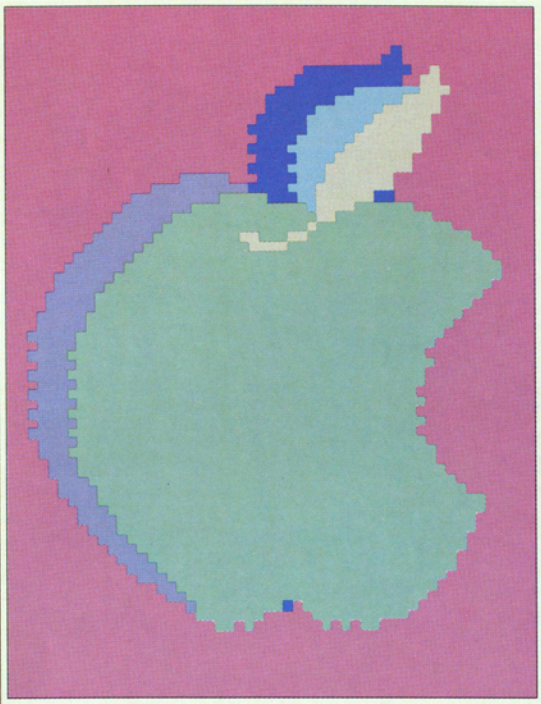
Arnold has written a number of life cycle simulation programs that allow him to study the effects of possible changes in the butterflies' environments. He can alter conditions, such as the size of the habitat or the number of predators. He can see what will happen if a drought cuts the supply of buckwheat in half—or if a troop of collectors comes through with butterfly nets.

"Short of going out and actually collecting the individual butterflies—which might destroy the population—this is the best way to examine the effects," he says.

Arnold expects more insects to start showing up on the endangered species lists. "Butterflies are a very well-known and popular group of insects. They ended up being the first insects on the list because people are more aware of them," he explains. "But what we're really talking about here is endangered habitats."

Arnold's analyses have shown that, because they depend on a specific array of plants, butterflies are a valuable clue to disappearing habitats. An isolated patch of San Bruno Mountain on the San Francisco Peninsula, for example, supports one species of endangered snake, seven species of endangered plants, and two species of endangered butterflies.

"One of the greatest values of what I've done is that eventually it can serve as a model for conducting studies on other endangered species," Arnold says. "Although I worked with butterflies, my methods and computer programs may easily be adapted to the study of birds, fish, mammals, or plants."



With enrollment in college computer graphics courses rising, many schools need computer graphics terminals, but can't afford them because they cost around $5,000 each.

Apples have emerged as a cost-effective remedy.

Until recently, the University of Michigan's Computer Information and Control Engineering Program was teaching computer graphics on four Tektronix terminals hooked up to the university's mainframe. Faced with too many computer graphics students and too few terminals, Professor Richard L. Phillips began investigating the personal computer as a display device.

"I teach a course in 'highly interactive' computer graphics, in which a student will spend between 30 and 40 hours at a terminal for each problem," Phillips said. "With a class size of 50 students, the demand for terminal access is feverish.

"The Apple II was selected for our purposes because it is the only personal computer we've found that provides reasonably high graphics resolution and true graphics capability."

Equipped with a nucleus of 12 Apple II's, Phillips and his department have assembled a computer graphics laboratory. A program called TEKSIM, written by Phillips, allows the Apple II's to emulate Tektronix terminals. "TEKSIM lets us use all of our Tektronix-dependent software, unchanged. Programs that talk to Tektronix terminals now produce similar displays on our Apples."

Phillips is confident the cluster concept will catch on elsewhere. "It represents considerable capability for a modest investment," he said. "A cost-comparison I conducted revealed that each student in the lab could have complete computer graphics capability—an Apple, a plotter, graphics tablet, and TEKSIM—for around $4700.

"It would cost over $12,000 to equip each station with a Tektronix terminal, tablet, and plotter," he noted.

The laboratory is also being used to teach non-graphics courses, such as Basic Computing. "One big advantage of the Apples is that they can be used both in a stand-alone mode and with the host computer."

While the Apple II cannot produce the outstanding image quality offered by Tektronix' 1024 or 4096 lines of resolution (at best, TEKSIM produces 280 x 192), Phillips considers it more than adequate for teaching purposes.

"When extremely high-quality graphics are required, we still use our Tektronix terminals," he indicated. "On the other hand, the Apple II has six colors, all of which can be accessed through TEKSIM with slightly enhanced host software. This gives us features not available on our Tektronix terminals, which have no color capability. It's a real plus for our graphics applications."

All 12 Apples are equipped with TEKSIM, and connected to an Amdahl computer through a special remote data concentrator (RDC). Each microcomputer communicates with the Amdahl at 9600 baud, and has its own floppy disk for local file storage.

The laboratory also includes a 10-megabyte hard disk system. All Apples in the cluster can communicate through the RDC with a special "disk mother" Apple for rapid file transfer.

COMPLOT, a specially modified electrostatic copier from Houston Instrument, provides the Apples with hard copy capability. Each Apple has direct, queued access to the copier through remote switching.

The cluster's graphics capabilities have grown beyond Tektronix emulation. The addition of two Apple graphics tablets, for example, has made high-precision graphical input possible. Selective erase, and improved color manipulation for computer-aided design applications are also being achieved using the Apples' local processing power. Features Phillips foresees using in the near future include dynamic graphics, local zoom and pan, graphics scrolling, and light pen input.

APPLES ON

F I R E F I G H T I N G

An Apple II-based dispatch system is helping Texas Fire Departments save lives and property, cutting response time to alarms by up to 67 percent.

"It used to take an average of a minute to a minute and a half to send engines to the scene of a fire," according to William D. Michael, Bedford volunteer fireman, systems analyst, and developer of the computerized dispatch system. "Now that the fire department uses the Apple II, average response time is down by 30 seconds. When it's a life or death situation, 30 seconds can make a huge difference."

Michael believes his computerized dispatch system (which took two-and-a-half years to develop) is the first ever devised for a small city. Bedford, a suburb sandwiched between Dallas and Ft. Worth, has a population of approximately 30,000 people, and one fire station. Most big cities, he says, rely on larger minicomputers to handle their dispatch loads. Dallas, with 52 fire stations, uses an ITEL mini. But Ft. Worth, with 24 stations, is currently considering buying his Apple-based package, according to Michael.

"I've worked with other small computers, but the Apple's the only one with a low price that functions reliably," he claims.

The system, which can be run by anyone with a minimum of training, consists of a 48K Apple II Plus, hard disk drive, color monitor, modem, clock, and printer. Fire reports, previously prepared by hand, can now be generated in a minute and a half.

The kinds of information dispatchers are typically concerned with—addresses, cross streets, hydrant locations, type of fire (residential, commercial, car, grass, etc.), number of engines to send—must be processed as quickly as possible.

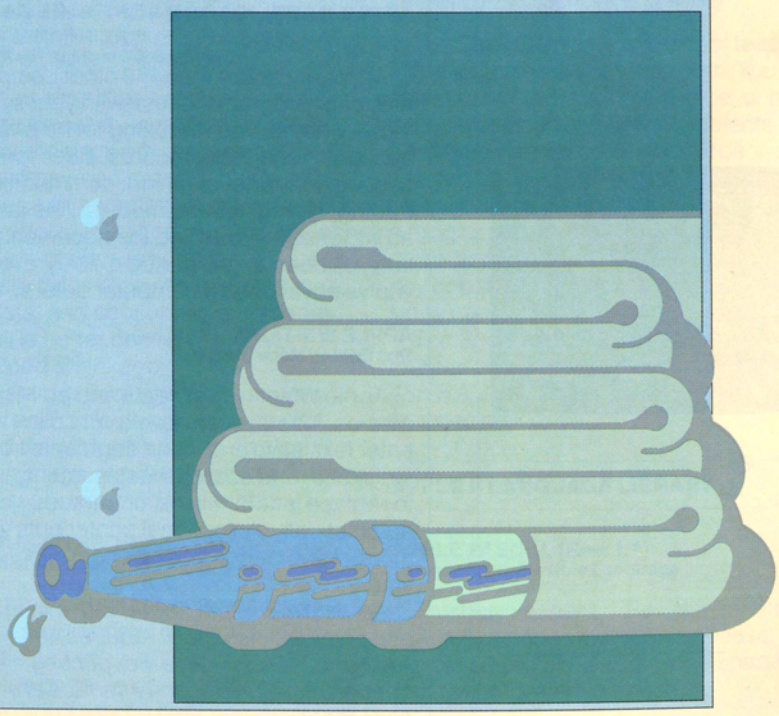
In many small fire departments, the police dispatcher fields all fire calls. When an alarm comes in, he races through a 3-ring notebook and 3 x 5 card file, consults a city map, and then alerts the necessary engines.

Using Michael's menu-driven software system, dispatchers can simply enter a street address, and details about which units to send quickly appear on the screen. Then, with a single keystroke, a high-resolution map of any section of the city can be loaded and displayed, revealing hydrant locations, as well as hazards of importance to responding units.

"If the hydrant nearest to the fire is buried in the bushes at the corner of, say, Central and Airport Freeway, we can make sure the trucks won't pass it by," Michael points out.

The program includes business phone and firefighter radio number directories, as well as a "hazardous chemical" file that lists businesses and the dangerous substances stored on their premises.

"In the old days, it might take minutes after trucks arrived for the dispatcher to discover there was an inflammable chemical problem at the scene of the fire," says Michael. "Now they're prepared for the situation by the time they get there."

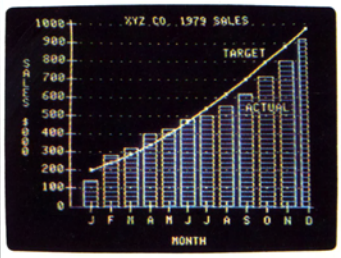


APPLE AT A GLANCE

A Summary of Apple Products

The following is a mini-catalog of Apple products. For more detailed product information and specifications, visit your local Apple dealer and ask for the latest copy of Apple In Depth, a complete reference guide to Apple products.

NOTE: All software products with a "16-sector" symbol require 16-sector PROMs supplied with currently available Disk II controllers, with the DOS Update Kit, and with the Language Card. All 13-sector diskettes (which work under Apple's older 3.2.1 version of DOS) will also run in any 16-sector environment, once you've booted the system with a BASICs diskette provided with the DOS Update Kit, with any Disk II and controller package, and with the Apple Language System package.



APPLE II PLUS PERSONAL COMPUTER SYSTEMS

The Apple II Plus is a powerful problem-solving tool that can increase your business or professional productivity, extend your scientific/industrial modeling and planning capabilities, or make learning more exciting and teaching more effective. The Apple II Plus's eight accessory slots let the system grow with your needs. Its high resolution graphics, color, sound, and other features give you maximum flexibility in programming and use. And its 48K bytes (64K with the Apple Language System or Language Card) of internal memory capacity allows you to perform a wide range of sophisticated tasks, from text editing to data processing. Includes Apple soft BASIC language in firmware.

APPLE II APPLICATION SOFTWARE BANK

Apple and more than 170 other companies offer programs for use with your system—whether you're looking for help with accounts receivable records, sales forecasting or budget planning, commodities trading, or engineering models. And just as important—you'll find the documentation you need to get started quickly, even if you've never used a computer before.

APPLE WRITER™
Text Editing Made Simple

Apple Writer helps create and edit memos, letters, even novels. You can enter text, save and insert segments from a diskette, and search the documents to replace letters, words, or phrases automatically. An optional printer puts your thoughts on paper, letter-perfect every time.

Apple Writer is packaged with a manual and program diskette. It requires 48K RAM and one disk drive. For printing documents, a printer and interface are necessary.

APPLE PLOT™
"Charting" the Way

Apple Plot helps you turn any information (from sales and stock activities to caloric intake and miles per gallon), into dramatic, comprehensive bar, line, or scatter charts. You can update and change information as needed, and label the charts exactly as you wish. Add a printer, and you can put your graphs on paper for presentations or later analysis.

Apple Plot is packaged with a manual and program diskette. It requires 48K RAM, Applesoft BASIC language, and one disk drive. For printing charts, a printer and interface are required.

TAX PLANNER™
The Personal Financial Planning Tool

Tax Planner lets you construct various income scenarios and compare the Federal income tax impact of each. The program reveals the importance of different income-affecting decisions, performing computations for you instantly.

Tax Planner requires 48K RAM and one disk drive. A printer and interface are necessary to print documents.

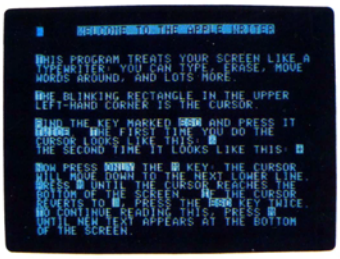
DOW JONES NEWS AND QUOTES REPORTER
Selected Business News at the Touch of a Key

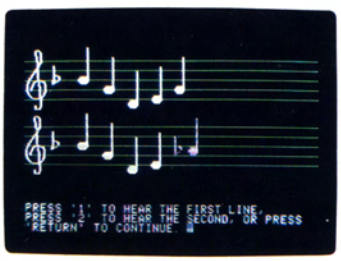
The Dow Jones News and Quotes Reporter puts the latest stock information at your fingertips—including all the past three months of published and unpublished stories filed with the Dow Jones News Service, The Wall Street Journal, and Barron's, plus quotations for more than 6000 securities on the major exchanges.

Requires 48K RAM, one disk drive, modem, and interface.

DOW JONES SERIES PORTFOLIO EVALUATOR
The Stockmarket at Your Fingertips

Get the most from your stock investments. Use Portfolio Evaluator to maintain up to 50 stock portfolios per diskette, analyzing each for short and long term gains





and losses, and current values.

The Portfolio Evaluator package includes a manual, program diskette, and Dow Jones News/Retrieval Directory. It requires 32K RAM, the Applesoft BASIC language, and one disk drive. For printing portfolios, a printer and interface are required.

APPLE POST™
Mailing List Maintenance the Apple Way

Apple Post helps you create and use mailing lists of up to 500 names and addresses per diskette. It allows for easy entry and editing, and can print customer lists or actual labels by name or ZIP code. Apple Post even lets you locate names and phone numbers quickly, and uses a unique "phonetic search" feature when correct spelling is not known.

Apple Post includes a manual and program diskette. It requires 48K RAM, 2 to 6 disk drives, and the Applesoft BASIC language. A printer and interface are necessary to print lists and labels.

THE CONTROLLER™
Small Business Management and Accounting

The Controller is a comprehensive accounting system that lets business managers maintain general ledger, accounts receivable, and accounts payable simply and automatically. This new 1.1 Revision of The Controller provides improved access to data, error-free computation, centralized record-keeping, and letter-quality printer output. It comes packaged in an attractive, 3-ring binder with manual and diskettes.

The Controller requires 48K RAM, dual disk drives, a printer and interface, and the Applesoft BASIC language.

THE APPLE CASHIER™
A New Concept in Store Management

The Cashier simplifies a retailer's job by monitoring inventory levels and creating sales documents. It processes back orders, down payments, and refunds, and can manage an inventory of more than 800 stock numbers. Transaction and customer account information is automatically used to generate sales receipts, billing records, mailing lists, and accounting summaries. The result is better control of inventory, and reduced shrinkage.

The system is packaged in a binder with a manual and diskettes. It requires 48K RAM, two disk drives, and the Applesoft BASIC language. A printer and interface are necessary to print documents.

APPLE MUSIC THEORY™
The Sound of Music at Your Fingertips

Apple Music Theory's entertaining drill and practice exercises make music fundamentals enjoyable! The program displays notes on an "electronic music sheet," so you see and hear compositions simultaneously. Learn at your own pace what might otherwise take hours of private lessons to master.

Requires 32K RAM, one disk drive, and the Applesoft BASIC language.

DOS TOOL KIT
Selected Aids for the Apple II Programmer

Reduce programming time with the DOS Tool Kit, a utility diskette that assists in developing programs in machine language and in Applesoft BASIC, as well as graphics and animation.

The DOS Tool Kit requires 48K RAM, one disk drive, and the Applesoft BASIC language.

ELEMENTARY, MY DEAR APPLE™
Problem Solving and Spelling for Youngsters

Elementary, My Dear Apple is a challenging collection of educational programs that help children 12 years and older sharpen spelling, mathematical, and problem-solving skills.

Requires 48K RAM, one disk drive, and both the Integer and Applesoft BASICs.

APPLE HOW TO!™
Tutorials That Make Programming Easy

Apple How To! is a collection of programs useful in teaching about computers. It includes tutorials on how to program in Assembly language, and how to produce scrolling windows in BASIC—plus a program that emulates an RPN (Reverse Polish Notation) calculator.

Requires 48K RAM, one disk drive, and the Applesoft BASIC language. A printer and interface are necessary to print out programs.

SHELL GAMES™
An Entertaining Approach to Learning

The Shell Games is a library of teaching aides for the home or classroom. You can select matching, multiple choice, or true/false quizzes on a variety of subjects. The Shell Games also contains an editor, so you can create your own quiz problems to place in each "shell." (You don't have to be a programmer.) In a few short minutes, you can enter a complete set of questions into any one of the three quiz programs; revisions can be made just as quickly.

The Shell Games is packaged with a manual and program diskette. It requires 48K RAM, the Integer BASIC language, and one disk drive.

APPLE II LANGUAGE LIBRARY

APPLE PASCAL (Rev. 1.1)
The Powerful, Flexible Language

The new Pascal 1.1 Revision for the Apple II provides faster disk access, 23 percent more diskette storage space, and greater programming ease.

Apple Pascal is one of the most sophisticated, structured programming languages available on a small computer. Its advanced capabilities boost program performance and cut software development time for large business, scientific, and educational applications.

Apple Pascal is packaged with the Apple Language System. It requires an initial 48K of RAM (providing a total of 64K of RAM after Language Card installation), plus one disk drive (two drives are recommended, and up to six drives are supported).

APPLE PILOT
The Teacher's Aide

Apple PILOT is a powerful system for the courseware author. Without becoming a programming expert, you'll quickly become proficient in developing courseware for your particular classroom needs. And your student users will learn more, too, because Apple PILOT lets you offer much more than simple language capabilities. Color graphics, sound effects, and a character set editor encourage you to build around words, pictures, and sounds.

Apple PILOT is packaged with a manual and program diskettes. It requires 48K RAM, DOS 3.3 or the Apple Language System, and one or two disk drives. For printing lessons, a printer and interface are required.

APPLE FORTRAN
For the FORTRAN Programmer

FORTRAN is a powerful programming language for mathematics, engineering, and scientific applications. Apple FORTRAN is the ANSI Standard Subset of the recently-defined FORTRAN 77, with many enhanced features and capabilities. The package is supplied and documented for those who are already familiar with the FORTRAN language, so that they may develop, modify, and use FORTRAN programs on an Apple II.

Apple FORTRAN is packaged with a manual and program diskettes. Apple FORTRAN requires 48K RAM and the Apple Language System (which increases RAM to 64K). Two disk drives are recommended.

OPERATING SYSTEMS

DOS 3.3
The Apple Disk II "Housekeeper"

DOS 3.3 helps you take advantage of your Disk II Floppy Disk Subsystem by keeping track of files, saving and retrieving information, and performing a variety of other "housekeeping" chores. If you are using a previous version of DOS (e.g., DOS 3.2.1), you'll need the DOS Update Kit which, in addition to providing all the advanced abilities of DOS 3.3, also boosts the capacity of older disks to 143K bytes to accommodate 16-sector software.

DOS 3.3 comes with all Disk II with controller packages, and includes a manual and appropriate diskettes. The DOS Update Kit includes a manual, 16-sector PROMs, and the appropriate diskettes. (NOTE: Your system must have at least 32K RAM to support a Disk II drive and DOS 3.3).

PERSONAL AND ENTERTAINMENT SOFTWARE

APPLE ADVENTURE

Apple Adventure challenges your perseverance, intuition, and deductive powers. Learn to use magic words and strange tools, to escape sinister opponents, and to outwit the toll collector as you make your way through the Colossal Cave toward the 350-point Grand Master rating.

Requires 48K RAM, one disk drive, and Applesoft BASIC language.

STELLAR INVADERS

You're being attacked by alien invaders! All that stands between you and them is your "tank." While the aliens are dropping bombs, you must fire at their ranks and destroy them before they destroy you. Requires 48K RAM, either Applesoft or Integer BASIC, and one disk drive.

APPLE BOWL

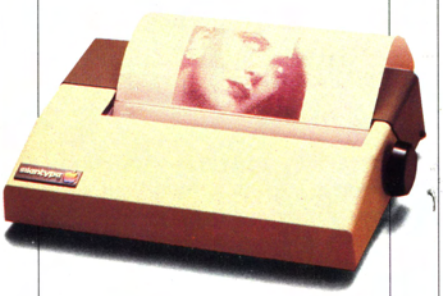
Enjoy this realistic simulation of a bowling alley. You control the ball; Apple keeps the score. Requires 16K RAM and Integer BASIC for cassette tape version; 32K RAM and Integer BASIC for diskette version.

ACCESSORIES

DAISY WHEEL PRINTER (QUME SPRINT 5™)
Letter-Quality Hardcopy for Business Communications

The Qume Sprint 5 Daisy Wheel Printer improves the quality and impact of business communications. It produces all kinds of documents, from form letters printed on letterhead to detailed financial statements. The Sprint 5 plugs directly into the Apple III's back panel, or into a connector on the High-Speed Serial Interface Card for the Apple II or II Plus.

(™Sprint 5 is a trademark of Qume Corp.)



APPLE II IEEE-488 INTERFACE CARD
IEEE-488 Standard for Instrument Control

With an IEEE-488 Interface Card installed, the Apple II Plus can be used to program and operate virtually any test, measurement, or control instrument that is compatible with the IEEE-488 interface standard.

DISK II FLOPPY DISK SUBSYSTEM
Dynamic and Versatile Data Storage

Disk II expands the capability of your Apple II Plus through the use of flexible, or "floppy" disks for data storage. Extended data storage capacity, fast data retrieval speed, and random access to stored data—all are available through the Disk II Subsystem.

Disk II comes with a controller card for your first drive, and without a card for subsequent drives. It is packaged with the current version of DOS (Disk Operating System) and a complete manual. A minimum of 32K RAM is required to support Disk II.

SILENTYPE™ THERMAL PRINTER
Eliminating the High Cost of Hardcopy

The Silentype is a quiet, versatile, and compact thermal graphics printer. It offers increased flexibility over other printers in its class because it receives both its power and intelligence from your Apple II Plus or Apple III computer. With a few simple keystrokes, you can change margins and line spacing, specify printing intensity, even print finely detailed charts and graphs. It's the right choice for clear, readable, draft-quality hardcopy.

The Silentype for the Apple II is packaged with its own interface card, a roll of heat-sensitive paper, and manual. A minimum of 16K RAM is required to support the Silentype with the Apple II. The Silentype for the Apple III comes with a driver diskette, in addition to paper and manual.

MONITOR II

This black-and-white video monitor is the ideal display for the Apple when color output is not required. It sits neatly on top of the computer, and provides a very clean and sharp picture. It accepts direct video output from the computer. Supplied with cable adapter and documentation.

APPLE II INTERFACE CARDS
Intelligent Interfaces to Expand Your Apple II System

The Communications Card allows you to connect an Apple to modems, CRT terminals, and other devices employing a 110/300 baud, serial RS-232C interface. The card's built-in intelligence lets you control these devices easily, in BASIC.

The Serial Card allows an Apple computer to exchange data with computers, printers, and other devices in serial format (one bit at a time). It is intended for use (in place of the Communications Interface Card) in applications that use data rates other than 110 or 300 baud, and that involve serial printers that don't require "handshake." Also included is a "letter-quality-printer" ROM for use with the Qume Sprint 5.

The Parallel Printer Interface Card lets you generate reports, listings, labels, and letters with your Apple, using a variety of parallel-interfaced printers.

The Centronics Printer Interface Card, a special version of the Parallel Printer Interface Card, is available for use specifically with the Centronics 700 series of printers.

APPLE II HAND CONTROLLERS
Manual Input for Games and Graphics

These easy-to-use hand controllers plug directly into the Apple II's Game I/O Connector. Besides being essential for playing many computer games, the controllers can be used with Apple PILOT to develop graphics for courseware, as well as with a number of other entertainment/simulation programs to input data.

EXPANSION OPTIONS— GROWING YOUR APPLE II SYSTEM

THE APPLE LANGUAGE SYSTEM

The Apple Language System provides Apple users with the powerful Pascal language, as well as both the Integer and Applesoft BASIC interpreters. It does this by means of the Language Card, which provides 16K of RAM memory that electrically replaces the ROM firmware built into each Apple II. This technique gives Apple II owners access to all available languages, as well as to the hardware needed to run future language processors as they appear.

The Apple Language System is packaged with the Language Card, Pascal and BASICs diskettes, 16-sector PROMs, and manuals. It requires 48K RAM and one disk drive.

LANGUAGE CARD

As described under "Apple Language System" (above), the Language Card is also available as a separate Apple product, without BASICs or Pascal diskettes, or programming language manuals.

APPLESOFT FIRMWARE CARD

This card provides access to a library of programs written in the extended Applesoft BASIC language. It contains hardware and software controls that allow it to electrically replace the existing Integer BASIC firmware in standard Apple II computers.

INTEGER BASIC FIRMWARE CARD

This card provides access to a library of programs written in the Integer BASIC language. It contains hardware and software controls that allow it to electrically replace the existing Applesoft BASIC firmware in standard Apple II Plus computers.

16K-BYTE EXPANSION MEMORY MODULE (RAM)

This module allows user memory expansion in 16K-byte increments for any 16K or 32K Apple II or Apple II Plus computer. The module contains eight RAM devices, installation instructions, and a test program to insure that installation is properly completed.

APPLE /// PROFESSIONAL COMPUTER SYSTEM

The Apple /// is a professional, desk-top computer system designed for sophisticated business application needs. Its outstanding, built-in hardware includes a 140K-byte Disk III drive; 96 or 128K bytes of user memory; a calculator-style numeric key pad; and two interfaces—serial RS-232C and Silentype Thermal Printer—for easy, economical system expansion. A 12-inch, high resolution video monitor completes the system.

The Apple III is offered in specific configurations to meet your requirements.

APPLE /// INFORMATION ANALYST

The Apple /// Information Analyst is a powerful modeling, problem-solving, and forecasting tool. Its easy-to-use VisiCalc™ III and Business BASIC software packages allow you to handle the most complex tasks more quickly, accurately, and thoroughly than ever before.

Any business problem you might wish to tackle using rows and columns can be solved with VisiCalc III, a huge "electronic worksheet" with enough room for a detailed, five-year forecast. It virtually eliminates calculator, pencil, and paper in developing plans and analyzing results.

Business BASIC, with up to 70K bytes (on a 128K system) of user memory (the largest workspace available on any personal computer), allows you to write programs tailored to your needs. Its special, 18-digit (64-bit) data type lets you handle even the toughest accounting chores with "penny accuracy."

The Information Analyst's built-in disk drive lets you store and quickly retrieve up to 140K bytes of data per diskette.

APPLE /// SOFTWARE AND HARDWARE

MAIL LIST MANAGER™
(Available 2nd Quarter, 1981)

Apple's Mail List Manager, developed for the Apple ///, automates the tedious task of maintaining and generating telephone and address lists. It stores, sorts, edits, and prints mailing labels and phone lists, eliminating hours of drudgery.

Requires 128K RAM. A printer is necessary to generate lists and labels.

WORD PROCESSOR
(Available 2nd Quarter, 1981)

Turn your Apple /// into a powerful word processing system. Word Processor lets you compose, revise, edit, and print all kinds of documents—memos, brochures, form letters, even book-length manuscripts—quickly and accurately.

Requires 128K RAM, and one expansion disk drive (Disk III). A printer is required to generate text.

DISK III

Disk III is a floppy disk drive subsystem that allows you to increase the disk storage capacity of your Apple /// up to 560K bytes (4 drives). As your needs expand, you can daisy-chain as many as three Disk IIIs to your system—without adding any control hardware or software.

UNIVERSAL PARALLEL INTERFACE CARD

The Universal Parallel Interface (UPI) Card lets a variety of parallel-mode printers—including most dot matrix models, plus some thermal and daisy wheel units—attach to Apple /// computer systems. The UPI Card also emulates the Centronics and the Parallel Printer Interface Cards used with the Apple II.

APPLE /// OEM PROTOTYPING CARD

Apple's OEM Prototyping Card is a convenient, modular, printed circuit card on which to build custom interfaces for the Apple /// Computer System. It saves users time and money by reducing the effort required to assemble working prototypes.

APPLE /// MONITOR

Designed for use with Apple /// Computer Systems, the portable, 12-inch (diagonal), black-and-white Apple /// Monitor displays precise, 80-character by 24-line text and high-resolution graphics. It connects to the computer via a standard cable, supplied with every Apple /// system.

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