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The MSX Standard

The New Computers

Robert Chapman Wood

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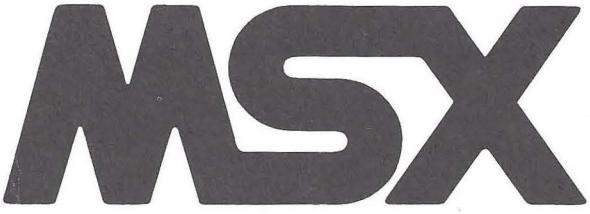

Standard

The New Computers

To my parents on their 40th wedding anniversary.

Contents

Acknowledgments

I'M delighted to acknowledge that the completion of this project leaves me with a large collection of debts. To mention a few of the most obvious: Steve Ting, formerly of Spectravideo and now of Qest Publishing, spent hours explaining how MSX worked internally. Ron Hosogi of Microsoft always answered telephone calls, even when my questions must have seemed silly. Harry Fox articulated many of the key ideas behind MSX, and of course Kay Nishi helped me generously on the rare occasions when I could catch up to him.

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Japanese-language MSX manuals from Toshiba Ltd. and Nippon General Corp. provided useful guidance, and Frederick Holtz's *Using and Programming the TI 99/4A* (TAB Book No. 1620) gave me ideas.

The staff of TAB BOOKS Inc. must be thanked for having the vision to decide they wanted a book on MSX a year and a half before any other publisher got interested. They've been highly professional in their support throughout the project. And of course my wife. How do wives put up with people crazy enough to want to write books?

The

MSX

Standard

The New Computers

Introduction

MANY computer books start with the premise that computers are wonderful and easy to use, or else that computers will become wonderful and easy to use if only you follow the directions in that book. That premise can make you feel foolish when you try to put the book's advice to work. Computers do produce wonderful changes in people's lives, and they can be easy to use. Today's computers, however—whether or not they are designed with ease of use as a primary goal—remain annoying, frustrating machines. Millions of man-years of work remain before ordinary people can fully enjoy the potential of the computer. The benefits of computer ownership today are enormous, but so are the frustrations, and the benefits today don't compare with the transformations the computer will produce when it's really been put to work. The manufacturers supporting the MSX standard, including more than a dozen companies who lead the world in consumer electronics and employ tens of thousands of engineers and market researchers, are deeply aware of all this.

Why, then, do so many authors claim computers are a cinch to use? After all, if computer books explained the truth to you—that computers are frustrating, but that the benefits make the frustration well worthwhile—you'd have all the more reason to buy computer books. Good computer books—and there are too few of those—are supposed to reduce the frustration and increase the benefits you can get from a computer.

I think that some authors exaggerate the ma-

Fig. I-1. Drawing by Rich Tennant.

chine's ease of use for a good reason. If you know the frustrations and benefits of using a computer today, you'll surely want to own a computer, but will you want to own one of the computers that most other computer books describe? If you really understand how computers are likely to change our lives, you'll know that any non-MSX computer you buy today, with the possible exception of some IBM products and compatibles used in offices, is designed so it will quickly become totally obsolete. In a year or so, you'll want to buy a new, less frustrating computer. If you replace your old machine, however, you'll almost certainly have to throw away all the software, most of the data, and some of the auxiliary equipment you've acquired for it. Who wants to do that?

Computers are remaking our world because they can do thousands of tasks for us at very low cost. I'll show you in this book how you can, with an MSX computer:

- ☐ Make exquisitely beautiful music.
- ☐ Create fascinating pictures.
- ☐ Learn to think better.
- ☐ Communicate more quickly with friends, neighbors, teachers, or your boss.
- ☐ Enjoy the thrills of flying an airplane.
- ☐ Analyze your finances.
- ☐ Bring an expert psychologist (of sorts) into your living room.
- ☐ Tap into giant libraries.
- ☐ Pay your bills instantly.

The equipment to do all this exists today and costs the equivalent of less than $1,000 in the countries where it is for sale.

As you do more with computers over the next couple of decades, you're sure to wind up owning several of them—probably a stand-alone machine or two and a couple of others built into such appliances as a laser disk player and a telephone. If your computers have been designed to serve you, you'll be delighted to own several. When you buy a new and more powerful computer for your study or your living room, you can move your old one to the bedroom or den. You probably did the same with your old black-and-white television set a decade or two ago. Then when someone got tired of whatever was on television in the living room, or simply wanted to watch TV while lying in bed, they could watch whatever they wanted on the old TV, losing the advantages of the latest models, of course, but enjoying the show.

As I'll discuss in detail in Chapter 1, however, you can't move software from your new computer in the living room to your old one in the bedroom unless the two support the MSX standard or unless they are closely related machines, probably from the same maker (two IBM PCs, for example, or one IBM PC and one compatible from another manufacturer such as Compaq). If you upgraded from an Apple II to an Apple Macintosh, for example, virtually nothing you produced with your old computer could be used with your new one. It's as though the people who introduced 33-rpm record players had never included the ability to play old 78-rpm records on the new machines.

MSX computers, however, as I'll try to show throughout this book, are designed to let you begin right now to build the life you're going to live as long as you remain on earth. MSX is a set of hardware specifications designed to let a wide range of computers, carrying brands like Sony, Panasonic,

Magnavox, Hitachi, and Toshiba all talk to each other and use the same software. The giant electronics companies supporting the MSX standard are committed to making all their future computers highly compatible with today's MSX computers, whether the computers of the future control your home entertainment center, vacuum your floors, take out the garbage, or whatever.

Thus, this book differs substantially from other computer books. Instead of claiming that it will make the use of today's computers easy, it will help you begin the real job of coping with the computer age: figuring out how you'll want the computer to change your life and how you can bring those changes about. This book will make the use of computers truly easier, by helping you decide which MSX products you'll want to buy this year, which you'll want to buy soon thereafter, how you'll integrate them all into your budget and your life, and how you can make them work for you.

To accomplish these goals, I need to cover four major fields:

- ☐ What MSX computing is.
- ☐ How to get started.
- ☐ The many ways you can use MSX computers today.
- ☐ Where MSX computing will take us in the future.

Thus, the first two chapters of this book will focus on what MSX is and how it came about. Essentially, MSX is a set of hardware standards accepted by leading manufacturers and designed to make computers functional in the home by enabling computers from various makers to talk to each other and run a wide array of software. I'll try to show where the MSX movement came from and why it is vitally important to you.

The next seven chapters will help you get started with MSX. You'll find out how to choose MSX products, how to set them up, and how they work. You will play your first games, learn a little bit of programming, and understand a disk drive.

Then, in six more chapters, I'll discuss ways you are likely to want to use your computer—creating art and music, enjoying computer games and simulations, learning with the computer, making your life run better, consulting "expert systems," connecting with local and international computer information networks, and hooking your computer to your television, videotape recorder, laser disk player, and other home entertainment products so you can improve your life.

Finally, I'll take a look at how the MSX computer standard is likely to change your life between now and 1995, and beyond. This book will help you understand clearly why an MSX computer can be so powerful in your home. The people at TAB BOOKS Inc. asked me to start work on the project way back in 1983 (that's a long time in the computer business) when the MSX standard was first announced. I understood the computer market (they thought) and I read and spoke Japanese, so I could follow the machines as they were developed in Japan. I've regularly read Japanese-language materials on the computers as they've appeared. I've come to appreciate MSX not just as a piece of hardware, but as part of a philosophy of home technology.

This book is written for beginners in computing, but since everyone is a beginner with MSX today, I've tried to be careful enough so people with years of experience in computing can learn how MSX will change their lives as well. I don't claim this is a "complete" MSX book. MSX products are being introduced every week by companies on several different continents. I've been privileged to receive extensive advance information on MSX machines in both English and Japanese. Inevitably, however, some MSX products won't be exactly as I expect when they reach you.

Moreover, I must warn that the big manufacturers behind MSX are very cautious about introducing products in the United States. These companies hope to sell home computing devices for the next 50 years, and they're reluctant to release a product here when short-sighted pundits might compare it unfavorably to some product from ATARI or Commodore that does things MSX computers don't yet do. Thus, though every product mentioned in this book is being manufactured

(unless I specifically indicate otherwise), and virtually all are on sale in Japan and other countries, you may not find them locally.

Nonetheless, I think you'll find this book vital in learning to benefit from MSX and understanding where the computer is taking us all. The launch of MSX computers in the U.S. has finally made home computer shopping something more than the purchase of an educational toy. Today it means launching what will ultimately be a radical, probably beneficial, but certainly difficult transformation of your life. This book is designed to communicate the excitement, ease the pain, and maximize the benefits.

Chapter 1

A Keyboard that Can Do Anything—On a Budget

MSX computing can help you and your family live your whole lives better at a reasonable price. The computer industry has made lots of false promises over the past 10 years, so that sentence may sound like excessive hype, but it's not. The MSX group—a loose association of electronics giants led by ASCII Corporation, the software company that is the Japanese affiliate of American software leader Microsoft Corporation—has set standards for how computers should work and how they should communicate with other devices. The standards enable the companies to mass-produce computer devices and be sure they'll be able to work together for you.

MSX VS OTHER COMPUTERS

For years you've heard stories about how computers could give you the equivalent of an audio and video studio in your living room, control your appliances, and tie every part of your home to services and information systems all over the world. If you paid a few hundred or even a couple of thousand dollars for a home computer, thought you soon found that most of these promises were illusory. In theory your machine might perform most of these tasks, but in reality it might not do what you wanted without hardware attachments which cost two to ten times as much as a home computer. Often the hardware attachments weren't even being manufactured yet—there were always promises that they would be available in a few weeks or a few months, but they never seemed to show up on the market. You quickly realized your computer would be totally obsolete before it could do half of what you wanted.

MSX should make buying home computers far easier and less frustrating. MSX is a set of continually evolving hardware specifications. All computers, peripheral devices, and software that follow the specifications should be highly capable, cheap to manufacture, and compatible with each other. For the first time, the world's leading consumer electronics companies will manufacture compatible machines, bringing state-of-the-art mass production techniques to computers and related products for you and me. All Japan's top consumer electronics companies—Sony, Matsushita/Panasonic, Hitachi, Toshiba, Yamaha, Mitsubishi, Pioneer, Casio, Canon, Fujitsu, JVC, Kyocera, and Sanyo—plus the giant Philips Group in Europe and important electronics producers in Hong Kong, Taiwan, and Korea have commited themselves to MSX home computers.

The two leading consumer electronics manufacturers in the United States, RCA and Zenith, are still thinking about it, too. So is IBM. It is one of three investors in a Japanese videotext (i.e., telecommunications—see Chapters 14 and 15) company that will use MSX computers as a home communications terminal. It's probably unlikely, however, that IBM will support MSX computers in the United States until they have been made more compatible with existing IBM machines.

In the longer run, MSX computers and related computing devices will be built into millions of televisions, telephones, videodisk players, videotape recorders, stereo systems, electronic musical instruments, home security systems, and even kitchen appliances that can prepare your dinner by remote control. Matsushita Electric (the Japanese company that is the world's largest consumer electronics producer, owner of such brand names as Panasonic, Quasar, National, and Technics) and other leading Japanese companies have been planning for this electronic home-of-the-future at least since 1979, and in the final last two chapters of this book we'll take a look at their ideas. For now, however, it's sufficient to say that their plans are moving ahead on schedule, and that the changes they'll produce over the next decade will be enormous.

UNDERSTANDING A STANDARD

MSX stands for MicroSoft eXtended BASIC, the computer language that is built into every MSX computer. Extended BASIC, however, is in many respects the least important aspect of the MSX standard.

What's most important about the MSX standard is *compatibility.* Today you can plug a toaster from any company into an electric wall socket from any other company and expect it to work. You can plug a telephone from any company into a telephone jack from any other company and expect it to work. You can turn on a television from any manufacturer and expect to receive programs broadcast by any public broadcaster. You can't take a computer from one company, however, and plug in a software program or a printer from another company and expect it to work, unless the two were specifically designed to function together.

We take compatibility of toasters, telephones, and televisions for granted. When the machines were invented, however, (and even today when they are improved), manufacturers and trade associations had to struggle to develop standards that would permit the inventions to deliver their full power, yet allow hundreds of companies to produce complimentary products. Even today if you take an American toaster or television set to Europe, you can't plug it in, or receive programs: the two countries have adopted different standards.

There have been two major attempts to set standards in the microcomputer business—both fairly successful, both largely irrelevant for home computing. First, a company called Digital Research, Inc. released in 1976 (ancient history in the computing business) an operating system called *Control Program for Microcomputers*, or CP/M. Current versions are still widely used for business applications today. Because there's so much software available for CP/M systems, the MSX standard was designed so MSX computers can run most CP/M programs without change.

CP/M's programing techniques were designed for the specialist computer professionals who operated microcomputers in 1976. They were hard

to learn. CP/M never prescribed such essential elements of a home computer system as color graphics, sound, the exact format to be used in writing data on a computer disk, and the method the computer would use to talk to printers and other devices. Thus, CP/M computers are incompatible with each other in a great variety of ways, and CP/M has been of little use for home computers.

IBM and the software firm Microsoft Corporation led the second effort to bring standards to microcomputers. IBM introduced its personal computer in 1981 and adopted a Microsoft disk operating system, (*MS-DOS*) as a standard computer operating system. IBM encouraged other companies to use most aspects of its microcomputer design, thus making MS-DOS and "IBM compatibility" a new standard. Though the "IBM standard" did prescribe some aspects of microcomputers that CP/M left to the discretion of individual manufacturers, it prescribed solutions appropriate for business, not home, users.

The IBM PC can normally display only four colors at a time and cannot play more than one musical note at a time (no harmony can ever come out of a PC's speaker). Moreover, it uses expensive chips and a large power supply so that manufacturing costs for a PC compatible—even a Japanese-made, price-competitive PC compatible such as Sanyo's—are approximately twice those for MSX home computers with almost the same speed and the ability to do much more than an IBM compatible. When IBM released the PCjr, a computer which with all its faults at least offered slightly improved graphics and sound for home use, it based the jr's graphics on a chip with a secret design so others would have difficulty producing true compatibles at a lower price.

Thus, there have been no standards for home computers, and the buyer has been left to the high prices of Apple and IBM, the notorious unreliability of Commodore and ATARI, and the likelihood that whatever he bought, he'd probably have to throw it out in a year or two, until MSX arrived.

Is the MSX Standard Any Good?

I suspect that MSX will ultimately be seen as the first truly great microcomputer design since the Apple II, which was produced in 1976. MSX, which is based on a design originally produced in 1982, has expandability and flexibility few computers other than the Apple II and the IBM PC have incorporated. Its design has absorbed a lot of the lessons that the computing industry has learned since 1976. MSX computers can do virtually anything that any other small computer can do, including the much more expensive computers from IBM and Apple, and generally (though not always) they can do it cheaper and more simply.

Here are the basic technical details: all MSX systems are built around a Z80A microprocessor or another processer which can act like a Z80A. The Z80A, although not the newest, flashiest microprocessor in the world, is a highly capable and well-respected processor.

In addition, all MSX systems contain a General Instruments AY-3-8910 sound chip or another that acts like the AY-3-8910. Today's MSX 2.0 computers contain a new video chip specially designed by Microsoft, ASCII Corp., and Yamaha. The chip can produce 256 colors, resolution of 512 × 212 dots, and graphics comparable to the best any widely available computer today can produce—and far superior to those of such computers as the IBM PC and the Apple II series.

In addition, the latest MSX computers contain 48,000 bytes of read-only memory, including the Microsoft EXtended BASIC, an exceptionally powerful version of BASIC. (More on that in Chapters 7 and 8.)

Finally, they contain a slot management system, which is probably their most important feature by far. Every MSX computer has one or more *slots* that can instantly recognize and make use of MSX-compatible disk drives, printers, software, memory add-ons, devices to connect with a telephone line, appliance interfaces, and dozens of other devices (Fig. 1-1). All you have to do is plug a new device into the slot on the computer. If you don't have enough slots, you can plug in a simple expansion unit that will give you more. They may be expensive initially, but with mass production their costs should decline rapidly.

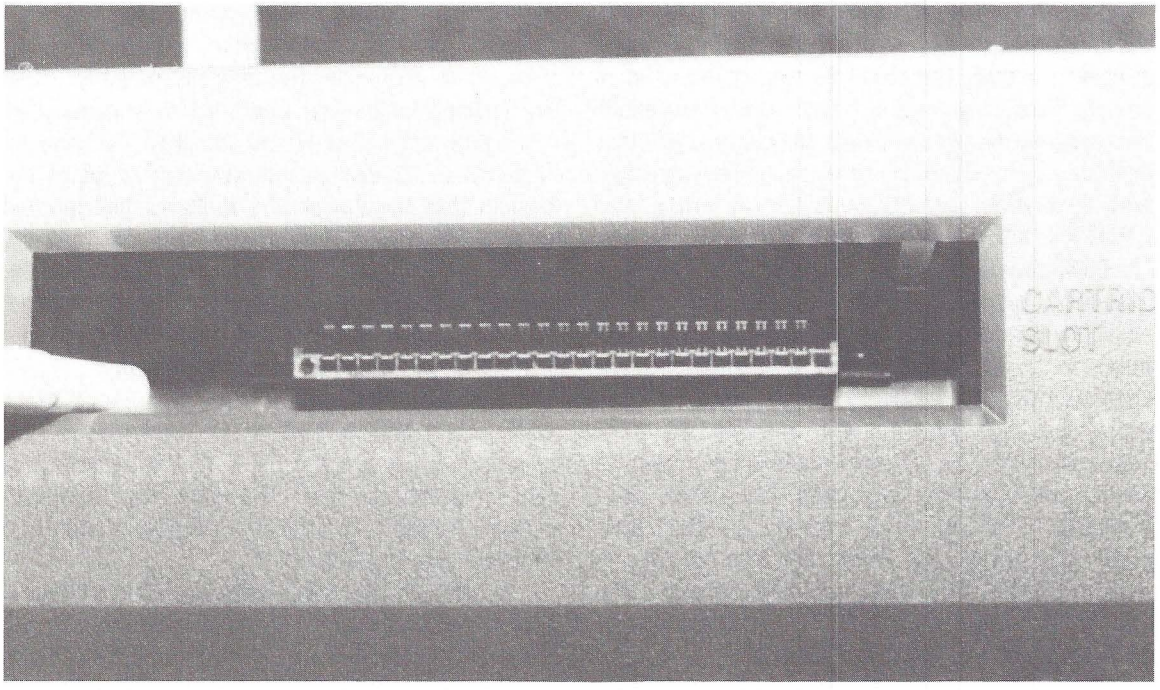


Fig. 1-1. This standard slot in all MSX computers is designed to make every MSX machine expandable to do anything you might want.

Thus, MSX computers make expandability more than a slogan. Some Apple and IBM computers can be expanded in a somewhat similar way to the MSX computers, but they require that you go to the back of the computer to get at the expansion slots. Most expansion products for Apple and IBM computers are not mass-produced, and are, therefore, far too expensive for most homes.

MSX computers provide nearly the speed of the IBM PC (which is dramatically faster than Apple II, Commodore, and older ATARI home computers), together with superior graphics and sound performance and unlimited expandability. MSX disk-drive and printer interfaces will give the same high performance as IBM's, again far more than Commodore's or Apple's.

That doesn't mean that MSX computers are world leaders in sheer processing power. If you want to create a model of the United States economy, a computer like the IBM's PC/AT will give you significantly more processing power. In fact, even an Apple Macintosh and an ATARI ST contain a microprocessor chip—the Motorola 68000—which is in theory far more powerful than the MSX's Z80A. There's no simple answer to the question of whether the Macintosh and the ST are more powerful machines than MSX computers, however. There's much less low-cost software available for 68000-based machines than for Z80-family machines. Some Macintosh software is easier to use than most software that will run on MSX. For every application I know of, though, except for a few graphics-intensive jobs such as bringing out a newsletter, there's more software available for MSX than for the Macintosh or the ST. Once you've learned to use it, you can probably get your job done faster on an MSX machine than on a 68000-based machine.

An 8-Bit Standard?

Some computer marketers criticize MSX because it is an 8-bit computer, while the IBM PC is allegedly a 16-bit computer and the Macintosh

and ATARI ST series are said to be 32-bit computers. I'm not impressed by these complaints. Most people who make these criticisms don't really know what a 16-bit computer is. Of the small portion who do know, most are programmers who intend to write their own software for their machines. They would prefer to program an advanced Motorola 68000 chip to a Z80A, and I don't blame them. MSX is not a machine designed for people who will write their own programs; however, it's a machine designed for ordinary people. Ordinary people are much better off with a machine that runs a lot of already existing software than with a machine that has useful, but obscure, advantages in programming, or "ease-of-use" features that limit its flexibility.

People who criticize MSX for failing to adopt state-of-the-art technology forget that when they were introduced, the Apple II and the IBM PC also avoided state-of-the-art technology. Ordinary people are almost always better served by tried-and-true technology than by the latest new gizmos no one quite understands.

For those who are interested, however, here's an explanation of the controversy over whether MSX is as powerful as the IBM PC, the Macintosh or the ST. The 8-bit vs 16-bit vs 32-bit debate is built around the question of how may bits of information a computer's microprocessor handles at a time. A *bit* is the most basic unit of information: as we'll discuss in Chapter 4, a bit of information is usually represented by a zero or a one. It generally takes 8 bits of information to represent a standard decimal digit or a letter. Generally, the more bits a microprocessor handles at a time, the faster it will be. Z80 microprocessors handle information 8 bits at a time.

Some microprocessors, however, handle 8 bits at a time for some purposes and 16 bits at a time for other purposes. Most notorious of these is the Intel 8088, the processor which powers the IBM PC and the PCjr. It handles data 16 bits at a time internally and has a 16-bit *memory address bus,* so is often called a 16-bit chip. It communicates with the outside world 8 bits at a time, however, and this determines its processing speed. Thus it is not inherently faster or easier to program than the standard 8-bit Z80A.

Moreover, although the techniques had not been perfected in 1981 when the IBM PC was introduced, the Z80A can address every bit as much memory as the 8088, and do it just as easily. MSX can use more than 1 million bytes of random access memory—16 times as much as the Commodore 64, 2 times as much as the IBM PCjr., and 60% more than the IBM PC.

The Motorola 68000 chip which powers the Macintosh and the ST handles data 32 bits at a time internally and 16 bits at a time in communication with the outside world. Thus it is genuinely more powerful than the Z80A. It's a newer chip, though, and programmers have much less experience with it than they have with the Z80 series. There's much less software available for the 68000 than the Z80 series. Today, new microprocessors are under development that are even more powerful than the Motorola 68000, and which nonetheless can run the software of the Z80 series.

Someday, 16- and 32-bit chips like the Motorola 68000 and the Intel 80286 will provide real usefulness to ordinary users like you. Computers that respond precisely to your voice and translate foreign languages or produce interactive graphics with the realism of an ordinary television picture, for instance, probably cannot be based on either the Z80A, which powers the MSX standard, or the 8088, which powers the IBM PC. When truly useful software is developed for true 16- and 32-bit chips, the MSX group will build a more powerful microprocessor into MSX computers, while making sure they still run older, Z80A-based software. The group is already working on the project. Until that day comes, however, MSX-based computers are the most powerful machines you can buy for home use.

MSX-2 AND BEYOND

A new version of the MSX standard, MSX-2, was introduced in Japan in the summer of 1985. It offers superb graphics. A video picture can be converted to a computer graphic on an MSX-2 machine and look like a blown-up photo from a magazine.

Fig. 1-2. Sony's Hit Bit computer (courtesy of Microsoft Corp.)

In addition, MSX-2 offers expandability up to 1 million bytes of random-access memory plus 128,000 bytes of memory dedicated to the video display, and the ability to display 40- or 80-character lines of text, a built-in calendar/clock with battery back-up so you don't have to worry about resetting the time when you turn the computer on, support for a standard superimpose system so computer graphics can be combined with conventional video produced by a video disk or video recorder, support for a standard lightpen, and an optional MSX audio chip which can mimic all sorts of non-computerlike sounds (Fig. 1-3).

MSX-2 creates a fine package, but MSX group members recognize that it is still only a beginning. Now that MSX standards are established for video, audio, and most peripherals, the attention of MSX group members is shifting to how the system can be improved next. High on the priority list is a microprocessor superior to those in other com-

puters, but in a configuration that will still use today's MSX data and software.

MSX FEATURES

You can expect MSX computers to do a lot for you that competing computers can't do. First, because MSX is an international hardware standard designed by software companies, rather than a machine designed for production by a single hardware company such as IBM, Apple, or Commodore, dozens of manufacturers can invest in mass production of MSX machines and MSX-compatible products without fear that the manufacturer who originally designed the standard will suddenly change it. MSX machines and software will be available in a bewildering but useful array of configurations that can all communicate with each other (Fig. 1-4). Products that work with MSX will be more productive, more available, and cheaper than products that work with other systems.

Second, MSX computers will do more with a larger number of household devices than other home computers. MSX is the computer standard accepted by most of the world's companies that make televisions, videodisk players, videotape recorders, and microwave ovens. The coordinators of the MSX consortium are actively working to help these companies build powerful and compatible future products. Japan's electronics manufacturers are working with Japan's telephone company, Nippon Telephone and Telegraph, and Japan's Ministry of Posts and Telecommunications to produce an all-electronic home and a worldwide Information Network System by 1995. The MSX project is one part of those efforts. With MSX you can use videodisks interactively, edit home movies from your video recorder, or play a state-of-the-art music synthesizer from Yamaha (Fig. 1-4). I'll discuss the radical long-term implications of these trends in the final chapter of this book.

Finally, only MSX computers allow programs

Fig. 1-3. Yamaha's CX7M/128 is one of the new generation of powerful MSX-2 standard computers.

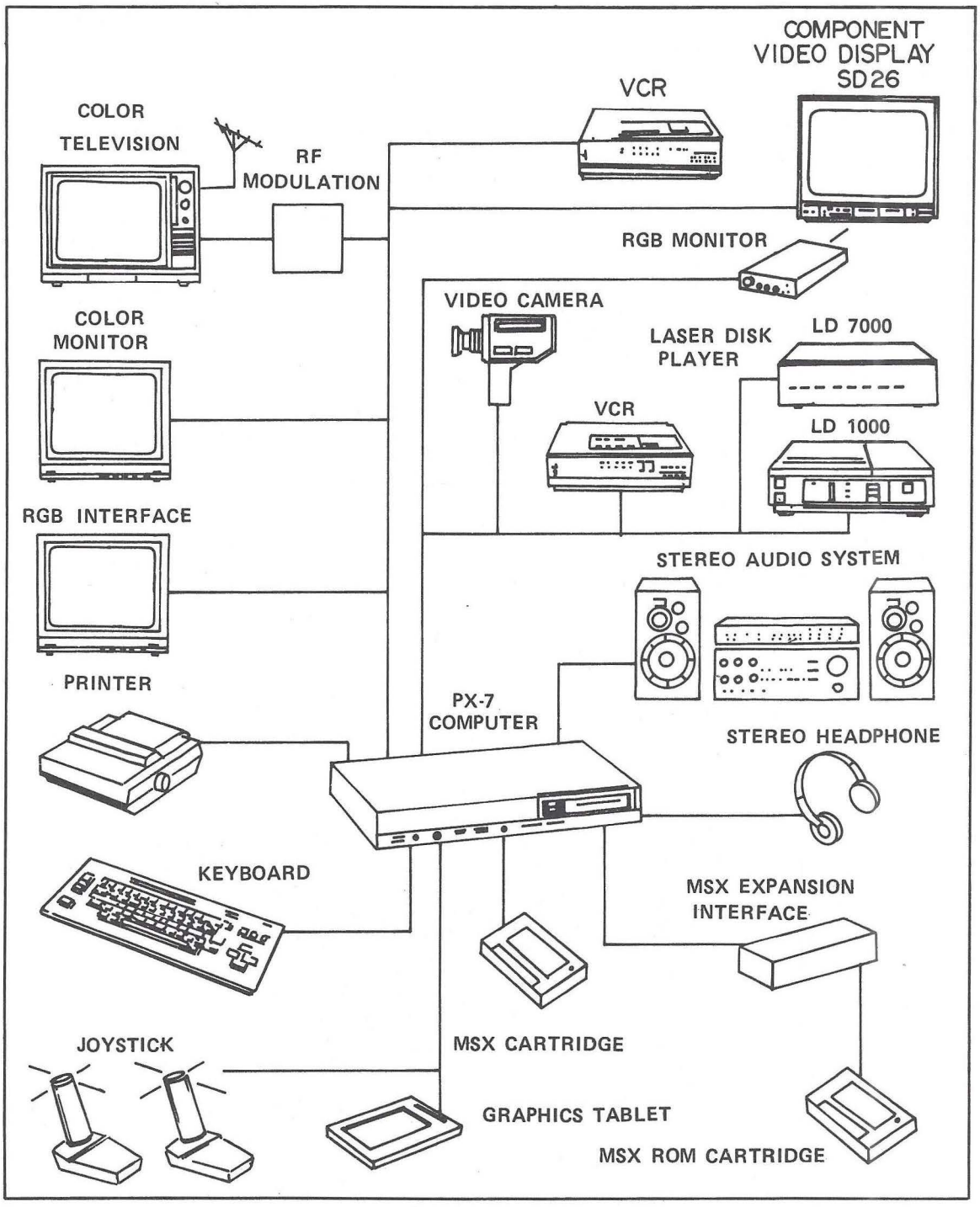


Fig. 1-4. How a computer and other electronics gear from one manufacturer—in this case Pioneer—can be put together into a complete home electronics system.

from CP/M systems to run with little or no modification and also permit you to swap data disks with an IBM or IBM-compatible system. Those are important considerations if you think you may someday want to share data with either of these more business-oriented systems.

Chapter 2

The MSX Story

THE development of the MSX is one of the most colorful stories in the colorful computer business. It illustrates a great deal about how the Japanese take American technology and use know-how--practical, often low-tech techniques, many popular in the United States many years ago--to make it more useful.

It can be seen as the story of two small-time New York importers and of how they and their friends among the hard-working wheeler-dealers of Hong Kong tried to give Americans the first true home computer, then saw their dream taken over by Japan Inc.

It's more realistic and more helpful in understanding where MSX is taking your family if you can see MSX as the Japanese see it—as a part of a long-term effort to help their nation make the best use of new information-era technologies. This effort has already included some 7 years of work on 'home bus' standards to bring computer networking and digital video technologies to every corner of the homes of the 1990s, and 'information network system' technologies to tie the homes of the future into a worldwide information grid. You must also see it as a story of Kazuhiko "Kay" Nishi, a pudgy, affable, but strong-willed, Japanese entrepreneur who largely designed the New Yorkers' computer, then convinced the entire extended family of the Japanese electronics industry that this vision suited their own goals. Nishi made MSX the standard for home computers in the Orient, and encouraged the Japanese industry to begin thinking of MSX as a standard for all computers everywhere.

It was early 1982 when the two importers, Harry Fox and Alex Weiss, set out to build a "true" home computer. The term 'home computer' then usually indicated machines like the Sinclair ZX-80 which cost about $100 but could do almost nothing

useful. Occasionally the term would also be applied to the Apple II or the Atari 800, but assembling a complete system from those products cost as much as buying a car, and few ordinary American homes could afford that kind of investment just so the kids could computerize their homework.

"We were in the watch business in New York, and we could see that the way the technology was going, the product we were importing was going to cost about six cents, and there would be no way you could continue making money on it," Fox recalled in an interview in early 1984.

On the other hand, Fox and Weiss noted that the same technological changes which meant watches would be worth only a few pennies at wholesale, also meant truly useful home computers could be produced for just a few dollars more than the Sinclair ZX-80. Fox and Weiss talked with Tony Law, an entrepreneur in Hong Kong whose Bondwell Group had produced watches for them and also for Timex. They chose the name Spectravideo.

It was obvious that no one would buy a computer made in Hong Kong from an unknown company unless it somehow gained some credibility in the marketplace. Therefore, Fox set out to hire Microsoft Corp., which had produced operating systems and other basic software for IBM, Apple, Radio Shack, and a host of other manufacturers, to write the system software for the Spectravideo.

Fox launched a campaign to capture Microsoft's interest. It consisted largely of long-distance telephone calls from Hong Kong. "It took about two months to get them to take us seriously," he recalls. "Then finally I got through to Kay Nishi and he asked me to send him our specs. He got them and he was all excited. Within about ten hours he was on the plane to Hong Kong."

THE JAPANESE AND HOME COMPUTER STANDARDS

Nishi's excitement indicated more than an appreciation of Fox's idea. Computers are one of the few manufacturing businesses in the world where the United States and Japanese markets have until recently remained largely separate, with completely different brands dominating in the two countries. (A machine Nishi designed—the lap computer produced by the Japanese manufacturer Kyocera and sold in the United States as the Radio Shack Model 100—was the first Japanese-made computer to achieve major sales in the United States.)

Nishi and many others in the Japanese electronics industry had, like Fox, noted that technology was making true home computers possible. The Japanese home computer market, though, made the United States market look simple by comparison. Home computer software in the United States could be written in only a few formats: Apple, IBM, Sinclair, Atari, Commodore, and Texas Instruments. In Japan it seemed every electronics company was introducing its own home computer totally incompatible with everyone else's. By mid-1983 a foreigner was able to find a video game in 14 different formats in one Ginza store. Everyone, except perhaps some corporate bureaucrats at Nippon Electric Co. (NEC), which had the largest market share in Japan, agreed that some kind of standardization was needed.

Nishi is best known in the United States simply as a Japanese vice president of Microsoft, but the Japanese company he helped found, ASCII Corporation, is important in its own right. It is Japan's largest supplier of both microcomputer software and microcomputer magazines. One ASCII official estimated in 1983—before MSX machines arrived on the Japanese market—that ASCII had 30 percent of the Japanese microcomputer software market, an estimate which if accurate would give ASCII a far more commanding position in Japan than any software company has ever held in the United States. Japanese microcomputer stores frequently display catalogs of ASCII software on their walls when there are no rivals' products in sight. ASCII adopts a low-price policy on its products. It sold cassette software for ¥3,200 ($14) and ROM-cartridge software for ¥4,800 ($20) or less long before those prices became common in the United States. In addition, through a relationship Nishi developed, ASCII is Microsoft's representative in Japan. It supplies every Japanese computer manufacturer with a version of the language BA-

SIC, which ASCII, together with the Microsoft home office in Bellevue, Washington, has prepared for each Japanese computer.

By early 1982 Japanese electronics leaders were already calling ASCII-Microsoft Corp. for the same type of help Spectravideo sought. Some—notably Kazuyasu Maeda and Dai Akutani of Matsushita Electric Corp., the world's largest consumer electronics company—were already calling for new standards in the industry. The idea of a home-computer standard appealed to the Japanese because it fit into Japanese industry's "information network system" and "home bus system" plans. Nippon Telephone and Telegraph Corporation, The Ministry of Posts and Telecommunications, Matsushita/Panasonic, and other Japanese companies had been working on these plans since 1978 to tie together consumers' homes and the nation and world as a whole with fiber optic cable. The plan was for consumers to control security systems, audio and video systems, robots, and kitchen appliances from anywhere in the house, tap into an array of new information and entertainment services, and through a more powerful telephone network control the same appliances and reach the same services from outside the home as well. Matsushita had exhibited a prototype of the system in 1979.

"We have the technology to do it now," says Ken Shimba, a Matsushita spokesman in the United States. "'But the problem is price. We think that when we can get the price down so the whole system costs as much as a car, the consumer will buy it." Matsushita and other companies believed home computer standards would speed the system's development.

KAY NISHI AND SPECTRAVIDEO

Kay Nishi is an idea man in a country where possessing original ideas is considered a bit impolite. Moreover, in seeking industry agreement on a standard, Nishi faced a problem common to standard setters everywhere. If he proposed accepting as standard something that was already on the market, producers whose product was not accepted as standard would feel they were losing competitive position. If he proposed a totally new product as standard, he would have to justify his own original idea to the entire industry, and it's especially tough to justify an original idea in Japan without sounding rude.

Thus Nishi found the Spectravideo proposal extraordinarily significant. Nishi knew that the configuration Fox proposed could create an unusually capable, flexible home computer. Nishi disagreed with the goal of trying to produce a $100 computer immediately, but he knew that a computer based on the technology Spectravideo expected to use could rival expensive office machines in processing capability, produce superior graphics and sound, yet cost perhaps half as much to produce as a computer based on the chips which power the IBM Personal Computer.

Nishi arrived in Hong Kong within 48 hours of his conversation with Fox and rode directly to Bondwell Holdings' offices, where a Spectravideo headquarters had been established. "He looked at our plans and he began saying immediately, 'Change this here, change the pin-outs over here, make this bigger,'" recalls Weiss. In two days in Hong Kong Nishi:

- ☐ Reorganized the computer's layout to make it more easily expandable.
- ☐ Expanded the computer's read-only memory (ROM) several-fold.
- ☐ Promised that Microsoft would develop a BASIC for the computer even more powerful than the BASIC in the IBM PC.
- ☐ Made it easy for the computer to support an array of add-ons and to access a disk drive in the same way that professional computers do.
- ☐ Set up an easily programmable interrupt system so the computer can, for instance, continue monitoring a home security system at the same time the kids are using it to do their homework.
- ☐ Reworked the computer's keyboard.

When he was through, Nishi had produced a

machine that would—at least for the first couple of years—cost significantly more to manufacture than the $30 Fox had originally intended. It was however, also a machine that, unlike any other computer then on the market, could do virtually everything a business computer could do and yet also had the graphics, sound capability, and ROM cartridge slot needed for a fine entertainment machine. Nishi pointed out that the price would fall further as technology improved. "He said to us, 'Don't worry, you can sell this same machine for five years,'" recalls Fox.

"Kay Nishi is unique," Weiss says in remembering the performance.

HOW MSX BECAME A WORLD STANDARD

If Fox and Weiss felt a bit overwhelmed watching Nishi leave, they were even more overwhelmed when they got another call from him 8 months later in April, 1983. "The entire Japanese electronics industry wanted to license our design," says Fox. "And they weren't going to pay us more than a few cents a machine."

Nishi had gone visiting the leading Japanese electronics companies. He had carried with him a mock-up of the Spectravideo computer, and showed off its diverse features. The reaction had been, "That's very good. Make us something like that." The Matsushita leaders had been especially impressed, and had seen the Spectravideo as an ideal basis for their dream of a home computer standard acceptable to the entire Japanese electronics industry.

Fox was accustomed to negotiating watch import deals, but never before had he negotiated with a united front of the electronics companies from the world's most advanced manufacturing nation. Moreover, he had to admit that most of the design consisted of Nishi's ideas, and he hardly felt he could hold out for a high price when selling Nishi back his own ideas. He essentially gave the design away.

"At first they talked about a license for Japan only. But then they said they wanted to be able to sell it all over the world," Fox recalls. He wanted exclusivity on the Spectravideo design. He suggested that Nishi prepare a new design, "enough different so that you don't have to license it from us, but close enough so that you can make our machine compatible with an adapter."

Nishi agreed. The plan not only allowed him to save on royalties, but also enabled the companies supporting the standard to add more advanced features with less worry about compatability with the original Spectravideo design. These features included the capability of addressing much more memory and the sophisticated switching system which would enable any MSX computer to instantly recognize and work with up to 16 MSX-compatible add-on devices plugged into slots that look simply like game cartridge ports. It was natural for the Japanese to name the system after Microsoft Extended BASIC, because they saw it as an extension of the languages they had been buying from Nishi for years. The MSX standard was born.

Ironically, Spectravideo never found the millions of dollars in financing it would have needed for anything but a token sales effort in the United States. Although its machine was sold in Europe and Asia, Spectravideo has so far made little direct impact on the United States or world markets (Fig. 2-1).

MSX AND THE UNITED STATES

Most of the employees at Microsoft's Bellevue, Washington, headquarters were as surprised as anyone in the American computer industry to learn in July, 1983, that Microsoft was teaming up with the Japanese electronic industry to produce a new "standard" computer. "Most of the people there didn't hear about it until about a week before the public announcement," says Steven Ting, a Chinese-American engineer Spectravideo had hired to bring its plans to fruition. (Ting now runs Qest Publishing, a leading provider of products for MSX software development.) Although most MSX technology was American, the project has always been a child of the Tokyo-based ASCII Microsoft affiliate rather than a true Microsoft Corporation

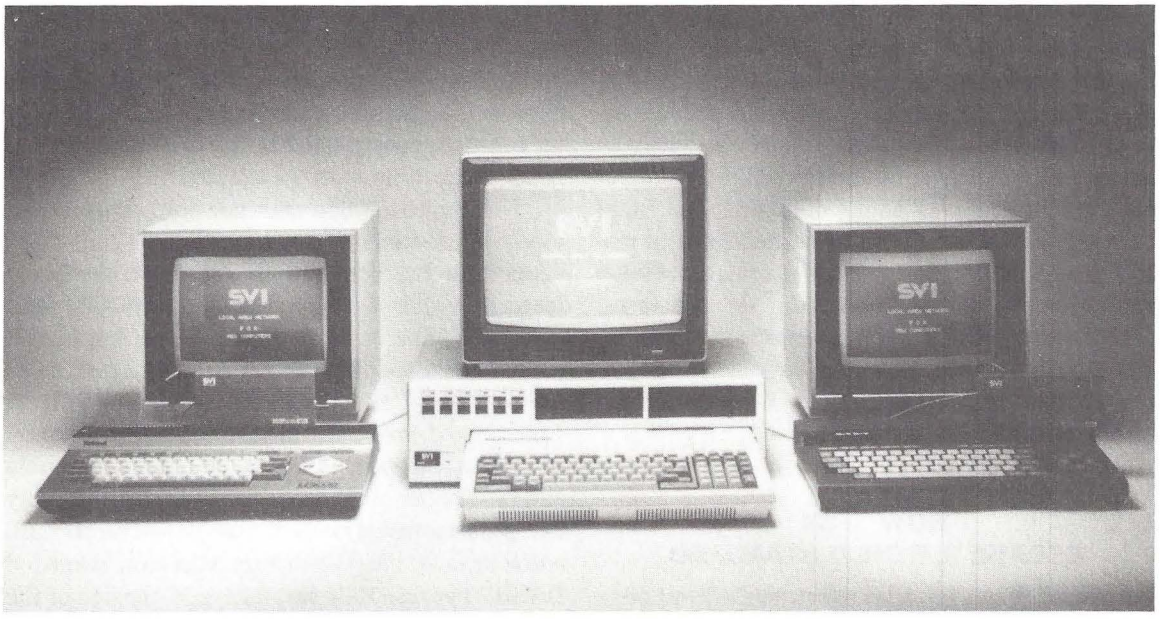


Fig. 2-1. Spectravideo, the small Hong Kong-affiliated firm whose computer launched the MSX movement, now has one of the widest arrays of MSX computers for the American market (courtesy of Microsoft Corp.).

project. Even today, specifications published in English for those seeking to provide software support are sometimes full of Japanese-style phrasing.

Nishi named an ASCII Corporation subsidiary that was in charge of the project, *Microsoft Far East Headquarters.* which only compounded the confusion. Microsoft owns no stock in the subsidiary.

ASCII Corporation staff members sometimes complain that Gates and other executives of Microsoft Corporation do little to promote MSX in the United States. Until recently, at least, Microsoft provided very modest amounts of help for developers writing software on MSX machines. On the other hand, ASCII Corp. staff admit that ASCII persuaded Gates to accept royalties on the MSX substantially lower than the company gets from sales of Apple, IBM, and Radio Shack systems based on Microsoft software; so the American headquarters of the company has little incentive to help MSX defeat these established rivals.

On the other hand, the Japanese electronics companies licensing MSX didn't behave like American microcomputer companies. First they rushed their first MSX computers to market in Japan within 4 months of announcement of the MSX standard. They didn't push their products hard in Japan, however, and instead of rushing their products to the American market as companies like Commodore, Coleco, and Texas Instruments had, they cautiously began evaluating what consumers in the United States would want as they developed the peripherals and improvements which would demonstrate that MSX was a true standard for true home computing.

In Japan's home market, the limited communication between ASCII and Microsoft's home office had little effect on product introduction. MSX computers from Sony, Yamaha, Matsushita, Sanyo, and other leading Japanese electronics companies began arriving in Japanese stores very quickly. The support of such a wide array of Japanese hardware companies quickly gave the MSX standard an ability that no other computer, even IBM's, can claim—an ability to talk through standard interfaces with almost every appliance you may have in your home, except possibly your kitchen sink. Exactly why you would want your computer to control your audio system might be obscure, but the Japanese

had produced an interface to do it. Some interfaces—for a cheap, but wonderously capable, digital music synthesizer and an exciting mixture of computer images and laser disk graphics, for instance—were obviously useful and modest in price.

Americans often criticize Japan's business society as less creative than America's. Occasionally they dismiss the whole Japanese economy as one big cartel. One strength of the Japanese, however, is that they are a bit more willing than Americans to conform to an emerging standard and even help one to emerge. Also, large Japanese companies, unlike many large American companies, are not so bureaucratic that they cannot innovate.

In home computers, each company that led the world in a particular technology developed an interface that would tie MSX home computers to its particular product. Yamaha produced the magnificent music synthesizer; Pioneer's laser disk interface would integrate frames from a laser-disk player into a video game or educational program displayed on your television; JVC's would allow computer images to be superimposed on videotapes. Smaller companies introduced devices that take advantage of the MSX's interrupt capabilities to control simpler devices such as lights and heaters.

The Japanese showed much more knowledge than American computer makers that designing a computer was only the start of the process of getting computers widely used in homes. To tap the full potential of the MSX standard, Nishi and Microsoft programmers sought to create a superior disk operating system, *MSX-DOS*, which would contain the basic instructions for the computer when it operated with a disk drive—the most common, most powerful, and fastest method of storing programs and data.

The specifications were demanding. Programmers wanted to enable MSX computers to run the vast library of CP/M-80 programs written for MSX computers' Z-80 chip without modification. They also wanted MSX computers to read data created on an IBM PC and work-alikes. Of course MSX-DOS also had to be able to use the whole array of sophisticated graphics and sound features built into the MSX. In America, Microsoft produced the disk operating system MSX-DOS, which it claimed met all its criteria.

Meanwhile, the Japanese had set about reducing MSX manufacturing costs with the same single-minded zeal they had previously brought to videotape recorders and electronic watches. MSX had been designed from the beginning to limit manufacturing costs as much as possible, while giving full, professional-grade utility. It required less power and a significantly less complex keyboard than an IBM PC, for example.

The Japanese began working on *VLSI* (very-large-scale integration) chips to cut the number of system microchips in an MSX computer from approximately 40 to about 6. The chips will be produced by the largest Japanese chip manufacturers. Once a VLSI chip is in mass production, increasing output will cost hardly more than increasing output of mass-produced chocolate chip cookies. Though Commodore and Apple computers also employ VLSI technology, the use of MSX VLSIs in computers produced by giant electronics companies worldwide will create enormous economies of scale in MSX production. Therefore, MSX computer prices will decline quickly.

In the rest of Asia, MSX produced an outpouring of low-budget creativity. Workshops in Hong Kong, Taiwan, and Korea had been producing illegal copies of the Apple II for years, selling them in local markets but looking to the day when they could produce computer products legally for an international standard. Many shifted to producing IBM compatibles, but many others looked to MSX as the standard that would enable them to produce for the Western computer consumer as they had for other consumers. They couldn't match the mass production know-how of the Japanese, and it seemed likely that all-purpose MSX computers and disk drives would be manufactured mainly in Japan for a couple of years at least. They could produce software, game controllers, graphics tools, and other add-ons extremely competitively, however. Perhaps they wouldn't acquire much distribution in the United States, for awhile, but they were on their way.

The MSX computers introduced in Japan in 1983 had one significant limitation in comparison to competing machines that had been introduced in America in 1985: their graphics capabilities. While significantly superior to the Commodore 64 and the IBM PC, MSX graphics still displayed only 16 colors, while the new Atari ST series displays 512. Worse, early MSX computers could only display 40 letters or numbers per line. That may be all an ordinary home television picture tube can handle, but since typists normally use about 60 characters or so per line, it meant MSX computers couldn't display a document as it would look when printed. Also, more home computer owners in the United States were buying special computer monitors to use with their machines so they could see everything the machines could display.

The MSX group sought to solve the video problem with a new graphics chip designed by ASCII, Microsoft, and Yamaha, and manufactured by Yamaha. The new chip could produce 256 colors (certainly as many as you need) and 80 characters per line, and best of all, would cost no more to produce than the old one. New computers with the chip, more memory, and other MSX-2 improvements were delivered in mid-1985. The new chip should be in virtually all the MSX computers sold in the United States.

MSX represents an unusual combination: a computer standard designed to be useful rather than to impress buyers with its technology; and a standard that's the result of years of planning but which nonetheless is fundamentally oriented to serving people in ways its builders can't yet define. When Sony, Panasonic, and other Japanese electronics companies showed MSX computers for the first time in the United States at the Winter Consumer Electronics Show in Las Vegas in early 1985, they stressed their commitment to MSX as part of the long-term home bus/Information Network System concept. Masao Morita, son of Sony president Akio Morita, spent most of the show standing next to a Sony machine and listening to computers' comments about what they would like to see it do. He emphasized its superiority to other home computers in traditional applications: more expandability, software compatibility, the maker's commitment to keeping the computers of the future compatible with the MSX of today, its excellent disk-drive storage capability, and excellent graphics.

Morita added, however, that he didn't really feel those justifications were adequate for a true home computer. "With the Commodore and Atari computers, they started out as game machines, and people said, 'What else can you do with them,' so they started to sell the applications you use in business," Morita said. "You look at the peripherals of the Commodore, Atari, or Apple computers, and they are the peripherals of business: a disk drive and a printer. But the peripherals of MSX are the videotape recorder, the laser disk player, the telephone. They are the peripherals of the home. The MSX computer will be the computer the homeowner uses in his everyday life."

Concretely, I asked, what would MSX do over the next few years in home entertainment? "I don't know. You tell me," Morita said. "It will take two or three years to figure out."

Morita said Sony engineers were working on ways of editing videotapes through the home computer, and pointed to Pioneer's spectacular laser-disk-based games in another corner of the booth. In the next hall, at its own booth, Matsushita/Panasonic was showing a "home of the future" with a computer monitoring security systems, linking with the video cameras that watched the front door, controlling utilities throughout the house, contacting outside information services through telephone lines, and controlling appliances when the owner was away. There seemed to be plenty of worthwhile applications for a home computer, but it was difficult to figure out which would be affordable, worthwhile, or widely used soon.

Chapter 3

Buying an MSX Computer

MANY of the best computer books warn you:

- ☐ Don't buy until you've studied computers.
- ☐ Choose your software first, then choose your hardware.

Unfortunately, these warnings give most home purchasers no help at all. Probably a key reason they're even considering a computer is so they and their families or friends can study computers firsthand. They probably know instinctively that they'll learn more about computers by sitting in front of a real one than from reading books or touring computer stores.

Moreover, the home computer buyer doesn't know exactly what software he wants. The lure of a home computer is its, at least potential, flexibility. You can enjoy dozens of activities with even the least efficient computer.

Yet the warnings are important; buy the wrong computer and you'll find yourself stuck. The computer may do what you want either poorly or not at all. An IBM PCjr or Apple *IIc* is difficult to expand with additional memory; an office-quality IBM PC handles most games poorly, an Apple Macintosh runs only a few hundred programs. When you've discovered the limitations of the computer you've bought, you're faced with the choice of either junking your investment or spending hundreds of more dollars on expanding even while you remain frustrated about the product's limitations.

MSX computers offer a partial solution to the

dilemma. Because MSX machines from one maker are largely compatible with MSX machines from other makers, and because they run products produced under the old reliable CP/M operating system, you can be sure that a wide variety of software will be available. Because the MSX is designed to make expansion easy, you can be sure that a wide variety of expansion devices will be available and will plug in easily. MSX computers offer superb graphics together with the ability to handle business programs almost as well as an IBM PC. Also, the companies making MSX computers are simply more reliable than the companies making most other home computers. Commodore dealers have reported they have to return as many as 30% of the machines they get from the company because of defects. We can expect better performance from brands like Panasonic and Sony.

Problems will still exist. Some business programs are produced exclusively for the IBM PC. Many games won't be available in MSX format at first. Some CP/M programs may not run as well on MSX machines as the computer's designers hope. Most companies producing MSX computers expect to offer special hardware add-ons that no other company produces; some may not work on other companies' machines without special adapters. When all is said and done, though, buying an MSX computer is still the safest computing investment you can make. The introduction of MSX computers means that for the first time you can buy a machine for as little as $200 or so and expect to continue using it for as long as you would normally continue using a television set or videotape recorder.

The problem in buying a home computer during 1983 or 1984 was: Do I want to buy a system I'll have to throw away after a few years? The problem in buying an MSX home computer today is: How do I make each home electronics purchase over the next few years work together to enhance my life? It's a very different, and much nicer, problem.

HOW TO GET STARTED

I suggest you acquire an MSX computer as soon as possible, but that you start with a small investment if you want to be cautious. If MSX computers aren't yet widely available in the United States, you need not put off buying a computer. Just be sure to buy a computer that supports one of the two standards MSX maintains some compatability with: CP/M or MS-DOS. Anything that's IBM-compatible is fine. A computer that runs MS-DOS but has 3.5-floppy disks to store information, such as machines from Hewlitt-Packard or Data General, for example, may be even better. (3.5-inch disk drives will be common on MSX machines.) The main point is to avoid creating a lot of data files in a format that the computers of the future probably won't be able to read.

When MSX computers are readily available, deciding what to buy may be difficult. If you know exactly what you want to do at home with a computer—word processing, or performing music, for example—you'll obviously want to find out whether you can afford to buy everything necessary to do what you want. If, however, you're unsure exactly what you want to do, look for a computer that offers reliability and the opportunity to do most of what you want with expansion products that are already on the market.

Start by at least skimming this book to the end. Then make a list of everything you think you'd like to do with a computer, and try to rank the items in order of their importance to you. Seek a computer that has the capability—with equipment that is already on the market today—to do most of what you want. Even if you can't afford the equipment to do everything, you can buy the computer itself and some basic additional equipment for perhaps $500. MSX guarantees you can expand your system later without worrying about compatibility as much as do owners of other machines.

As soon as possible, look for a computer user's group near you. Good computer stores can often recommend them. Many user's groups specialize in a particular computer; if you can't find a user's group that specializes in MSX, try to find a group specializing in the CP/M operating system. Although CP/M groups attract highly technical people, MSX is so CP/M compatible that it can run much of the free software that these groups will

have available. The technical expertise of these people will be useful to MSX buyers. Just be careful how many dumb questions you ask. User's groups vary enormously in how interested they are in helping beginners. It's usually a good idea to leave the techies alone when you think you could figure out an answer yourself.

BASIC EQUIPMENT

Suppose you're most interested in enabling your children to use the computer as a word processor for school reports (See Chapter 11). To do that you'll need not only a computer but also a printer, some word-processing software, and if possible a disk drive to store your data. All that will cost perhaps $900 or so. You could cut the initial investment down to about $700 by using a tape recorder at first, but getting word-processing documents out of a tape recorder can be almost as time-consuming as typing them by hand. You could, on the other hand, make your system work much better by purchasing a special two-color word-processing monitor for $130 or so.

Whatever your long-range plans, however, if you buy MSX-compatible products there's no reason you shouldn't buy the computer first, together with perhaps a tape recorder and a game or two—say, for Christmas— and then plan to buy the printer and word-processing software later, perhaps for someone's birthday. This approach has two advantages. First, you will undoubtedly learn a great deal in your first few months of computer ownership, and that knowledge may make you a better buyer when you shop for additional equipment later. Second, the price of the additional equipment you need may fall further before the birthday.

On the other hand, some manufacturers and retailers offer genuine bargains on "bundles" of equipment—a computer with word-processing software built-in, for example, or a computer plus a printer. You may decide to buy one of these package deals.

A BRAND-NAME GUIDE

If you plan to use your computer mainly for word processing, your choice is broad. Any MSX computer will run excellent word-processing software (though such non-MSX computers as the Commodore 64 will not).

If, on the other hand, your main interests include more exotic activities—say, music or the production of quality home movies on your video recorder—your first purchase should take account of what you want to do.

The following brand-name guide is designed to tell you various manufacturers' specialties and capabilities, to help you in your shopping. Any computer buyers' guide is obviously obsolete by the time you read it, and particularly for MSX computers. Though the makers have all worked out basic technology and manufacturing techniques, they are introducing new products all the time which incorporate new upgrades in MSX technology.

Thus I can't tell who will have introduced which new products by the time you read this. I can be sure, however, of who will be the leaders in several specialties for the next year or two. The following rundown of the major players can give you an idea which features you can find where:

- ☐ *Sony* appears to have sold more MSX computers around the world than anyone else. It invented the 3 1/2-inch disk drives which are the most common, most cost-effective method of storing programs and data when the computer is turned off. (More on storage devices later.) Sony has used the technology and design skills it developed to produce such products as the Trinitron television and the Walkman personal stereo to produce beautiful and (from all accounts) highly reliable all-purpose computers. It has also published an array of computer games. Sony also has a 'graphics ball' tool designed to help you create compute pictures. (See Chapter 8.) Some Sony engineers are working on a system that will help you edit Betamax format videotapes using your MSX computer; though it's not clear when or whether it will reach the U.S.

market. If you own a Betamax and you're fascinated with Betamax technology, it might be advisable to keep in touch with the MSX computers Sony is offering. Sony also seems most advanced in the development of compact disk/read-only memory (CD-ROM) technology and application (see Chapter 15).

- ☐ *Matsushita Electric*, with its Panasonic, Quasar, National, and Technics brand names, is the largest and most important consumer electronics company in the world, selling $16.7 billion worth annually. Without doubt it is one of the most reliable manufacturers anywhere. It has played a central role in developing the MSX standard, but so far it has been less aggressive in marketing its products worldwide than Sony. Matsushita seems principally interested in MSX as a computer system to control the home of the future. In Japan, it first showed a prototype of the computerized home based on a home bus system in 1979, and it continues to work on the concept. It has introduced a home security/appliance controller in Japan based on an older home computer, but no one at Matsushita is saying when it will introduce home control products to the United States. When it does, though, you can count on them to be reliable and functional.
- ☐ Matsushita owns 51% of *JVC*, the company which developed the VHS format in videotapes. JVC was first to build a superimpose adapter into an MSX computer for the Japanese market, designing it to superimpose graphics on VHS format videotapes. JVC's superimpose format is essentially the MSX group's standard; so you should be able to superimpose pictures from a JVC computer on tapes in a Betamax recorder, and pictures from a Pioneer laser disk on programs running in a JVC machine. At least for the first year or two, though, I'd be cautious. If I were anxious to superimpose graphics on VHS videotapes, I'd buy either a JVC computer or a Panasonic computer with a videotape superimpose adapter built in. All JVC computers I've seen to date have had the superimpose adapter built in, but if you're really interested in this capability, be sure to check that it's in the model you're buying. JVC also sells an adapter in Japan designed to give other computers the same superimpose ability that its own computer has, but it's not clear how available the adapter will be in the United States.
- ☐ *Yamaha* is one of a group of smaller, more entrepreneurial companies that are backing MSX and offering exciting add-ons. It has developed an extraordinarily powerful, yet cheap, digital music synthesizer built into many of its computers. These Yamaha machines (see Chapter 10) make music in ways you probably didn't even know could be done in a professional studio, much less at home. They work with Yamaha software and musical instruments—and with any other electronic musical instrument that has the industry-standard MIDI (musical instrument digital interface) built in. In Japan Yamaha sells an adapter for other MSX computers that includes its Yamaha digital synthesizer. It's such an appealing product that I can't imagine it won't be readily available in the United States. Yamaha also makes other general-purpose MSX computers.
- ☐ *Pioneer* laser disk MSX computer interface produces breathtaking graphics. It, or something very much like it, is likely to become standard in homes of the future (see Chapter 15). The Pioneer LaserVision videodisk format, which has beaten the formats of much larger competitors such as RCA to become the world videodisk standard, creates by far the best picture of any home video technology. Moreover, MSX computers can move quickly from one set of laser disk pictures to another anywhere

on the same disk, giving you the illusion of flying a spacecraft through an unbelievably detailed future universe, of investigating and solving a murder mystery in a real house, or of watching an educational lecture that changes depending on how you respond to questions. Unfortunately, however, you can't make your own recordings on the current generation of videodisk players.

- ☐ *Casio* seems to be using the technologies it developed for watches and calculators to cut the cost of its computers. In Japan it was the first company to offer an MSX computer for the equivalent of 125 U.S. dollars (Fig. 3-1) Casio's technology is excellent, but before you buy an inexpensive Casio MSX computer, be sure the company hasn't cut some corners you'd rather not see cut. Test the feel of Casio's keyboard and be sure the machine has enough MSX slots and connections to work with the peripheral products you want to use.
- ☐ *Sanyo,* a Japanese appliance maker just as large as Sony, has concentrated on graphics with its MSX computers. Its light pen is one of the leading MSX graphics tools. Although Sanyo makes many good products, its reputation for quality is not as good as that of some other Japanese manufacturers, and its products are therefore sometimes sold more cheaply than competitors' machines.
- ☐ *Hitachi Ltd.*, is the largest of Japan's "general good makers," with products ranging from generators to batteries. Hitachi products are known as solid and well-made, but its distribution system and the styling of its products are not always as alert as the distribution systems and styling of spe-

Fig. 3-1. Casio has designed some MSX computers for light weight and low manufacturing cost. They lack some of the features of more expensive models (courtesy of Microsoft Corp.).

cialist consumer goods makers. Hitachi has concentrated on portable MSX computers, and sells one in Japan that's also a portable stereo tape player.

- ☐ *Toshiba,* another general electrical goods manufacturer, has concentrated on power and expandability in its MSX computers. Toshiba was the first manufacturer to introduce an expansion unit that permitted the user to plug in more than two add-on MSX devices at a time. If you're anxious to use an MSX computer with a lot of add-on devices, you might want to take a look at what Toshiba has to offer (although by now products from Sony, Panasonic, and some other makers may be just as easily expandable as Toshiba's).
- ☐ *Philips* is sort of a European version of Matsushita. It's the largest consumer electronics company outside Japan, and the largest consumer electronics company in the European market. It sells its products in the United States principally under the Magnavox and Philco brands. It's not clear what brand names its MSX computers will carry in the United States, but Philips is committed to selling computers here, and its products are high in quality.
- ☐ *Spectravideo,* the Hong Kong company whose computers launched the whole MSX movement, is now featuring its low-cost local area network—a good way for schools and others who need to tie together several machines to get the power they need. Spectravideo machines may also be available at lower cost than other MSX products. Of course, since Spectravideo sales have been minimal in the United States up to now, there's no way of knowing whether a Spectravideo machine is as reliable as a Panasonic.

Other important makers which may ship MSX products to the United States in 1986 or later include the Japense companies Fujitsu, Canon, Kyocera, Mitsubishi, NEC, and Sharp. Each one is a large, reliable manufacturer, even though some are not well known in the United States.

The giant Korean conglomerates Gold Star, Samsung, and Daewoo are also seeking distribution for MSX products here (Fig. 3-2). Generally Korean quality today is better than the average United States customer gives it credit for being. The label "Made in Korea" is about as good on a product as "Made in U.S.A.," though not as good as "Made in Japan." The Koreans, however, don't yet have the know-how to manufacture the 3 1/2-inch disk drives which will be the standard MSX data storage medium. So watch out for MSX computers with inferior substitute "quick disk" drives. I'll discuss them in greater detail in the next chapter.

Many lesser-known MSX manufacturers hope to distribute their products in the United States under American brand names, such as those of Sears or Montgomery Ward or possibly ATARI. Of course, more manufacturers may have joined the group by now.

PLANNING FOR YOUR NEEDS

Buying a home computer after the introduction of MSX machines is like buying a hi-fi system 20 years ago. The quality is improving constantly; everyone's machines have different features, and there's an emergency industry standard that enables components from most industry companies to work with components from most other companies producing machines that work only with their own devices. If you buy a good-quality product, it will give you years of excellent service. If it supports MSX standards, it can eventually be made to work with most other products from most other manufacturers, though perhaps with some difficulty.

If you're anxious to use a specific feature, you are well-advised to buy as much of your equipment as possible from a maker who supports that specific feature. If, however, you buy, say, a Toshiba computer and you later decide you want to use your computer to edit videotapes, you can be confident that the equipment will exist to let you do so.

In addition to compatibility with specific ap-

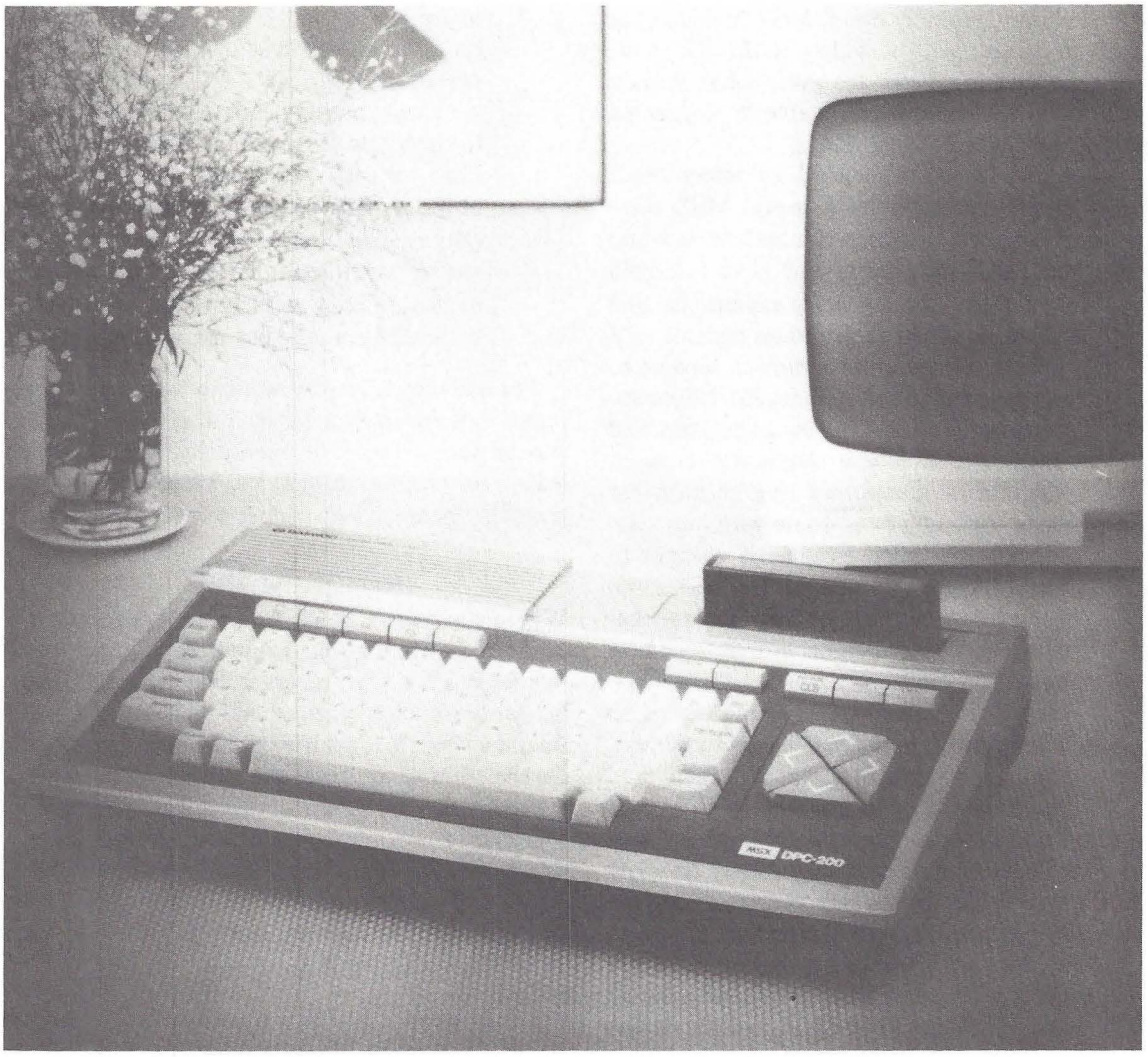


Fig. 3-2. Versions of the MSX computer from Daewoo may appear under other companies' brand names (courtesy of Microsoft Corp.).

plications in which you're interested, you should look for several important features when shopping for MSX computers. You want:

- ☐ A computer that supports MSX-2, including the capability of displaying 80 characters per line of text and 256 colors. Most MSX computers sold in the United States should meet this criterion, but some specialized machines will support only MSX-1 and some left-over, obsolete computers may be shipped to North America, too. They'll work fine and produce data you can use with the newest computers, but they won't run the latest programs well, if at all.
- ☐ At least 64K (64,000 bytes or characters) of random access memory (RAM) usable by programs plus 64K of video RAM used to manage the display. All MSX-2 computers meet these criteria; MSX-1 ma-

chines generally don't. MSX-2 video chip requires 64K of video RAM to work. MSX-2 machines are even better if they have 128K of RAM usable by programs and 128K of video RAM.

- ☐ A printer interface and as many MSX "slots" as possible. A useful MSX computer needs at least a printer interface and two expansion slots. The slots will hold game cartridges, memory expansions, and connections for such add-on devices as a disk drive to store programs, a modem to connect with the telephone, etc. IBM computers come with five expansion slots, and many owners claim that's not enough. Most MSX computers I've seen so far come with only two—some with only one. Though it's much easier and cheaper to buy an expansion unit for an MSX computer than for an IBM, it seems to me that computers should come with at least four slots. You can't make one slot serve many functions. If you pull anything out of an MSX slot while the machine is turned on, you'll cause your program to "crash" and you'll lose all your data.
- ☐ A port to connect the machine with the kind of television or monitor you will be using and the kind to which you would like to upgrade. I'll discuss connecting MSX with an ordinary television, with a monitor that has a composite video port, and with an "RGB" (Red-Green-Blue) monitor in the next chapter. Be sure you get a computer that connects easily with the kind of display you want to use.
- ☐ An RS-232 port. This is the standard plug for connecting computers with modems (devices link them to telephone lines). It also hooks computers to other computers and to some specialized devices.
- ☐ A clear set of instruction manuals. No doubt many people will buy this book because they find themselves owning a computer whose manuals say it is easy to use, but which say nothing else clearly. I'm trying to substitute for good manuals as much as I can, but really there is no substitute. Look at the instruction manuals that come with the machine before you buy it. Some Japanese companies provide excellent manuals—Sony and Panasonic are usually better than most—but many do not.

In addition, you may want to look for a computer with a built-in 3 1/2-inch disk drive. You're sure to want a disk drive eventually, and having at least one built-in is simpler, easier, and quite possibly cheaper than adding one one later.

WHERE TO SHOP

Where you buy an MSX computer is generally no more or less important than where you buy your television set or video recorder. The computer itself is a fairly standard product, and (unless you buy an unknown brand) it's fairly unlikely to break down. On the other hand, if you can find a good computer specialty store it may be worthwhile to spend a few extra dollars to buy your computer there. Then when the computer seems broken down (because you haven't understood the rather complex directions you had to follow to make it do something you wanted it to do), you'll know you have someone to turn to for advice.

Even if you buy your computer at a discount toy store, as many people do, it's a good idea to seek out a good computer specialty store which carries MSX machines. Good specialty stores are rare, but in exchange for their slightly higher prices, some give good advice on both software and hardware, even software and hardware you bought somewhere else. Just be prepared to pay the higher specialty store prices on at least some of your purchases.

Chapter 4

Building a System

UNFORTUNATELY, most of the fun you'd like to have with your computer can't be done with the computer alone. Buying a computer today is rather like buying a dog: dog food will cost you a lot more than the animal himself. Although continuing dog food expenses don't add value to the dog, however, additional equipment adds to the value of an MSX computer. If you choose equipment wisely, you'll have a constantly growing system that continuously improves your life.

PERIPHERALS TO BUY AT THE START

It may seem unfair that companies who are seducing you into buying a computer with prices perhaps under $200 can't produce good add-on devices for $40 to $50, but printers and disk drives inherently cost a lot to produce compared to a computer. The computer is a collection of mass-produced chips. Expensive full-featured appliances from video recorders to microwave ovens actually contain fairly sophisticated computers already built in to them. A good computer includes less that's inherently expensive to produce than a television set (which is why a good computer now costs less than a good television set.)

Computer memory devices and printers, on the other hand, are much harder to manufacture. A disk drive—the best kind of large-scale, permanent memory for storing programs, data, and documents today—is similar in principle to a record player: data is recorded all over the disk, and the drive's "read/write head" can reach all over the disk just like the record player's needle can reach to any point on a long-playing record. The cheapest disk drive needs the precision of the finest Swiss watches, however. To locate data when you ask for it, the disk's surface must move at the speed of an

airplane, and the head must stay a distance from the disk comparable to the thickness of a human hair. Like prices for the precision components in videotape recorders, disk drive prices will continue to decline as the Japanese apply mass production know-how, but disk drive manufacture remains a difficult process.

Similarly, a printer's head must stand up to millions of hammerings against paper. Even if you use your computer relatively in frequently, you will find that you print far more with your computer printer than you could ever type on a typewriter. Probably the only products you own that face greater punishment are the pistons and a few other components in the engine of your car.

You'll certainly want to own a disk drive and a printer. In addition, most people will eventually want game-playing joysticks and a *modem*—the device that connects your computer to your telephone to let you communicate with information services and other users. Someone in your family will eventually want a music synthesizer, a laser disk player with accompanying interface, or both. All that means you'll probably need an expansion unit to create enough slots for your computer to be connected with so many products. If money is tight, though, you don't need more than an MSX computer, a tape recorder, the cable to connect the recorder to your computer, your own home television set, and a couple of games or other pieces of simple software to get started.

You'll soon tire of using a tape recorder with your computer. To store and retrieve information on a tape recorder, you must wind the tape to the approximate location you are seeking, issue commands to both the recorder and the computer, and then wait for a fairly slow, sometimes unsuccessful, process of loading. Loading from a disk requires little more than typing a simple command and normally takes only a few seconds. A tape recorder, however, may be adequate for your first months or even years with a computer. You may be able to use an old recorder you have around the house, and even if you must buy a new one, it can cost as little as 1/4 the price of a disk drive.

TAPE RECORDERS

Can you use a recorder that's sitting in a closet at home? Probably. While companies like Commodore often seem to have chosen their method of communicating with tape recorders specifically to force you to buy a new recorder or interface from them, the MSX group knows that for the long-run development of the home electronics business, it's better to make communication with a tape recorder as easy as possible.

Most home cassette tape recorders will work as long as they've got three standard jacks, labeled:

- ☐ REM, or REMOTE.
- ☐ EAR, or EARPHONE.
- ☐ MIC, or EX MIC, or MICROPHONE.

The recorder should be monaural, not stereo, and should have a "counter" mechanism that tells you how far you are into the tape. Most tape recorders sold within the last decade or so have these features (sometimes labeled slightly differently), but some older recorders don't, and some recorders have jacks which don't work reliably. Jacks labeled "Line in" or "Line out" will normally do nothing useful with an MSX computer. I'll discuss how to load and save programs with a tape recorder in Chapter 7.

Don't buy a special tape recorder for recording programs unless you're certain you have no tape recorder at home that will work with an MSX computer, and you're sure you can't afford a disk drive. The average home cassette recorder may be inferior in some respects to tape recorders designed especially for recording computer programs, but even the best program recorders are frustratingly slow and will sometimes fail to load or save a program accurately. Think of a tape recorder, if you decide to use one, as a temporary expedient—it's something you'll use until you can afford something better. I found that the "remote" plug from the MSX computer I had brought from Japan early in 1984 wouldn't fit snugly into the jack on my tape recorder. But when I held it there with my thumb, the recorder worked fine to load and save pro-

grams. If you have a similar experience, I don't advise you to go out and buy a new tape recorder. Wait till you can afford a disk drive.

If you do buy a tape recorder especially for use with a computer, you should in principle seek an "intelligent" tape recorder—one that knows how to find files with little more fuss than a disk drive requires. The electronics to provide this kind of intelligence costs only a few dollars. I own an Epson HX-20 computer with this kind of tape recorder built into it.

Unfortunately few computer manufacturers—Japanese or American—have built much intelligence into their recorders so far. The electronics in most "computer tape recorders" closely resembles the electronics in ordinary audio tape recorders.

QUICK DISKS

Some manufacturers have introduced a product called a *quick disk,* which isn't very quick, at least by disk-drive standards. Quick disks operate much faster than tape recorders but hold much less data than real disk drives and can't rapidly move from one sector of a disk to another. The inability to move quickly from one sector of the disk to another may not seem like a big problem in principle, but it prevents you from ever using many powerful programs designed to work with ordinary disk drives' rapid access times. It's not clear whether quick disks will ever be marketed in large numbers in the Unites States. If they are, my guess is that they'll be a reasonably good deal if they sell for about half the price of a disk drive, if you really need to buy something new to store your programs and data, and if you can't afford a real disk drive that runs the disk operating system MSX-DOS. In other words, they're a reasonable alternative to a tape recorder, but nothing more.

Unless you're sure you're getting a good, intelligent tape recorder or a very good deal on a "quick disk," either use a tape recorder you've already got at home, buy a very inexpensive tape recorder, or skip the use of a tape recorder entirely and go directly to a disk drive. Don't spend a lot of money on anything less than a true MSX-compatible disk drive. Ultimately, every home that has a bookcase will also have at least one disk drive, and MSX' compatibility standards mean you can buy a disk drive with the confidence that it won't quickly become useless.

REAL MSX DISK DRIVES

Choosing an MSX disk drive is like choosing any major appliance—there are differences between various manufacturers' units, but the main questions are whether you're getting the size and power that's appropriate for you, whether you trust the brand, and whether you are getting a good price. True MSX disk drives come in at least two formats: 3 1/2 inch and 5 1/4 inch.

The 3 1/2-inch disk drives will probably predominate and will give you more convenience and storage capability for your money. Although both 3 1/2-inch and and 5 1/4-inch disk drives are called *floppy disk drives* because the material they record on is flexible, the 3 1/2-inch disks come enclosed in hard plastic which reduces the danger of damaging the magnetic disk inside. It's important to own a 3 1/2-inch disk drive because a good deal of MSX software is likely to be distributed on 3 1/2-inch disks.

Most business computers use 5 1/4-inch disk drives, and if you want to take advantage of the MSX' unusual ability to communicate with office computers, you'll eventually want to look for a 5 1/4-inch disk drive. A word of caution, however: as I'll discuss in Chapter 9, merely owning a 5 1/4 inch disk drive won't enable you to work with non-MSX machines, even though MSX machines are more compatible than any others you can buy. See Chapter 9 and talk with the owner of the computer with which you'd like yours to communicate before spending money on a 5 1/4 inch disk drive.

Whatever size disk drive you buy, try to get a double-sided one, which will allow you to put at least 320,000 bytes (characters) on a disk. They may cost more than drives that will only write on one side of a disk, and it may seem that the 160,000 bytes or more which single-sided disks record

would be adequate (160,000 bytes is equivalent to about half the information in this book), but every consumer I know who's bought a computer system with single-sided drives has regretted it.

Disk drives need the disk operating system MSX-DOS in order to work properly (see Chapter 9). Be sure to allow for the cost of the disk operating system in your budget. If you can buy a disk drive or computer with MSX-DOS included in the price, you're likely to get a good deal.

HARD AND HIGH-DENSITY DISK DRIVES

Although they're unavailable as this is written, companies expect to introduce several kinds of MSX-compatible disk drives that will store a great deal more information than today's floppy disk drives. The two technologies closest to market are hard disks and high capacity floppy disks.

Hard disk drives, which use a hard, usually nonremovable magnetic disk, are widely used in office computer systems. There's no technical obstacle to linking hard disks to MSX computers, and some (probably small) manufacturers will certainly be selling MSX-compatible hard disks. I would avoid buying them unless they had been specifically approved by the MSX group. The group is currently working on standards for high-capacity media including hard disks, and there's a real danger a hard disk you buy before major manufacturers like Sony introduce theirs will quickly ecome obsolete.

High-capacity floppy disk drives have been introduced by several manufacturers, notably IBM, over the past year, and MSX manufacturers are exploring several technologies for these machines. IBM's high-density floppy disks hold four times as much data as standard floppy disks. I've heard of high-density floppy formats which would hold as much as 25 times as much data as today's floppies—about as much as a hard disk. Watch developments in the high-capacity floppy disk business: they'll eventually provide good value in data storage. Other data storage technologies, such as read/write laser disks, also bear watching. As I discuss in Chapter 15, you're sure to want increasingly more digital storage capacity as more home entertainment is digitized.

At first I wouldn't worry about high-capacity storage media. You'll need at least one floppy disk drive that can handle today's standard 3 1/2 inch disk format because most software in the United States is likely to be distributed in that format for the next few years at least. You can waste money buying high-capacity storage devices before standards have been set and prices have fallen. So be cautious.

TELEVISIONS AND MONITORS

You can use the cheapest black-and-white television to monitor what your computer is doing. You can even play the most sophisticated of computer games on it. If you do, though, you'll miss a lot.

There's little reason for most people to buy a new computer monitor when they buy an MSX computer unless they know exactly where and how they intend to use it. All MSX buyers do need to think about two questions:

- ☐ What TV or monitor will I use my computer with initially?
- ☐ When I buy another TV or monitor, what kind do I want?

You need to worry about these questions because the MSX standard supports three different kinds of monitor interfaces, and few MSX computers come with more than two of them built in. In order of increasing quality, they are:

- ☐ An RF (radio frequency) modulator is usually simple to use: you can just attach the wires from the RF port of the computer to the screws where you would normally attach the antenna to your television. The problem is that the picture quality is generally mediocre. You won't be able to display more than 40 characters per line with great clarity on a television, and there are a lot of programs which work better when you can display more than that, and

some that won't work at all unless you can.

- ☐ Composite video output resembles the output from an RF modulator, but instead of being translated into radio frequency to be received through the antenna leads of a television, it is transmitted directly through a wire to a jack. There's less interference and a higher quality picture. To handle this kind of input, the television should have separate jacks to receive audio and video. All televisions should be built with these jacks today. They add little to manufacturing costs and in addition to being useful with computers, they are also useful with videotape recorders, laser disk players, etc. The fact is, however, that many televisions lack this feature, and if yours is one of them, you can't use composite video output with it. Composite video output quality is a big improvement over RF output quality, but it's far from perfect. A good monitor television can produce a much clearer color picture with composite video than with RF, but a straight white line is still likely to be tinged red and blue. This situation is annoying and can give you a headache when you're trying to work with numbers or words. If you do a lot of serious writing or analysis of data, running a two-color monitor from the composite video port—an amber-and-black or green-and-black display—will make work a lot easier without the expense of an RGB monitor.
- ☐ RGB output can control each dot on the television screen separately. With an RGB connection, the computer can draw a white line on a color display and have it come out pure white. RGB is the wave of the future and is extremely helpful if you're trying to process a lot of data on a color monitor. RGB monitors are, however, a good deal more expensive than other kinds of monitors today, and unfortunately, manufacturers have yet to agree on standards for RGB monitor output. The RGB plug from one manufacturer's MSX computer (or other device) may not be compatible with another manufacturer's RGB monitor.

Any display device creates its images in the form of dots, and neither the number of dots a conventional television picture uses nor the sharpness with which the picture tube locates them equal a professional-quality monitor's sharpness. Most MSX computers are built to be easily connected to a television and to make best use of the fairly blurry pictures a conventional color television provides. When the computer is processing words and numbers, that means displaying only 40 characters per line, rather than the 80 characters per line business computers display. If you want to run software that was originally designed for businesses, you must get a monitor which can show an 80-column display without ruining your eyes.

Thus, although you don't need to buy a monitor when you buy your MSX computer, there are a lot of reasons why you may want to own one or even two. (I use an amber-and-black monitor for word processing and a color monitor for games.) If there's only one television in your house, you'll probably want to buy a special monitor or monitor television for your computer fairly soon. The family can't possibly get maximum use from the computer if it's set up in the living room and you have to shoo everyone away from the television set every time you use the computer. If you plan to do much serious work with the computer, consider an amber-and-black or green-and-black display. The price is reasonable—perhaps $130 or so. Two-color monitors can deliver much more sharpness much more easily from a standard composite video port.

PRINTERS

The other computer component which virtually all computer owners want is a printer. Printers probably have traveled farthest down the cost cycle of any computer-related product. When I first got into computing in the long-ago days of 1983, a $1200 printer was considered inexpensive, and a large share of the printers on the market were made in America. Today the overwhelming majority of

printers are made in Japan, and you can get an Okimate printer for $250 or so.

An MSX computer will work with all printers that have a Centronics compatible parallel interface—a type of plug on the back which most, but not all, printers have. MSX computers may not use all the features of a printer properly unless the printer is specifically sold as an MSX-compatible printer because in printers, as in so many aspects of computing, there were few standards until the MSX group appeared. Dozens of printers are sold to work with IBM computers, and they look for a half a dozen different—and conflicting—codes to tell them when to print such things as bold face. A printer which is said to be an MSX printer should reliably produce all kinds of text for you.

You should know about three main types of printers (Fig. 4-1):

- ☐ Thermal printers are least expensive. They work by slamming a flat printhead either directly against special paper or against a special printing ribbon. Electrical currents running to each of dozens of dots on the printhead heat up a letter-shaped area. The printhead can either create a letter directly on the special paper by heating the paper, or produce images on ordinary paper by heating up the special ribbon and melting ink off it. Okimate-series printers are thermal printers, and can print color as well as black ink. The main disadvantages of this cheap technology is that the special thermal paper turns yellow more quickly than ordinary paper; so you wouldn't want to use it for work you need to keep for the rest of your life. Thermal ribbons, on the other hand, are notoriously short-lived. You may need to buy a new thermal ribbon every 20 pages or so. Thus if your printing needs are heavy-duty, a thermal printer is not for you.
- ☐ Daisywheel printers are most like conventional typewriters. They contain a wheel with metal or plastic letters on it which creates impressions by striking a ribbon. Good daisywheel printers create the best looking text—exactly like the text that comes out of an office IBM Selectric typewriter. Quality daisywheel printers, however, can be slow and cannot generally produce computer graphics. I think most home computer users get better deals today in thermal or dot-matrix printers, but a daisywheel printer may be important if you do business at home and must impress clients.
- ☐ Dot-matrix printers have a printhead consisting of a series of several dozen pins which hammer against the ribbon. Dot-matrix printers can handle graphics well, but they don't print quite the same quality of text as daisywheel printers. Nonetheless, some dot-matrix printers in the $300 to $450 range now produce remarkably good correspondence quality print by going back and forth over a line up to four times. If your printing requirements are heavy duty, a dot-matrix printer with a good correspondence quality mode, such as the Panasonic 1091, is a good deal.

JOYSTICKS

You may consider yourself too dignified to want game-playing joysticks for your computer. I recommend you look for some, but don't be in a hurry to spend money to buy them unless you can get them very cheaply. The reason is that MSX computers are fully compatible with the joysticks that were provided free with Atari and Coleco game players over the past few years, and the chances are quite good that you have a friend who has an old Atari or Coleco game player in a closet (Fig. 4-2). Assuming they still work, you can simply plug the old joysticks into your new computer.

Fully MSX-compatible joysticks have two "fire" buttons, both important in playing some MSX games. Amazingly, some manufacturers are selling joysticks for MSX with only one fire button. I fear they are only the first of a wave of "MSX-compatible" products from low-cost Oriental manufacturers that won't deliver the full utility of true MSX products. If you've never heard of a

shows output typical of an inexpensive dot-matrix printer or a medium-priced dot-matrix printer in high-speed "draft" mode.

Middle sample shows output from a medium-priced (approximately $400) dot matrix printer in "correspondence quality" mode.

schedules through CompuServe, the nation's largest provider of videotex services. The TWA database includes approximately 100,000 pairs of cities and three million different fares.

Fig. 4-1. Three kinds of computer printer output. The top sample shows the output typical of an inexpensive dot-matrix printer or a medium-priced dot-matrix printer in high-speed draft mode. The middle sample shows the output from a medium-priced (approximately $400) dot-matrix printer in correspondence quality mode. The bottom sample shows the output from a daisywheel printer. Thermal printers (no sample shown) vary considerable in type quality, but all must either print on heat-sensitive paper or use short-lived thermal ribbons.

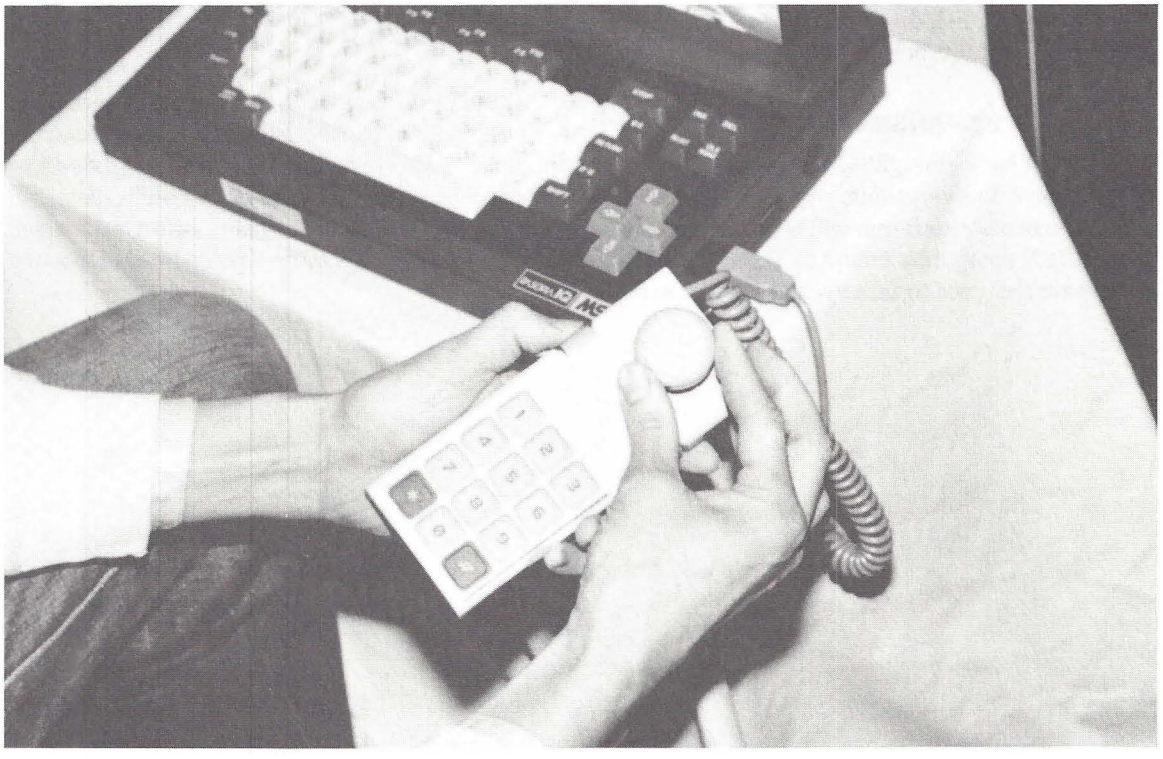


Fig. 4-2. A Coleco joystick can be readily used with an MSX computer, although the number pad will not function.

manufacturer, beware when it offers you MSX bargains, and don't buy MSX joysticks with only one fire button.

CHOOSING YOUR FIRST SOFTWARE

Computer games are by far the easiest software with which to work; so it's a good idea to bring at least one home with your machine. You're in for a frustrating time on Christmas morning if you put a computer under the tree and don't add anything you can do with it. Struggling to learn programming using the computer's manual isn't anyone's idea of Yuletide joy. I'll discuss a few MSX-compatible games I like in the next chapter. A classic game like Pac-Man may be a good choice for starters, or try a typing tutor game if anyone in your family doesn't already know how to type.

All software packages should say on them exactly what computer equipment they require to run. If a package says "For MSX computer with 64K, disk drive," for instance, you know that you can't use it without a disk drive. Be sure to read this information carefully before buying software.

EXPANSION UNITS

If you don't have enough slots on your MSX computer to plug in everything you've bought, you'll need an expansion unit that will provide more slots. A few MSX computers (some of Toshiba's, for instance) are designed to take special expansion units that won't work with any other MSX machine. Most expansion units, however, simply plug into a regular MSX slot and convert it into two or more slots. Be sure you get the kind of expansion unit that's compatible with your computer.

OTHER HOME LIFESTYLE COMPONENTS

Other tools you'll want to consider for your home include:

- ☐ A tool to create graphics on your computer, which I'll discuss in Chapter 8.
- ☐ A music synthesizer and keyboard, which I discussed when I mentioned Yamaha, and which I'll say more about in Chapter 10.
- ☐ A modem to connect your computer to telephone lines, which I'll discuss in Chapter 14.
- ☐ A laser disk interface unit, which I discussed when I mentioned Pioneer, and which I'll discuss in greater detail in Chapter 15.

I think interface units for videotape recorders are still fairly experimental right now. Eventually we'll all make our home movies on videotape recorders and use MSX computers to edit them, but that day is still a few years off. Get started cautiously with MSX today. You'll be glad in a few years.

Chapter 5

Setting Up and Playing Games

SETTING up a computer system involves the same potential frustrations and dangers as setting up a component audio or video system, plus a few more created by the likelihood that your system will expand enormously over the next few years. Your computer probably has 6 to 10 jacks on the back and sides designed to connect it with a monitor, a printer, a speaker or two, joysticks, and possibly other items (Fig. 5-1). Connecting can be difficult if you're as accident-prone as I am. Even figuring out where to put the system can be difficult. If you have a den with a television in it, that may be an ideal location for your first computer, but not everyone does.

HOOKING UP TO A MONITOR OR TELEVISION

Your first step is to link your computer to the monitor or television set you want to use with it. You can play cartridge-based games with just the monitor and the computer itself. Thus you'll be able to do things as soon as the machine is connected, if you want. A monitor will also let you test every other connection as it's made.

If you're using an ordinary television set with your computer, you need a computer with an RF (radio frequency) output jack, or you need an RF adapter. Hooking up is usually simple. The cable from the RF jack can be attached directly to the screws where you would normally attach antenna wires. To minimize interference, the computer may come with a switch box to which both the antenna leads and the RF leads can attached. You slide the switch when you want to change from using the computer back to using the television.

If you have a video recorder or laser disk

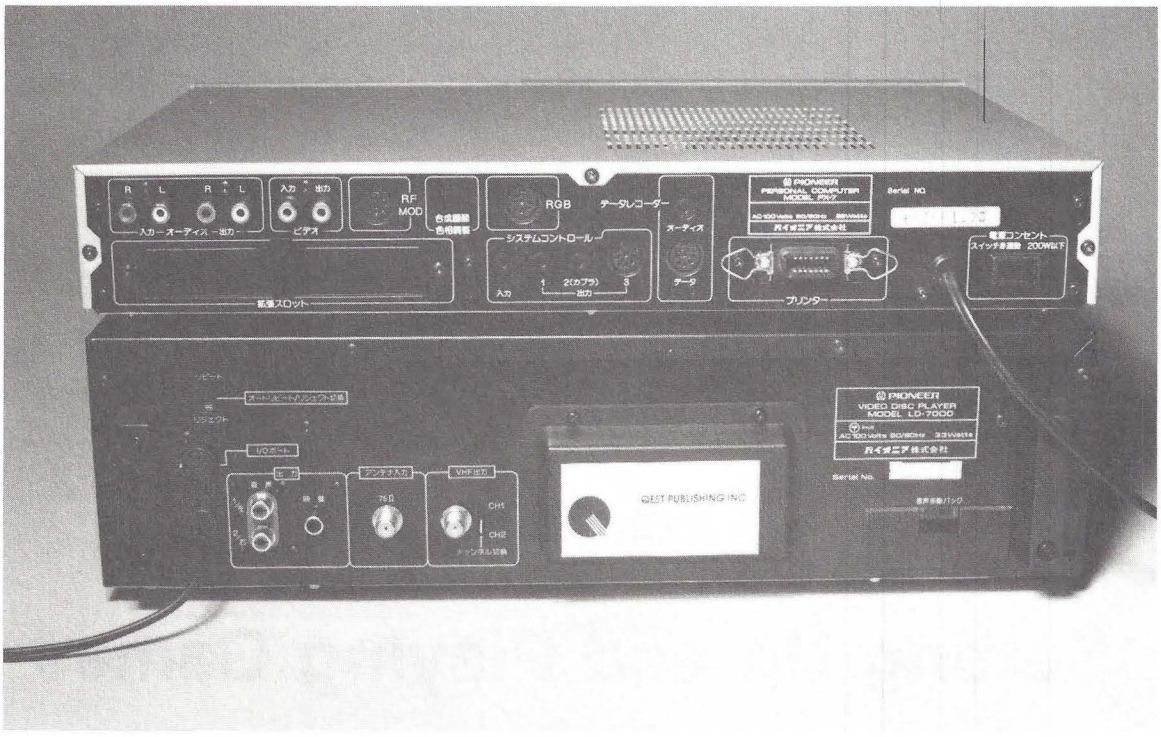


Fig. 5-1. The backs of a Pioneer computer (top) and a Pioneer laser disk player (bottom) illustrate the complexity of connecting a computer to everything with which you'd like to use it (courtesy Qest Publishing Co.).

player, you may already have a box like this on your set. Possibly you'll have to set up one switch box to lead into another. This may give you a maze of crummy-looking, hard-to-operate switches, but the only solid alternative to that is to upgrade to a monitor television. Even some monitor televisions don't have enough video inputs to cope with all the gadgets people would like to plug into them.

Hooking your computer to a coventional television set can become really complex if you have a cable TV connection screwed directly into the back of the set. If you do, you'll need a conversion box sold by your computer or electronics store. You unscrew the Cable TV cable from the back of the set, screw the cable into the conversion box, attach the wires from the computer to the conversion box, then screw a cable from the conversion box into the back of the television where the cable TV wire was originally attached.

A computer with an RF jack will have a switch on the back which allows you to select on which television channel you want to receive the computer's output. Choose whichever is unused in your area. If you have cable TV using Channel 3 and there's a local station on Channel 4, it may still be worthwhile to set the switch to Channel 4. Occasionally cable TV will interfere with both channels the computer is equipped to use. If so, you may have to unscrew the cable TV lead from the converter box when you are using the computer.

If you plan to use a computer monitor or a monitor television, on the other hand, you can probably just run a cable from the composite video or RGB jack on the back of the set to the monitor. The kind of wire needed will depend on the monitor and the computer; make sure you get the right one.

Planning for the Best Possible Sound

If you are connecting your computer to a television through an RF jack, the computer sound

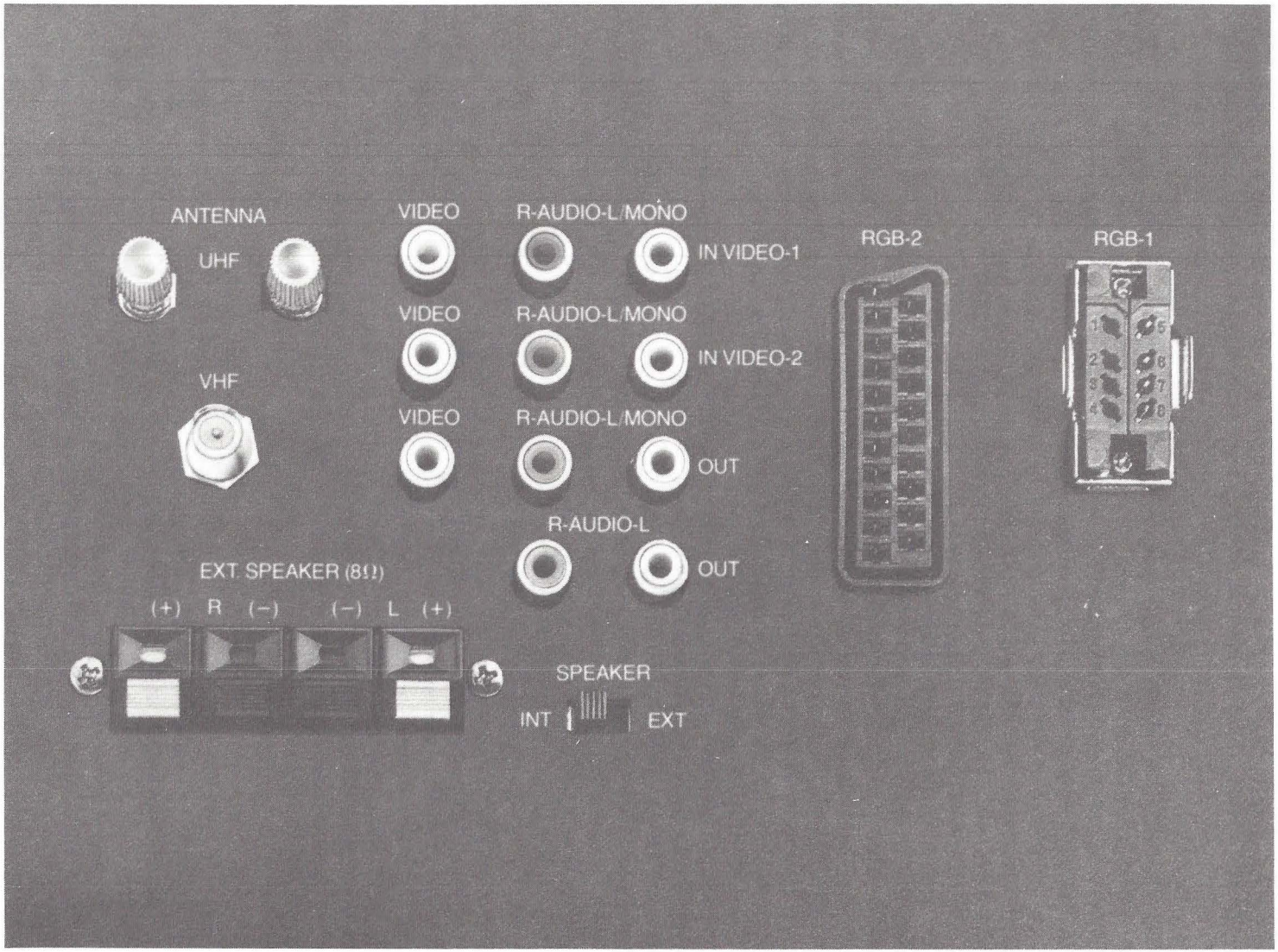


Fig. 5-2. A sophisticated Toshiba monitor television accepts composite video input (the jacks labeled video) and also two different types of RGB input (courtesy Calet, Hirsh & Spector, Inc.).

should come out of the television's speaker automatically. You still should consider connecting your computer's audio jack to a good hi-fi amplifier. MSX computers can produce excellent music, even without add-on devices, and there's no reason to waste the sound in your TV's tiny speaker.

If you're using composite video, you must run a wire from the computer's audio jack to a speaker, either in the monitor or elsewhere (Fig. 5-2). The best video monitors have both an audio "in" and an audio "out" jack. Thus you can run a cable from the audio jack on the computer to your monitor and use the speaker in the monitor most of the time, yet also have in place a cable from the audio "out" jack on the monitor to a jack with a label like AUX on your audio amplifier. Then when you want you can turn on the amplifier and hear the computer's output through your hi-fi system's speakers.

Some MSX computers have two-channel audio jacks—one for the left and one for the right speaker of a stereophonic system. I would recommend running the wire from one channel through the video monitor, and the wire from the other directly to the stereo amplifier. This may cause some loss of fidelity, but in fact there's not much software that requires great fidelity these days except software that uses Yamaha's digital synthesizer and Pioneer's laser disk interface. If you have these, you might want to run both wires directly to the hi-fi amplifier.

If your computer's manufacturer didn't supply enough cables for all the connections you'd like to make, you can get cables easily at most electronics supply stores. All the plugs used to connect the audio ports on MSX computers to the outside world are a type first used many years ago by RCA, and are thus called *RCA plugs.*

Testing Your Hookup

Now you can turn the computer on and see if everything is hooked up properly. When the computer is turned on, it takes a few seconds for it to do a bit of internal housekeeping and get ready to work. For a while a simple message such as "MSX Version 2.0," will appear on your screen. (See Chapter 6.) If your machine doesn't produce anything on your screen within 10 seconds of the time you turn it on, check first to be sure your TV is tuned to the channel the computer is using. Also make sure everything is plugged in and any "computer/TV" switches are set to "computer." If you are using a monitor television, you may have to set a complex array of switches to get the output you want.

After a few seconds, the display will change. If nothing is plugged into your computer's slots, the new display will read:

MSX BASIC . . .

You can now test the hookup of your computer's sound. If you type in **BEEP,** and a carriage return, the computer should beep. You can produce a slightly more interesting sound by typing in exactly the following characters:

PLAY "FFFCDDC" <return>

If you don't get sound, try turning up the volume on your television or monitor and making sure that all connections have been made correctly.

NOW THE FUN AND GAMES BEGIN

All you need to run most cartridge games is the computer itself and a television or monitor, so when you get the computer and the TV or whatever connected, you might want to take a break to play a game or two. If you haven't bought your games yet, there's an introduction to computer games at the end of this chapter.

A few seconds into its warm-up routine, your machine will check to see if anything is plugged into any of its slots. Many MSX-compatible products plugged into slots, including programs and disk drive interfaces, contain information for the computer that tell it what to do at this point in starting up. Most game cartridges will tell the machine to start running the game program, which will probably display a sample of the game, then a menu from which you must type some information if you want to start playing. The menu for the game "An-

tartic Adventure" from Konami, for instance, reads:

PLAY SELECT
1. key Play with JOYSTICK
2. key Play with KEYBOARD

If you type nothing, the computer will go back to showing a sample of how the game works. It's a good idea to let the sample screens run for a while the first time you turn the computer on with the game plugged in. They can provide useful information while you read the directions on the game box. Generally you can type the characters requested by the menu at any time, even if the menu isn't displayed, in order to start the game.

SETTING UP A PRINTER

Finding a suitable location for a printer can be a serious problem because the printer needs an appropriate path for paper to feed in. Even good printers can jam fairly easily when you print more than five or six continuous pages of paper, as you almost certainly will want to do.

Linking the computer to the printer is very simple, however, as long as the printer has a Centronics-compatible parallel interface, your computer has a printer jack, and you have an MSX-compatible printer cable. If you have trouble linking up the two, it's probable that either you have one end of the cable upside down, or your dealer sold you the wrong cable. If you get the cables plugged in, you can test the hookup by turning on the computer with nothing in any of its slots, turning on the printer (it should make a noise), and pushing the printer's "on-line" switch.

If your dealer doesn't have MSX-compatible cables, go to any dealer that handles NEC computers and get the cable sold for NEC's "lap" computers. It works fine.

You can test the printer from BASIC by simply typing:

LPRINT "TEST TEST TEST"

and ending the line with a carriage return. The printer should print out "TEST TEST TEST." If it doesn't, check to be sure you've followed the manufacturer's directions in unpacking and setting up the printer, and check to be sure that everything is plugged in and turned on.

I usually find that when a printer, modem, or other piece of hardware doesn't work, it's usually because I've forgotten to turn something on, or some plug has fallen out of a socket.

SETTING UP OTHER PERIPHERALS

If you're going to use your computer with a cassette recorder, you'll want to read Chapter 7 as soon as possible. While you don't need to know much about BASIC programing to use your computer with plug-in cartridges or with a disk drive, coping with a tape recorder and with programs that must be loaded from cassette tape involves learning a few BASIC commands. A cable from a cassette recorder plugs into a special cassette tape port on most MSX computers. I'll discuss using it in Chapter 7.

Joysticks plug into special joystick ports on most MSX machines. Other devices plug into your computer's slots. Hooking them up is easy. I'll discuss actually using them in later chapters. If you've bought a disk drive, you'll probably want to read Chapter 9 right away to learn how to use it.

CHOOSING COMPUTER ENTERTAINMENT

Some folks think computer games went out with the downfall of ATARI Corporation in 1983. These are the same kind of people who thought the computer industry had passed its peak when in the 1950s UNIVAC, its original leader, got into trouble. Most of them haven't played the best of today's computer games.

The world contains a lot of dumb computer games, and any new format like MSX attracts an unreasonable share of software publishers who either think the public will buy garbage because theres a shortage of software for the new machine or who are trying to break into the computer business and simply don't know how to produce good games. Computer games, however—or perhaps I should be broader and say "computer entertain-

ment," because most of the best programs aren't properly called games at all—are clearly a new art form, which when fully developed is likely to be as important as movies.

Unfortunately, as long as only a few MSX computers are sold in the United States, many of these products may not be released here. Infocom, for example, showed the following games in MSX versions at the January, 1985, Consumer Electronics Show in Las Vegas. It notes, however, that the products won't be available for MSX in the United States "until a viable market emerges." Moreover, none of these games currently support MSX-2's superb graphics capabilities.

Here are a sample of recommendable games available now or soon for MSX computers, starting with games as simple as hopscotch and moving to highly complex "simulations" which show just what the computer can do:

- ☐ *Antarctic Adventure* (Konami). You guide a penguin in an effort to skate around Antarctica. That may sound silly, but a feeling of speed skating gives this game strong appeal. In Antarctic Adventure, as in most MSX games, you can choose to use either the keyboard or joysticks; if you don't have joysticks to guide the penguin and make him speed up after he has climbed out of a crevice in the ice, you use the keyboard's *cursor keys*—the arrow keys on the right side of the keyboard—to make him do those things. The button on the side of the joystick makes the penguin jump—over crevices, for instance. If you're playing from the computer keyboard, the space bar can do the same thing.
- ☐ *Pac-Man*. The classic adventures of a hungry little blob that gobbles little dots and dodges enemies in a maze. Like Antarctic Adventure, it's hard to pin down exactly why this game is so addictive, but it is.
- ☐ *Pitfall II* (Activision). An excellent underground adventure in color, in which you swim a lake, collect gold, and dodge scorpions, etc. Many games which promise you such opportunities force you to spend an inordinate amount of time figuring out what you're supposed to do and struggling with controls which stubbornly refuse to do it. Those difficulties beset the player of Pitfall II from time to time too, but not so much as to make the frustration outweigh the fun. Generally Pitfall II is a challenging, fun adventure.
- ☐ *Beam Rider* (Activision). An outer space shoot 'em up distinguished by excellent graphics. I personally can enjoy shoot 'em ups much more easily than sports simulations where you must control a baseball team or a decathelon champion from the computer keyboard. That's why there are no sports games on this list; your tastes may be different. This game is one of the most interesting and challenging shoot 'em ups I've seen.

These are all cartridge games. Cartridges contain 16,000 bytes or more of computer read only memory. Producing cartridge-based games involves essentially manufacturing a custom computer chip; so it's a fairly capital-intensive activity. Also, 16,000 bytes, or even the 64,000 bytes in the unusually complex Pitfall II, are far less than the amount of programming that a designer can put in a floppy disk-based game. The next two programs illustrate what a computer programmer can do with a disk drive, and the limitations he faces when he tries to keep his program on a cartridge.

- ☐ *Flight Simulator* (Sublogic). In early 1985, Sublogic was trying to figure out how to deliver its best-selling simulation to MSX users. The program, originally written for Apple computers with disk drives and translated to Atari and Commodore formats, and to IBM format by Microsoft, gives you a realistic opportunity to fly an airplane all over the United States and even dogfight with World War I flying aces. If it is delivered on cartridge, Sublogic chair-

> west
Living Room
You are in the living room. There is a doorway to the east, a wooden door with strang gothic lettering to the west, which appears to be nailed shut, a trophy case, and a large oriental rug in the center of the room. Above the trophy case hangs an elvish sword of great antiquity. A battery-powered brass lantern is on the trophy case.

> take sword, lantern
sword: Taken
brass lantern: Taken.

> turn on lantern
The brass lantern is now on.

> east
kitchen

> climb stairs
Attic
This is the attic. The only exit is a stairway leading down.
A large coil of rope is lying in the corner.
On a table is a nasty-looking knife.

> take rope, knife
rope: Taken.
nasty knife: Taken.

> go down
kitchen

> west
Living Room

> lift rug
The rug is too heavy to lift, but in trying to take it you have noticed an irregularity beneath it.

> move the rug
With a great effort, the rug is moved to one side of the room, revealing the dusty cover of a closed trap door.

> open the door
Which door do you mean, the wooden door or the trap door?

> the wooden door
The door cannot be opened.

> the trap door
You used the word "trap" in a way that I don't understand.

> open the trap door
The door reluctantly opens to reveal a rickety staircase descending into darkness.

> climb down
(down the stairs)
The trap door crashes shut, and you hear someone barring it.

Cellar
You are in a dark and damp cellar with a narrow passageway leading north, and a crawlway to the south. On the west is the bottom of a steep metal ramp which is unclimable.
Your sword is glowing with a faint blue glow.

> go north
The Troll Room
This is a small room with passages to the east and south and forbidding hole leading west. Bloodstains and deep scratches (perhaps made by an axe) mar the walls.
A nasty-looking troll, brandishing a bloody axe, blocks all passages out of the room.
Your sword has begun to glow very brightly.
The troll swings his axe, but it misses.

>

Fig. 5-3. A script from the adventure Zork. The user typed in commands in ordinary English at the > prompt (software courtesy Infocom, Inc.).

man Stu Moment tells me you'll probably need not only the cartridge but also a cassette tape with a program that must be loaded into memory while the cartridge is in the slot. It's much easier to simply use the game on a disk drive, as I do regularly on my IBM-compatible.

- ☐ *F16* (Nexa). This flying simulation is now distributed on cartridge, but in cramming the program into cartridge, Nexa had to leave out the most thrilling parts of flying: takeoff, landing, and the scenery below you. The current version is essentially a sophisticated shoot 'em up. You dogfight fairly realistically with enemy pilots. The neatest twist about *F16* is that you can link together two MSX computers and dogfight one computer operator against another. You need two computers and monitors to do it, but it's an interesting experience. There may be a disk version of F16 later which will add more of the thrills of real flight.
- ☐ *Zork I, Zork II, Zork III, Deadline* (Infocom). These disk-based games sound dull. They're all text, no graphics, but they've been on software best-seller lists for years. Infocom's products combine true literary talent and a sophisticated natural language interface to give you a true sense, at least when you're making progress, that you are freely participating in an adventure. In the Zork series, you're exploring a great, haunted underground cavern. In deadline, you're trying to solve a mystery. The natural language interface was one of the first products of artificial intelligence research to find its way to personal computers. You simply type what you want to do into Zork in ordinary English. It's far from perfect—Zork will often tell you it doesn't understand—but it's far more involving than maneuvering with a joystick.
- ☐ *Star Fighter, Astron Belt* (Pioneer). These games require a laser disk player and laser disk interface, so you're obviously not likely to be playing them as soon as you set up your computer unless you bought your computer from Pioneer. I mention them here just to suggest you should try to get a look at them, even in a store, for a sense of what computer games can be. The laser disk truly enables the enemy space ships to look as though they are about to leap out of your monitor at you.

A note on games for children: most of these games are tough to appreciate until a child is 8 to 10 years old. Antarctic Adventure and Pac-Man are exceptions, but even they can be frustrating for younger children, particularly if they see how much better you are at the games than they are. I try sharing duties with my 6-year-old daughter in playing Antarctic Adventure. I operate the arrow keys, while she makes the penguin jump with the space bar. That works pretty well, but if you have young children, you may also want to take a look at a version of LOGO (see Chapter 11) and at one of the depressingly small number of good games specifically aimed at younger age groups.

Chapter 6

How MSX Machines Work

IF you have an MSX computer hooked up to a television or computer monitor at home, turn it on. If you don't have one, turn on another computer or even a pocket calculator; all computing machines work in roughly the same way.

If you turn on an MSX computer with no extra devices attached to it, after a few seconds you'll see a large display of the letters MSX, followed by a copyright notice that looks something like this:

```
MSX System
Version 2.0
Copyright 1984 by Microsoft
```

Then a few seconds later, the screen will change and you'll see:

```
MSX BASIC 2.0 . . .
```

What's happening inside the machine? If you understand a few simple actions a computer takes as it starts operating, you'll have gone a long way to understanding how a computer works in general. Although you don't have to understand how a computer works to operate one, it's worthwhile to know about the basic operation of the machines because you'll be spending a lot of time with them over the next few decades. Many potentially mystifying problems you'll have with computers will be a lot easier to solve if you know a bit about what's going on. For people with computer experience this chapter will be largely a review and an introduction to some of the specifics of MSX design (Fig. 6-1).

THE MICROPROCESSOR HEART

The heart of any microcomputer or pocket

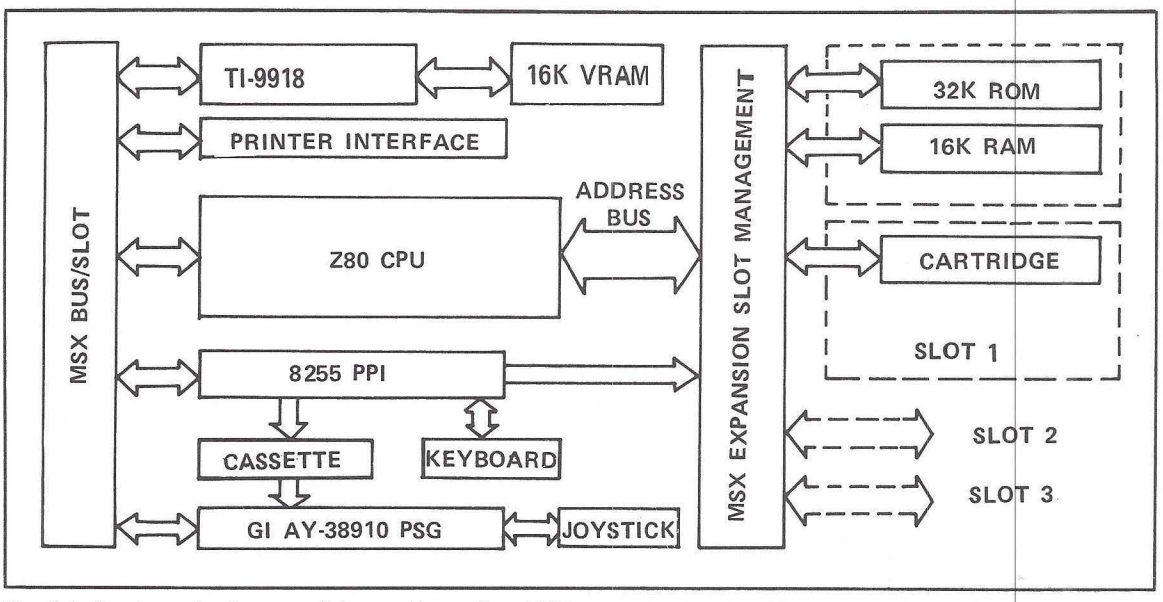


Fig. 6-1. A schematic diagram of the workings of an MSX computer (courtesy Qest Publishing Co.).

calculator is a small piece of silicon with incredibly tiny circuits etched on it. It's called the *microprocessor*. In many MSX computers the microprocessor may be combined with other important circuits such as those that control the sound on a single very-large scale integration silicon chip.

Microprocessors are designed to accept instructions from computer programs and execute them. Because a piece of silicon can't understand any human language, the programs must send instructions to the computer in the form of electrical pulses known as *bits* of data. It's traditional and very helpful in understanding how the computer thinks, to conceive of the electrical pulses which the computer receives as either ones or zeros. When computers were first invented, technicians had to learn to think in ones and zeros themselves. They had to translate their numbers and commands into a form like:

100010000110000111010101

The strings of ones and zeros were first divided into bytes of eight bits each. In other words, the string could more easily be read as:

10001000 01100001 11010101

The computer would know which numbers indicated commands and which indicated data to be acted on by their order.

After a few years of this foolishness, somebody decided it would be easier to understand what a computer was saying if it were translated into something more like what humans can read and speak. The bytes were translated into *assembly language*, cryptic little letters and numbers that correspond to particular strings of zeros and ones. Assembly language could be entered into the computer, and an assembler could translate it into ones and zeros the microprocessor could understand.

Microprocessors in computers are designed to be extremely flexible and to handle tasks in very small pieces. Their commands don't deal with specific tasks you and I would like to accomplish in our daily life. The Z80A microprocessor in MSX computers will accept some 160 commands. They include a command to add two numbers, but most deal with such functions as manipulating memory within the computer. To perform such actions as creating a letter on a television or computer monitor, the microprocessor must work with other com-

puter circuits and also with programs that show it how to do what we want done by using the 160 or so commands the microprocessor directly understands. A computer language like BASIC, which you can learn a bit of in Chapters 7 through 10, is itself a sort of program. When you issue a command in BASIC, such as "PRINT," the BASIC interpreter program built into the computer explains to the microprocessor in machine language how to do exactly what you've requested.

The Z80A is an 8-bit microprocessor. That means it processes one 8-bit byte of information at a time. What the microprocessor lacks in intelligence, it makes up in speed, however. It can process hundreds of thousands of bytes every second, and still you'll sometimes complain it's too slow.

Who'd want to handle more than a hundred thousand bytes per second in the home? You would, especially when you realize that a simple action like sorting through a recipe file can require that millions, tens of millions, or hundreds of millions of bytes of machine-language instructions be processed.

READ-ONLY MEMORY

All computers have two kinds of internal memory, and can handle several different kinds of memory devices outside themselves. The first kind of internal memory is *read-only memory* (ROM), which essentially consists of computer programs etched in silicon. When you turned on your computer, the first step it took was to read some of the read-only memory and follow the instructions in it. The instructions told it to communicate with another collection of circuits in the computer called the video display processor and write "MSX System," etc., on the screen. If you turned on another computer or a pocket calculator, the process was similar.

After that, the built-in start-up program launched a series of checks, including checks to see what was plugged into the computer's slots. If extra random access memory or interface devices were plugged into the slot, the computer would prepare to make use of them. If a cartridge game (which is itself a source of read-only memory), a disk drive, or other items designed to take control of the machine were plugged in, the internal program would set up an operating environment then hand control over to the other devices so they could load programs into the machine. If you had nothing plugged in that is supposed to take control, then control passed to another section of read-only memory within the machine, the BASIC Interpreter.

When the BASIC interpreter is ready to operate, the video display processor is told to display the screen that starts with the words, "MSX BASIC 2.0 . . ." From that point, the BASIC Interpreter controls the microprocessor, and every time you end a line you typed by hitting the Return key, the interpreter will try to either execute it as a command in the language BASIC, or if the line begins with a number, store it as part of a program. If you type a line that does not begin with a number but that is not a valid BASIC command, the computer will respond, "Syntax error." In other words, "You must have made a mistake somewhere."

RANDOM ACCESS MEMORY

Inside the machine, programs which aren't written in ROM are stored in a vitally important blank-slate piece of silicon called *random access memory*. When information is stored in RAM, the computer can access it in microseconds. The more RAM a microcomputer has, the more powerful it is. Most MSX computers will probably be sold in the United States, at least initially, with 64,000 bytes (often referred to as 64K) of RAM and an additional 64,000 bytes dedicated to managing the video display. MSX computers can be expanded to handle more random access memory than most other popular microcomputers—1 megabyte.

RAM amounting to 64K is equivalent to about 30 pages of typed, double-spaced text, and it is fine for most home applications today. Many business programs, however, require 256K or more. As programmers try to make a computer do more, they need random access memory to keep data readily available. By 1990 the ability of today's MSX computers to keep more than 1,000,000 bytes—enough

data to fill a small encyclopedia—in memory won't be especially impressive at all.

KEEPING TRACK OF THE WORLD OUTSIDE

One other aspect of the MSX' workings deserves mention: the computer's ability to recognize and keep track of any compatible devices plugged into it. An incredible array of devices are or can be designed to plug into MSX slots on your computer. MSX machines have a complex set of circuits, called a *slot management system*, to recognize what's plugged in and to direct signals to the proper part of the computer. MSX-compatible devices, in turn, have a small amount of read-only memory. During the power-up sequence, the computer's own ROM program checks each slot to see what's in it. The computer then stores this information in its random access memory and can make use of all the devices for as long as it's turned on.

Apple II and IBM computers have similar, though more difficult-to-use, slot systems. Generally, however, you're encouraged to leave installation of new devices in the slots to a professional computer dealer. The Apple *II*c, the portable Apple designed to be sold by mass merchandisers, doesn't even have expansion slots, even though these were one of the most useful features of older Apple IIs, Apple II+s, and Apple *II*es.

In addition, MSX computers have a sophisticated *interrupt system*—the microprocessor and associated software check regularly while running a program to see if any other messages are in memory, seeking attention. That means programmers can relatively easily create a program that will run together with other programs in your MSX computer, design devices that will operate together with the MSX computer, or link MSX computers in networks.

Many Apple, Commodore, and Atari computers lack powerful interrupt systems. The IBM PC and compatibles have one, and it's one of their most important features. I regularly run three programs at once in my IBM: the word processor on which I write books like this one, a program that watches whether I've touched the keys in the last minute or so and turns off the screen to prevent it burning out if I go away for a cup of coffee, and a program that controls output to the printer so that I can go back to writing while an article prints. You will be able to do the same on your MSX, although it's not clear how soon the software will be available that will enable you to do so easily. Perhaps more important, your MSX has the power to monitor your home security system while your children do their homework, or can easily (by computer programming standards) be networked with an array of appliances and other MSX computers to help you run your whole life.

YOU CAN DO ALMOST ANYTHING WITH SOFTWARE

When the BASIC Interpreter is running, the operation of an MSX computer is fairly straightforward--not always simple, but straightforward. When you push certain buttons with the BASIC interpreter running, certain things will happen. I'll discuss the BASIC interpreter in some detail in the next few chapters.

Remember that everything about the way the computer works can be modified if the proper software is loaded into the computer's random access memory. Your software controls what the microprocessor, and therefore everything else in the computer, does. When you're entering programs in BASIC, for example, the DEL key on the upper right-hand corner of the keyboard will delete the letter under the *cursor*, the blinking box on the screen. When other programs are loaded in memory, the Delete key may delete lines or whole paragraphs. A software program can even tell the microprocessor to print a "Q" on the screen when the "A" key is pressed on the keyboard.

Thus you can see how the versatility of software gives computers their power. Because software totally controls the machine, it can be designed to do anything. You can also see, however, how the versatility of software can make computers hard to use. Learning and exploiting the power of each new piece of software is a new challenge. When you understand a bit about how the machine works, however, it's a fun challenge rather than a chore.

Chapter 7

Commanding Your Computer in BASIC

YOU don't need to understand programming to enjoy an MSX computer. Though many introductory computer books devote enormous space to programming in BASIC, I suspect that's just because many low-priced computers just aren't interesting enough for the authors to fill a whole book about them. That's certainly not true about MSX.

I don't spend a lot of my time programming, and I don't recommend that you become a serious programmer unless you think you'll enjoy it. Even if you do learn a lot of programming, you may not want to concentrate on MSX BASIC, which is a dialect of Microsoft BASIC.

A computer language called LOGO is graphics-oriented, which makes it ideal for young children, and easier to use for some adults as well. Other languages such as Pascal and C are more commonly used for serious programming. Some applications software (spreadsheets, for example, which I'll discuss in Chapter 10) contain commands that make them extremely flexible, yet easier to use, than computer languages for such purposes as budgeting and printing invoices. I've spent a lot more of my own time developing special ways to use my spreadsheet program than I have spent programming in BASIC. Thousands of serious computer users, especially fans of LOGO and Pascal, and even of other dialects of BASIC, despise the commitment to Microsoft's version of BASIC that introductory computer books often implant in people.

Everyone should learn at least as much about how BASIC works as I'll teach you in this and the next chapter. Microsoft BASIC is by far the most common computer language for nonprofessionals, and one of the most powerful and easy-to-use ver-

sions of Microsoft BASIC in the world is built right into every MSX computer. Thus the BASIC that comes with your MSX will probably be a standard language for writing home software; certainly you'll find that much of the free or inexpensive software you'll be able to get will be written in BASIC, and you'll be much better able to cope with the problems that frequently exist with free software if you understand even a little bit of how BASIC works.

Also as computers become more important in society, you'll find you understand what's going on better if you know a little bit about how to tell them what to do. Don't believe people who say computers will become so easy to use that no one will bother learning programming. Computers may someday become smarter than people, but every respected computer specialist I've met agrees that they'll always think very differently from people. Understanding a bit of programming will be crucial to understanding computer psychology.

This chapter is designed to teach you just enough about BASIC programming to help you make your computer work for you. It is designed to supplement, not replace, the manuals describing BASIC which all MSX manufacturers are expected to provide. I've seen some of these manuals in Japanese and in English, and they are a substantial improvement over manuals for many competing computers. Most of them, however, don't make it easy to get started, which is what most MSX buyers will need. I want to try to do that here. A bit of knowledge of BASIC will help y you communicate with your computer, and also with other computer owners. (If you own a disk drive, however, you may find it more useful to read Chapter 9 before reading this chapter and the next.)

IF YOU'RE AN EXPERIENCED PROGRAMMER

If you already know how to program in BASIC, don't skip this chapter entirely. Be sure to read the sections on "function keys in MSX BASIC" and "The MSX BASIC Program Editor." Also note some of the special graphics and music features of MSX BASIC I'll introduce in Chapters 8 and 10.

Note that where MSX-BASIC 1.0 and 2.0 differ, this book is presenting MSX-BASIC 1.0 except where I state otherwise. Since BASIC 2.0 is highly compatible with 1.0, virtually everything discussed here will work on all MSX machines sold.

WHAT IS A COMPUTER "LANGUAGE?"

In Chapter 6 we peeked inside the computer and saw a microprocessor frantically processing ones and zeros. I said that the ones and zeros are code for instructions and data which the computer program wants processed; each eight-bit "byte" means something to the computer. I showed how strings of ones and zeros are often translated into the easier-to-understand form of instructions in assembly language.

Assembly language, though easier to handle than strings of ones and zeros, is still hard to work with and often an enormous waste of time. In a large program that handles a lot of mathematical computations, who wants to write over and over again the assembly language routines to divide two numbers? To make life easier, computer programmers have designed dozens of higher-level languages, of which the BASIC your computer understands is one. A language like BASIC can perhaps best be thought of as a big program made up of a group of little programs. When you enter a statement like **PLAY**, for instance, you activate a series of instructions in machine code that tell the microprocessor what to do play whatever musical notes follow.

MSX BASIC consists of more than 100 such commands, many of which can do a wide variety of things, depending on how they are used. To be a good programmer, you have to learn much more than just the meanings of the 100-plus commands. You also must learn a good deal about syntax; that is, about what can be done with the various commands individually and together.

BEGINNING TO COMMAND THE COMPUTER

When you turn on a standard MSX computer with nothing plugged into its slots (Fig. 7-1), the computer will automatically go into a state which is called BASIC immediate mode or direct mode. If

Fig. 7-1. The keyboard of an MSX computer (courtesy Yamaha).

you hooked your computer to a television or monitor as described in Chapter 5 and turned it on, you were in immediate mode. It's called immediate mode because if you type in a command, the computer will attempt to execute it immediately. Thus, if you typed in:

PLAY "FFFCDDC" <RET>

as I suggested in Chapter 5, the computer immediately attempted to play those music notes, which are first seven notes of "Old McDonald Had a Farm." If you had the computer properly connected to a television or monitor with a speaker, you heard the notes through the speaker. If the line had been entered with a number in front of it, the BASIC interpreter would have considered it part of a program, and you would have heard nothing until you typed, **RUN.**

Remember three points as you begin to command the computer:

- ☐ Computers, even those that are relatively easy to use, are extraordinarily fussy. They often won't do what you tell them unless you get your command exactly right. Thus be sure you type in the commands shown here exactly as I show them. Later, as you begin to understand how BASIC works, you can vary the commands slightly to see what happens. Ultimately, you want the computer to be an extension of your mind, but for now you have to spend some time learning to think like the computer.
- ☐ The first commands I'm introducing—PLAY, PRINT, and LPRINT—require quotation marks to make the computer play or print what you're typing in.
- ☐ If you make a mistake, the MSX BASIC screen editor will always let you backspace over the error and fix it. You can also move around the screen using the *cursor keys*, the keys with the arrows on the right side of the keyboard. The screen editor also gives you a number of other nifty capabilities, which I'll get to in a moment.

In addition to PLAY, you can experiment with the PRINT and (if you have a printer connected) LPRINT commands from immediate mode. If you type:

PRINT "MY NAME IS GEORGE" <Return>

the words "MY NAME IS GEORGE" will appear on the next line of the screen. The PRINT command prints whatever you ask on the screen, not on any printer you may have hooked up.

If you have a printer hooked up and you want to print something on it, you have to use the command LPRINT, which is short for "line print." Type:

LPRINT "MY NAME IS GEORGE" <Return>

and "MY NAME IS GEORGE" should appear on the printer. If it doesn't, check to be sure that everything is turned on, plugged in, and connected properly.

MSX BASIC lets you perform one really useful function from immediate mode: math. If you type in:

?2+2 <Return>

the computer will immediately print "4."

Subtraction works the same way. So do multiplication, division, and exponents, except that instead of using the conventional multiplication, division, and exponent symbols (which aren't easy to write from the computer keyboard), the computer uses for * multiplication, for / division, and ^ for exponents.

Try:

?4*132 <Return> (four times one-hundred-and-thirty-two)

And:

?132/4 <Return> (one-hundred-and-thirty-two divided by four)

And:

?4&^3 <Return> (four cubed)

From immediate mode you can also solve problems involving square roots (SQR), sines (SIN), cosines (COS), tangents (TAN), logarithms (LOG), and conversions to binary (BIN), octal (OCT), or hexadecimal numbers (HEX). These work just slightly differently from the previous examples; you must enclose the number being evaluated in parentheses. Try:

?log(32) <Return>

You can also perform more complex calculations from immediate mode. Try:

?4*(log(30)+4)/13 <Return>

Remember a couple of rules similar to the rules of elementary algebra:

- ☐ The computer always does jobs enclosed in parentheses first, then those outside them.
- ☐ Next it does multiplication and division.
- ☐ Finally it does addition and subtraction.

Thus:

?4*3+4 <Return>

is different from

?4*(3+4) <Return>

Also note that to the computer the number zero is completely different from the capital letter O, and the number 1 is completely different from the small letter l. Some people learn to mix these up in typing classes. On the computer, you must type the numbers with the upper row of computer keys and the letters with the other rows.

WRITING REAL PROGRAMS

Immediate mode is interesting and sometimes useful, but it can never let you use anything like the full power of the computer. The computer's power, after all, is its speed, and you can never type in commands nearly as fast as the computer can work.

The computer recognizes a line of true program in BASIC using a simple test: all lines of real program must begin with a number. The computer stores the programs in memory and executes the lowest line numbers first, regardless of the order in which they were typed.

Most programs put the computer to work by using *loops*, instructions which tell the computer to do the same thing over and over until some condition is met. The simplest looping command, which you can use to write a real program of sorts, is the GOTO command, which simply tells the computer to go from the line it's currently executing to some other line. Here's a real program you can type into your computer:

```
10 PRINT "My name is MSX"
20 GOTO 10
```

This program will make the computer print "My name is MSX" over and over on the screen until you tell it to stop.

When you've loaded a BASIC program into memory, whether you do it by typing the program in or by loading it from a tape recorder or disk drive, you must type **RUN** followed by a carriage return to start the program operating.

Try running the simple little GOTO loop, either by typing in **RUN** with a carriage return or by simply hitting the F5 key.

You can halt a BASIC program by pushing the STOP key on the computer, but pushing Stop halts a program only temporarily. A second push on the STOP key will start the program running all over again.

To stop the program completely so you can do something else with the computer, use the Control key, a key which operates much like the shift key on the typewriter, but which computer programs generally use for special functions. You'll find the Control key on the left side of the keyboard.

Holding down the Control key and at the same time pushing the STOP key will send a Break command to BASIC. The program will halt, and you'll receive an "OK" prompt, which means that BASIC is ready for more input. The program will still be in the computer's memory until you either turn the machine off (which erases everything in RAM) or type:

NEW <Return>

You can try modifying the GOTO program by changing the material inside the quotation marks to whatever you want (Try, "Help, this computer is out of control"). Your computer will print whatever is in the quotation marks over and over again.

LISTing a Program

You can learn exactly what's in the computer's BASIC program memory by typing **LIST** followed by a carriage return. If you type **LIST** followed by a line number or a range of line numbers, 100-500, for instance, the computer will LIST just the line numbers you've indicated.

Function Keys in MSX BASIC

MSX computers provide special function keys labeled "F1 F6," "F2 F7," "F3 F8," etc., to make it easy to enter common commands with a keystroke or two. RUN is F5 when you are in BASIC's immediate mode. The input you'll get by typing F1 through F5 are shown on the bottom of the MSX screen:

COLOR AUTO GOTO LIST RUN

If you hold the shift key down you'll see a different set of input you can get from function keys F6 through F10. Don't worry about the meaning of any of these commands you don't understand for now.

You can change any of these function key assignments for the duration of any program session by using a KEY statement from direct mode. The KEY statement consists of the word KEY followed by the number of the function key you are assigning, followed by a comma, and then the string you want assigned to that key. (If, however you input quotation marks or a carriage return, the BASIC Interpreter will understand them as the end of the string rather than as characters you want to make part of the string.) Here's the command to change function key 3 to input PRINT.

KEY 3, "PRINT" <Return>

Note to experienced programmers: You can add quotation marks or a carriage return to a function key definition by specifying it with the CHR$ function and the appropriate ASCII code. The following command sets F3 to PRINT.

Key 3, "PRINT" + CHR$(34)

The MSX BASIC Program Editor

Unlike many BASIC interpreters, MSX BASIC gives you highly powerful program editing capabilities. If you make a mistake in a program, you can easily edit a line and reenter it.

In MSX BASIC, as in most versions of BASIC, you can replace any line stored in memory by typing a new line that has the same number. You can erase a line stored in memory just by typing the line's number with nothing after it but a carriage return.

This way of modifying programs can be difficult, however; so MSX BASIC, like IBM BASIC, allows additional ways of editing programs. Here's a summary of some major features:

- ☐ Full cursor control. By using the arrow keys on the right side of your computer keyboard, you can move the cursor anywhere on the screen.
- ☐ Ability to reenter a line without retyping it. Anytime a line is displayed on your screen, you can edit any part of the line and then push <Return>. The newly edited line will be entered in memory. If, for example, you realize a line now in the computer's

memory needs a minor change, you can simply use the LIST command to make the computer print out the current version of the line, move your cursor to the point where the change is needed, make the change, and push <Return>. The newly revised line will be entered into the computer's memory.

- ☐ Insert mode. Move the cursor to a point where text needs to be inserted and push the INSERT key. You'll be able to insert the text at that point without writing over any old letters.
- ☐ Advanced cursor movements with control keys. By holding down the Control key at the same time you touch a letter key, you can move the cursor in the following ways:

—Control B—cursor to the start of the previous word.

—Control F—cursor to the start of the next word.

—Control K—cursor to the upper left (sometimes called the HOME) position on the screen.

—Control N—cursor to end of the current logical line.

There are other features of the BASIC screen editor, but these are the ones I find most helpful.

CALL Statements

MSX BASIC also allows programs on read-only memory plugged into any MSX slot to be called up with a CALL statement:

CALL LD <Return>

for example, will call up the program that controls a Pioneer laser disk if a laser disk interface is plugged in.

Input And "IF-THEN" Statements

Now you know almost enough to write some useful programs. Next, I'll show how INPUT and IF-THEN statements work. I'll use those statements to write a simple "quiz" program that's of no use at all, but may be fun. You can also, if you like, use the INPUT, PRINT, GOTO, AND IF-THEN statements to write a program to do any repetitive calculations which are important around your house or business.

An INPUT statement prints a question mark on the screen, then waits for someone to type an answer on the keyboard. For example:

```
200 INPUT; A
210 INPUT; B
220 PRINT A + B
RUN
```

This program will put a question mark on the screen, then wait for you to type a number, which it will save as "A." Then it will print another question mark, wait for you to type another number, and save it as "B." With an Input statement, you must hit the Return key to tell the computer you've finished typing each number. When you hit the Return key the second time, the PRINT statement (line 220) will tell the computer to print the result.

Question marks alone, of course, become confusing to the person who's doing the inputting. BASIC, therefore, allows you to type some words in quotation marks after the word *INPUT* to tell the person using your program what to do. The previous program should be modified to read:

```
200 INPUT"Please enter a number";A
210 INPUT What number would you like
added to it?"; B
220 PRINT "THE ANSWER IS";
230 PRINT A+B
RUN
```

Thus the complete format of a typical INPUT statement is:

INPUT "(whatever you want displayed on the screen)"; (the letter, name you want to assign to the number inputted)

Don't forget to use the semicolon, and be sure

not to enclose it within the quotation marks. The grammar of BASIC often differs dramatically from the grammar your third-grade teacher taught you, and this is an example of a key difference.

IF-THEN and IF-THEN-ELSE statements work much as you might intuitively expect. The best way to learn to use them is to see them in action.

A HUMOROUS "QUIZ"

The following program asks a series of silly multiple-choice questions and in turn gives you some silly answers. Try typing it into your machine.

You'll probably find it won't work perfectly at first because you'll make some typing mistakes, but I'll discuss in the next section how to find and fix them. You may want to type it in a little at a time and run each portion as you finish it. Unlike many BASIC programs, this one will run in parts. You can try typing lines 100-380 and running them, then adding, in succession, lines 400-570, lines 600-800, lines 1000-1170, lines 1200-1360, and lines 1400-1620.

It makes no difference that some of these program lines are too long to fit on a single line of your display screen. When you type them in, some words will be split between one line of display and another. The computer's memory sees your typing in logical lines of up to 255 characters. As long as you don't type <Return>, it treats everything you are entering as a single line. See Fig. 7-2.

Line 100. The first line begins with the letters "REM," meaning "*remark,*" a comment you're inserting for your own refrence or for others who may look at your program listing. This program moves directly from beginning to end; so I haven't felt I needed to add a lot of remarks to tell how it works. It's a good idea to always add a variety of remarks in a complicated program to help yourself or others who may subsequently want to modify it.

Lines 110-260. CLS means *clear screen.* It erases everything that was on the screen. The next series of print statements writes a question and some answers on the screen. Note that when the command PRINT is issued with nothing else on the same line, a blank line is printed.

Lines 270-350. The INPUT statement causes the program to pause and wait for your answer to the question. The number you type is called "A" by the computer. Lines 300-350 test "A" to see which number was typed in. Then they print an appropriate response on the screen. If you type in a number other than 1, 2, 3, or 4, this program will simply ignore it and go on to the next question. A more sophisticated program would be designed to print a message telling you that you did something wrong. If you type in something other than a number, BASIC will print a cryptic, hard-to-understand error message. Don't swear at the machine; try running the program again, and if that doesn't work go on to the next section of this chapter, which deals with listing a program and debugging it.

Line 370. I've used an INPUT statement in line 370 simply to tell the program to pause. There's really no reason why the program needs additional input at that point, but the statement makes the action on the screen stop until the user has read the message printed as a result of his previous answer. I won't be doing anything with the variable "Z$," which I've named the input the user types in at this point. Using a variable name with a dollar sign at the end, however, tells the computer to treat the input as a string rather than as a number. *Strings* can be any characters, but you can't perform mathematical operations on them. If I didn't tell the computer that the input was a string rather than a number, and the user accidentally pushed the space bar before pressing Return, for instance, BASIC would produce an error message.

Lines 400-1380. These lines simply repeat the process for four more questions.

Lines 1400-1450. These lines calculate the user's score. Line 1400 sets "X" equal to zero. Then lines 1410-1450 add 1 for each correct answer.

Lines 1500-1570. These lines print comments on the results.

Lines 1600-1620. These print three lines of blank space at the end of the program to separate the last output of the program from the "OK" that BASIC will print to tell you the program is over.

```
100 REM A QUIZ
110 CLS
150 PRINT"Test your knowledge.
160 PRINT"Type 1,2,3 or 4 to answer, then press
    `return'"
170 PRINT
200 PRINT"WHY DID THE CHICKEN CROSS THE ROAD?"
210 PRINT
220 PRINT
230 PRINT"    1. To get to the other side."
240 PRINT"    2. To see what he could see. "
250 PRINT"    3. He wanted to play PacMan."
260 PRINT"    4. Because the grass was greener over
                there."
265 PRINT
270 INPUT"Type 1,2,3, or 4, then type `return'";A
280 CLS
290 PRINT
300 IF A=1 THEN PRINT "*********That's right!!!!!
    *********"
310 IF A=2 THEN PRINT"No, that was the Bear who went
    over the mountain"
320 IF A=3 THEN PRINT"Wrong"
330 IF A=4 THEN 340 ELSE 350
340 PRINT"Wrong"
350 PRINT
360 BEEP
365 PRINT"Press `return' to try another question"
370 INPUT;Z$
380 CLS
400 PRINT "WHAT TIME IS IT WHEN THE CLOCK STRIKES
    13?"
405 PRINT
410 PRINT "1. One o'clock"
420 PRINT "2. Time to get the clock fixed"
430 PRINT "3. Time to get a digital clock"
440 PRINT "4. Too late for anyone to be awake"
445 PRINT
450 INPUT"Type 1,2,3, or 4, then type `return'";B
460 CLS
```

Fig. 7-2. The Quiz program.

```
470 PRINT
480 IF B=1 THEN PRINT"Wrong. Or do you own some kind
    of new-fangled clock?"
490 IF B=2 THEN PRINT"*******You're right********"
500 IF B=3 THEN PRINT"Close, but not quite"
510 IF B=4 THEN 520 ELSE 530
520 PRINT "Don't be silly"
530 BEEP
535 PRINT
540 PRINT"press `return' to try another question"
560 INPUT;Z$
570 CLS
600 PRINT "WHAT GOES 999-THUMP, 999-THUMP, 999-THUMP?"
610 PRINT
620 PRINT"    1. A cheap computer disk drive"
630 PRINT"    2. A centipede with a wooden leg"
640 PRINT"    3. A 1953 Studebaker"
650 PRINT"    4. 999 wooden shoes"
660 PRINT"
670 INPUT"Type 1,2,3, or 4, then type `return'";C
680 CLS
700 PRINT
710 IF C=1 THEN PRINT "No, that goes, `Whirrr, thump'"
720 IF C=2 THEN PRINT "******That's it!******"
730 IF C=3 THEN PRINT "No, that goes `thump, clank,
    thump, clank'"
740 IF C=4 THEN 750 ELSE 760
750 PRINT"No, they go `thump thump thump thump
    thump thump...'"
760 PRINT
770 PRINT "press `return' to try another question"
780 BEEP
790 INPUT;Z$
800 CLS
1000 PRINT"WHO IS BURIED IN GRANT'S TOMB?"
1005 PRINT
1010 PRINT
1020 PRINT"    1. George Washington"
1030 PRINT"    2. Abraham Lincoln"
1040 PRINT"    3. Ulysses S. Grant"
1050 PRINT"    4. a flock of pigeons"
```

Fig. 7-2. (Continued from page 53.)

```
1080 PRINT
1090 INPUT"Type 1,2,3, or 4, then type `return'";D
1095 CLS
1097 PRINT
1100 IF D=1 THEN PRINT"Guess again"
1110 IF D=2 THEN PRINT"Don't be silly"
1120 IF D=3 THEN PRINT"*****You're right -
     congratulations*****"
1125 IF D=4 THEN 1130 ELSE 1140
1130 IF D=4 THEN PRINT"That's ridiculous"
1140 BEEP
1145 PRINT
1150 PRINT"Press `return' to try another question"
1160 INPUT;Z$
1170 CLS
1200 PRINT"WHERE DOES A 12,000 POUND ELEPHANT
1210 PRINT"SIT DOWN IN A CROWDED THEATRE?
1220 PRINT
1230 PRINT"    1.  On the aisle only
1240 PRINT"    2.  In the rear
1250 PRINT"    3.  In the `No Smoking' section
1260 PRINT"    4.  Anywhere it wants
1270 PRINT"
1280 INPUT"Type 1,2,3, or 4, then press return";E
1290 CLS
1300 PRINT
1310 IF E=1 THEN PRINT "I'll hire you as an usher.
1320 IF E=1 THEN PRINT "Can you make him sit there?
1330 IF E=2 THEN PRINT "If you're lucky maybe, but
     that's not the right answer"
1340 IF E=3 THEN PRINT "Sure. Don't you believe it."
1345 IF E=4 THEN 1350 ELSE 1360
1350 PRINT "******** Absolutely right*********"
1360 PRINT
1370 PRINT "How have you done? Press `return' to
     learn your score.
1380 INPUT;Z$
1400 X=0
1410 IF A=1 THEN X=X+1
1420 IF B=2 THEN X=X+1
1430 IF C=2 THEN X=X+1
```

Fig. 7-2. (Continued from page 54.)

```
1440 IF D=3 THEN X=X+1
1450 IF E=4 THEN X=X+1
1500 CLS
1510 PRINT
1520 IF X=5 THEN PRINT"100% - YOU'RE A GENIUS"
1530 IF X=4 THEN PRINT"4 OUT OF 5 - NOT BAD"
1540 IF X=3 THEN PRINT"3 OUT OF 5 - TRY HARDER NEXT
     TIME"
1550 IF X=2 THEN PRINT "YOU SEEM TO NEED SOME MORE
     PRACTICE"
1560 IF X=1 THEN PRINT"COME ON, YOU CAN DO BETTER
     THAN THAT!"
1570 IF X=0 THEN PRINT "GOOF OFF!!!!!"
1600 PRINT
1610 PRINT
1620 PRINTNT
1620 PRINT
```

Fig. 7-2. (Continued from page 55.)

Perhaps the strangest part of this program is lines 1410-1450. Your algebra teacher never would understand "X=X+1." The equal sign has quite a different meaning in BASIC than in ordinary math. In BASIC it means "set the expression on the left to equal the expression on the right." So the command:

X=X+1

means simply: take the "X" you have in your memory, add 1 to it, and store that in your memory as the new "X."

LISTING AND DEBUGGING

If you're like me, you'll undoubtably make some mistakes typing programs into your computer. When you do, BASIC will give you an error message, such as "Syntax error in 110" or "Type mismatch in 300." It will then generally print the offending line on your screen.

If you see the mistake immediately, you can simply use the cursor keys to move the cursor over the error and correct it. Afte correcting it, simply hit the Return key. MSX BASIC will send a line to the BASIC interpreter any time you hit a Return with your cursor in that line. Alternatively, you can simply type the line from scrach. Any new line you type into the computer beginning with the number 110 will replace any old line numbered 110 in the computer's memory. If you simply type:

110

with nothing else on the line, the current line 110 will be erased.

Often, however, there won't be any error in the line number mentioned in the error message. You may have made a mistake in some other line which looked correct to the computer when it first read it, but which prevented the computer from doing exactly what you expected. Often, in fact, you won't get any error message at all; the computer will just behave strangely.

Then you must check what you've actually typed into the machine. Start by typing LIST (or

hitting F4, which will write the word for you) and hitting <Return>. The computer will type out a list of all the BASIC statements currently stored in memory. You can then analyze them to see if they're telling the computer to do exactly what you wanted. If you have a printer attached to your machine, you can type **LLIST** <Return>, and the computer will list the statements in memory on the printer.

The screen will probably be too small for all the statements in memory. So you can type a range of line numbers of statements you want listed. For example,

LIST 300-1000

will list all the statements from 300 to 1000.

LIST 300-

will list all the statements from 300 on, and

LIST -1000

will list all the statements up to 1000.

The process of looking for errors is called *debugging*. I find debugging hard, frustrating, annoying, horrible, rotten work. Unfortunately, you have to do it if you want to command the full power of the computer.

SAVING AND LOADING PROGRAMS WITH A TAPE RECORDER

You can connect an MSX computer to most cassette recorders with a special cable. It has a round plug that goes into the computer and three plugs for the cassette recorder. It's included with many MSX computers that don't have disk drives. Hook it up as follows:

- ☐ The black plug goes into the jack marked REM or REMOTE.
- ☐ The white plug goes into the jack marked EAR or EARPHONE.
- ☐ The red plug goes into the jack marked MIC or MICROPHONE.

To save a program, advance the tape to a blank spot and push the RECORD button. Because you have a plug in the REMOTE jack, nothing should happen immediately.

Now, on the computer keybord, type, **CSAVE,** quotation marks, and a name for the program:

CSAVE "QUIZ" <Return>

The computer should send a message to the recorder that will start the tape recording all the BASIC program lines in the computer's memory. If your remote jack doesn't exist or doesn't work, and the tape begins recording when you press the RECORD button, you can still use that tape recorder with your computer. Just wait to press the RECORD button until just before you type <Return> at the end of your CSAVE command.

Cassette data saving is much less reliable than floppy disk saving. Use good-quality tape (though you don't really have to buy expensive comuter cassettes). You'll probably get a message fairly often that the computer has failed to save the program accurately, or that it has failed to load it back in. If a saving is successful, you should get the message "OK" after the save is complete. As a general rule, I suggest you seek at least three successful saves, using at least two different tapes, before you feel certain you'll be able to recover your program. You can also verify that a save was performed properly by rewinding the tape to the beginning of the file and typing in:

CLOAD? "QUIZ"

The computer will compare the file on the tape to the program in memory and report either "Verify error" or "OK."

To load a program, simply wind the tape to a few inches before where the program is stored. Push PLAY (being very careful you do not accidentally push RECORD). Again, the REMOTE plug

should keep the tape from turning initially. Now type on your computer:

CLOAD "QUIZ"

or whatever you want to load.

If a program fails to load the first time, don't panic. Just try it again.

Chapter 8

An Introduction to MSX Graphics

MSX BASIC also gives you control of your computer's graphics capability. In fact, it's far easier to write programs that produce graphics with MSX BASIC than with the BASIC offered with other home computers, or even the IBM PC. Simple commands let you draw lines, boxes, circles, and even sprites, which can be any shape you want.

Most of these capabilities owe as much to the capabilities of the MSX graphics chips as to the version of BASIC that's built into the machine, and the computer can handle them far more rapidly in assembly language, but that's not for beginning programmers. In this chapter I'll try to give a reasonably thorough introduction to using MSX graphics in BASIC and then also discuss the use of other graphics tools, such as Sony's graphics ball and Sanyo's light pen. Graphics tools, if you can afford them, make the production of graphics much easier, generally turning it from a challenging job into fun. Even more sophisticated products—video disk players, video digitizers, and ultimately CD-ROMs—are also important to MSX graphics, but I'll save them for Chapter 15 on home entertainment.

Even if you do plan to use graphics tools or other technology to produce graphics, however, you may find it worthwhile to spend a bit of time with this chapter because it will give you an idea of how the computer handles graphics internally. Most graphics tools, after all, work by creating programs to draw things.

GRAPHICS IN BASIC

BASIC, unlike the computer language LOGO and specialized paint programs and graphics tools, won't let you easily draw a picture on the screen

the way you can draw a picture on a sheet of paper. You have to write a program that tells the computer what to draw, then run the program. That process is not too difficult, however, since you can write a little bit of the program, run it, issue a Break command (the Control key plus STOP), then modify it. Here's the simplest possible graphics program:

```
10 SCREEN 2
20 LINE (60,50)—(120,100)
30 GOTO 30
```

All this program does is draw a diagonal line on the screen, but it's useful in illustrating a great deal about BASIC graphics.

Line 10. SCREEN 2 tells the computer to get ready for graphics commands. MSX BASIC version 2.0 and later can function in nine different screen modes, but the only two you really need to know about as a beginner are SCREEN 0, which is the 40-column text mode, and SCREEN 2, which is a color graphics mode that uses 16 colors and fairly detailed screen resolution. All programs which will use the graphics commands discussed here should start with a SCREEN 2 command. If you want to try programming with more colors or higher resolution, check your manual or more advanced books on programming.

Line 20. The command LINE tells the computer to draw a line, naturally. The LINE command, and most other graphics commands, always describes the locations of what's being drawn with coordinates like those used on the graph paper you may have once used in math class. The coordinates for SCREEN 2 graphics are shown in Fig. 8-1.

Point (0,0) is on the upper left hand corner of the screen; so Point (256,192) is at the far lower right corner of the screen. As in high-school math, the coordinates that locate a point from left to right are often called the *X-axis*, and the coordinates that locate a point from top to bottom are called the *Y-axis.* In commanding the computer, points are always located by giving the X-axis coordinate first and the Y-axis coordinate second.

Line 30. GOTO 30 may seem at first a strange command, but it's vital for keeping the image on the screen. The computer will keep figures you draw on the screen until either you tell it to do something else with the space they occupy, or the program ends. Short graphics programs end very quickly, however. If you just type the first two lines of this program, you'll get a quick change of screen color, a line flashing across the screen, and then an equally quick switch back to text mode.

USING THE LINE COMMAND

The LINE command always takes this form:

LINE (coordinates where you'll start)—(coordinates where you'll end)

Each set of coordinates must be surrounded by parentheses. If you've used a LINE statement previously in your program and you omit the first set of coordinates, BASIC will automatically start to draw the new line from wherever the old line ended.

You can also add parameters to the LINE command to make the lines appear in colors or even to make the command draw boxes. Each of the 16 colors on SCREEN 2 is assigned a number. You must always call a color by its number, so it's important to know them. They are:

0 transparent
1 black
2 medium green
3 light green
4 dark blue
5 light blue
6 dark red
7 cyan (a light greenish blue)
8 medium red
9 light red
10 dark yellow
11 light yellow
12 dark green
13 magenta

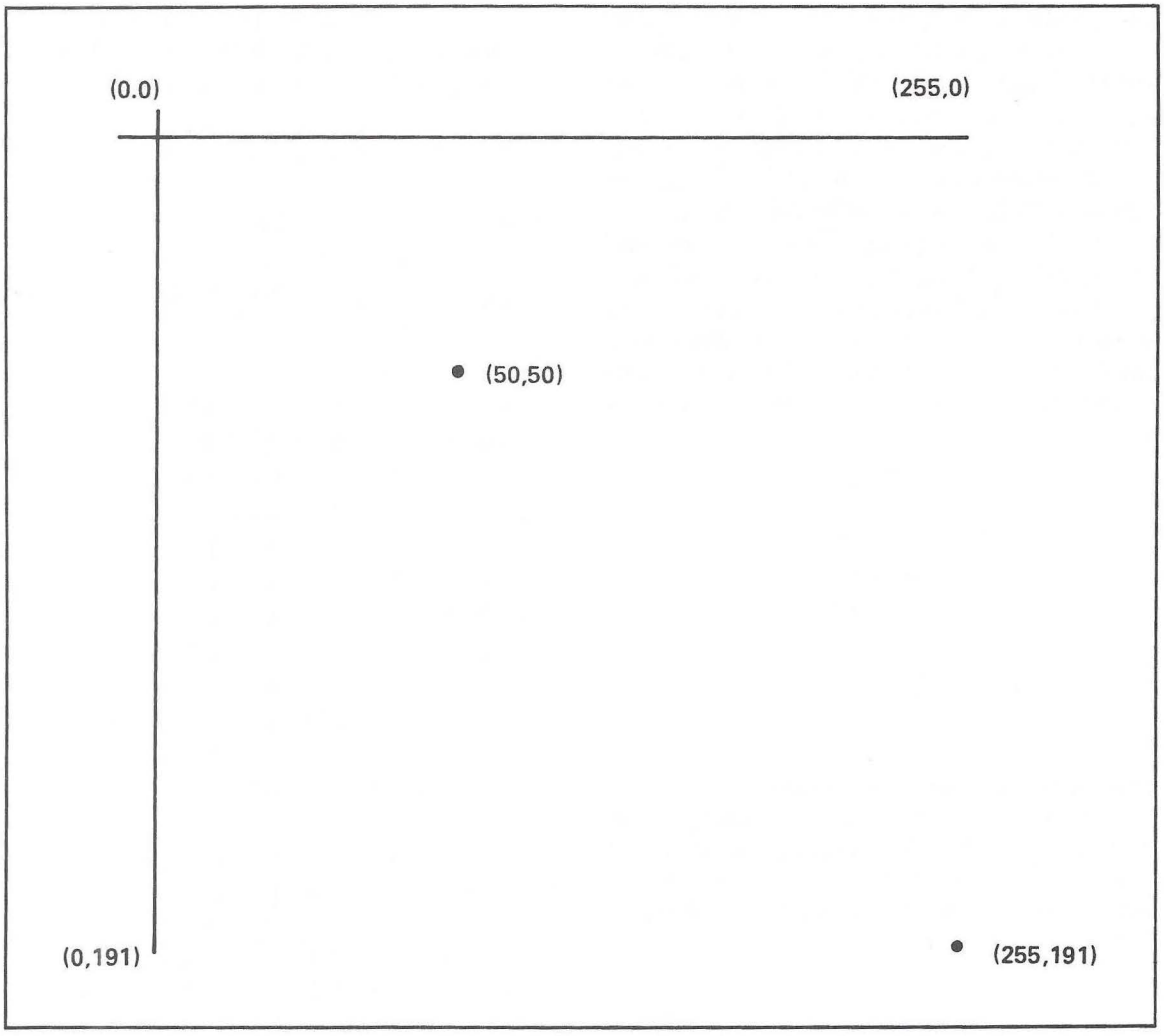


Fig. 8-1. Graphics axes for MSX computers, Screen 2.

14 gray
15 white

If you want your line to be one of these colors, simply put a comma after the last coordinate of the command and then type the appropriate color. For example, changing line 20 to read:

20 LINE (60,50)—(120,100) ,8

will make the program draw a red line.

Finally, adding an additional comma and the letter "B" at the end of the line:

20 LINE (60,50)—(120-100) ,8,B

will cause the program to draw a box. Using BF instead of B produces a box filled with color.

SPRITES

There are several other BASIC graphics commands

worth experimenting with: PSET AND PRESET (which affect individual points on the screen), DRAW, PAINT, and CIRCLE. Perhaps the most interesting and flexible feature of MSX graphics is the use of sprites you can construct yourself.

Sprites are normally produced from a grid filled with ones and zeros. On SCREEN 2, the grid can be 16-×-16 or 8-×-8 pixels. Within a square which corresponds to the sprite, the computer will place color wherever it finds a one and leave a spot blank wherever it finds a zero. To draw smaller sprites, simply use an 8-×-8 grid and include a lot of zeros to leave part of the sprite blank. Data such as this:

```
11111111
01111110
00111100
00011000
00011000
00111100
01111110
11111111
```

produce an hourglass-shaped sprite.

With practice, you can draw whatever you want with sprites, and MSX BASIC will let you move your sprites wherever you want on the screen. For instance, the following data pattern will produce a very rough picture of a duck:

```
00000010
00000110
00000111
10000010
11111111
11111111
11111111
01111110
```

The following program uses this crude drawing to create a carnival-type "BOWL 'EM AWAY" game. The programming techniques of drawing with sprites are a bit more complex than drawing with lines, but ultimately far easier to use for almost anything that moves. First, here's a program that just puts the sprite on the screen:

```
100 SCREEN 2,1
110 S1$=""
120 FOR R=1 TO 8
130 READ T$
140 S1$=S1$+CHR$(VAL("&B"
    +T$))
150 NEXT
160 SPRITE$(1)=S1$
200 DATA 00000010
210 DATA 00000110
220 DATA 00000111
230 DATA 10000010
240 DATA 11111111
250 DATA 11111111
260 DATA 11111111
270 DATA 01111110
400 PUT SPRITE 1,(20,20),
    11
1000 GOTO 1000
```

Run this program and you'll get a crude-looking duck sitting in the upper left corner of your screen.

A glance at this program will show that working with sprites requires you to handle several programming commands that I haven't discussed yet. The most important are FOR-NEXT loops and READ-DATA statements. These are crucial in almost all BASIC programming; so you might as well learn them now.

Here's how the program works:

Line 100. You tell the computer what kind of sprites to use by adding a parameter to the SCREEN command. After the command and the screen number, add a comma and then:

0—for 8 × 8 unmagnified sprites
1—for 8 × 8 magnified sprites
2—for 16 × 16 unmagnified sprites

3—for 16 × 16 magnified sprites

Line 110. Tells the computer that S$ is an empty string of characters. The sets of quotation marks must be exactly adjacent to each other so that the computer will perceive that S$ equals nothing. The next few program lines will then load the data that will become a sprite into this string.

*LINE 120.*The beginning of a FOR-NEXT loop which will read the data for the sprite into the string S$. An 8-×-8 sprite will be built from 64 bits of data. (If you supply less than 64 bits, the computer will leave the bottom portion of the sprite blank—a technique we'll use in the following game. We don't want to write out all 64 bits on one line, however. If we did that, we'd lose all sense of how the final picture was going to look. So we want to read eight lines of data one at a time, each time adding the new data to S1$.

A FOR-NEXT loop permits us to do that. When BASIC sees the word *FOR*, it knows you are setting up a loop. It expects you to tell it how many times to go through the loop by completing the line with something like:

FOR R = 1 TO 8

This sets up a counter, *R*. The first time the computer runs through the loop, R will be equal to one. When it finds the command *NEXT*, it will return to the FOR statement and run through the loop again with R equal to two. When R = 8 the computer will pass onto the next part of the program. If you use more than one FOR-NEXT loop in a program, your NEXT line should indicate which variable you want to return to:

NEXT R

*LINE 130.*A READ statement. READ statements always make the computer look down for the next DATA statement and assign the data there to the variable or variables which appear next to the READ statement. The first pass of the computer through this section will read the data in line 200 and thus set the variable T$ equal to 00000010.

*LINE 140.*Takes the data most recently read as T$ and adds it to the string variable S1$.

*LINE 150.*Sends the FOR-NEXT loop back to line 120, where the reading process will be continued till S1$ is complete.

*LINE 160.*Creates the sprite from the string S$. The computer automatically recognizes SPRITE$(1) as a sprite, and will store it in a way that permits it to be put to work in line 400.

*LINES 200-270.*Contain the data which was read by the READ statement in line 130.

*LINE 400.*Puts the sprite on the screen. This is always done with the command PUT SPRITE. MSX computers can handle sprites on up to 16 different "planes" at a time, which means that you can have up to 16 different sprites passing each other at once. The first number after the command PUT SPRITE should be the number of the plane where you want the sprite. (In elementary programming it should correspond with the number you had in parentheses after SPRITE$.) Next, in parentheses, come the coordinates of the point where you want the upper left hand corner of the sprite. Then, after a comma, comes the number of the sprite's color.

*LINE 1000.*Freezes the display on the screen.

BOWL 'EM AWAY

Now you're ready to write a real (though elementary) video game. It's my 2-year-old son's favorite game, but it also calls for a bit of skill from an older player. The program is given in Fig. 8-2.

The program creates the yellow duck sprite and sends him across the top of the screen. (Line 500 adds 1 to the X coordinate of the duck sprite every time the program runs through the loop.) You bowl little white balls at the duck by hitting the period (".") key on your keyboard. When you hit him, the computer plays a little tune and congradulates you. (The only way to stop the tune is by pushing the STOP button or issuing a "Break" command. Then you can run the game again by pushing F5—RUN.

Only a few of these commands should be unfamiliar now:

```
&10 REM       BOWL 'EM AWAY GAME
20 DEFINT A-Z
30 X=0: Y=192: Z=0
100 SCREEN 2,1 :REM CREATING DUCK
110 S1$=""
120 FOR R=1 TO 8
130 READ T$
140 S1$=S1$+CHR$(VAL("&B"+T$))
150 NEXT
160 SPRITE$(1)=S1$
200 DATA 00000010
210 DATA 00000110
220 DATA 00000111
230 DATA 10000010
240 DATA 11111111
250 DATA 11111111
260 DATA 11111111
270 DATA 01111110
300 S2$=""   : REM CREATING BALL
310 FOR Q=1 TO 3: READ Q$
320 S2$=S2$+CHR$(VAL("&B"+Q$))
330 NEXT
340 SPRITE$(2)=S2$
350 DATA 11000000
360 DATA 11000000
370 DATA 00000000
400 PUT SPRITE 1, (X,20),11,1
410 IF INKEY$="." THEN Z=1 :REM FIRE BALL WHEN PERIOD
    IS PRESSED
420 IF Z=1 THEN 430 ELSE 500
430 PUT SPRITE 2, (126,Y), 15
440 Y=Y-1
450 IF Y=34 GOTO 600
460 IF Y=(-4) THEN Z=0 : REM RESET COORDINATES AT END OF
    SCREEN
470 IF Y=(-4) THEN Y=192
500 X=X+1
```

Fig. 8-2. Bowling Game program.

```
510 IF X=257 THEN X=0
520 GOTO 300
600 IF X<132 GOTO 510 ELSE 400 : REM TEST FOR HIT
610 IF X>108 GOTO 520 ELSE 400
620 PRINT"YOU GOT HIM!"
630 PLAY "CEGBGBBBBB"
640 PRINT "CONTRATULATIONS!!!!!!"
650 GOTO 630
```

Fig. 8-2. (Continued from page 64.)

LINE 20. DEFINT simply tells the computer that the variables to be used will be integers—whole numbers—so the computer won't have to waste memory space.

LINE 30 sets the beginning values for coordinates to be used later in the program.

LINE 410. INKEY$ checks to see if a specific character—in this case a period—has been input on the keyboard.

A TIP ON DESIGNING BASIC GAMES

The BASIC Interpreter is not by any means the fastest way to execute a program. It must translate each line of your program into machine code each time the program runs; so you can't give it too much to do and still expect it to do everything you want at a speed which makes the game interesting.

One of BASIC's strengths as a language is that it runs easily in this "interpreted" form but that there also exist BASIC *compilers*, which take BASIC code and compile it into a form more like machine language. Then it executes much faster. Because MSX BASIC is a new version of BASIC, there may be no compiler available that can handle all its excellent features, but Microsoft expects to develop one. If you're seriously interested in BASIC programming, watch for this product.

MSX GRAPHICS TOOLS

Several of Japan's leading manufacturers are producing graphics tools designed to make creation of color images much easier. The products include Sony's graphics ball, Sanyo's light pen unit, Pioneer's video art tablet, and Canon's graphics tablet. (Some of these products may be sold under different names in the United States.)

Essentially, these products all do the same things. They allow you to draw anything you want on the screen of your computer, save the results in a file on cassette or disk, and—with a bit of skill—use them in other programs. Essentially, you can draw in two ways: freehand, or by selecting such items as circles, lines, etc. from a menu. The menu will also allow you to fill in any part of your drawing in any color you want. With an MSX-compatible color printer, the screens can also be printed out. So far, however, the graphics tools don't seem useful for creating animation, although if your tool creates a program in BASIC, there are ways to later write and insert code that will animate a display. The performance of these programs resembles the well-known MacPaint program on the Apple Macintosh, except that they perform in color.

I've played with the Sony and Sanyo products, which are the most popular in Japan. Both seemed to me powerful tools that would be useful for any graphics use you might have. One significant difference should be considered if you contemplate these products: at least in the versions I saw, the Sony tool creates programs in BASIC, while the Sanyo tool creates programs in machine language.

Thus the Sony programs can be moved into your own BASIC programs fairly easily. The Sanyo programs can also be accessed by disk batch files (see Chapter 9). They will redraw themselves faster than Sony's BASIC programs, but they won't be as easy to work with for some other purposes.

The tool you choose, then, should depend on the use to which you intend to put it. For most people these are simply gadgets, and as gadgets they are all powerful sparks for creativity.

Chapter 9

Learning to Love a Disk Drive

DISK drives make computers the flexible, useful tools they can be (Fig. 9-1). Computer manufacturers haven't yet perfected lost-cost methods of storing truly large amounts of information for long periods on computer chips, especially in forms which allow the information to be changed whenever you want. A single double-sided floppy disk, however, can store as much information as this book contains, and it will do it in a way that lets you, with appropriate programs, access or change any of it in seconds. Yet disks are so small you can fit half-a-dozen in your shirt pocket.

THE DISK OPERATING SYSTEM

To operate with a disk drive, most computers use a disk operating system, or *DOS*. MSX computers can operate without DOS in disk BASIC, and in fact most MSX computers will automatically go into disk BASIC mode if you turn them on wih a disk drive installed and no copy of MSX-DOS on the disk. A good disk operating system, however, helps the computer to run machine-language programs and gives the computer vast flexibility because it can turn the disk into almost an extension of the computer's internal memory.

MSX-DOS is patterned after MS-DOS, the Microsoft disk operating system that is used on the IBM PC and compatibles, and also after CP/M, the disk operating system used on older computers based on Z80-series chips like those inside MSX—computers from companies like Kaypro, Osborne, Epson, and Xerox. If you know how to use an IBM Personal Computer or compatible you know how to use MSX-DOS, because the two systems use identical commands. (Current versions of MSX-DOS are most similar to MS-DOS version 1.25, the version sold with most IBM compatibles until recently.)

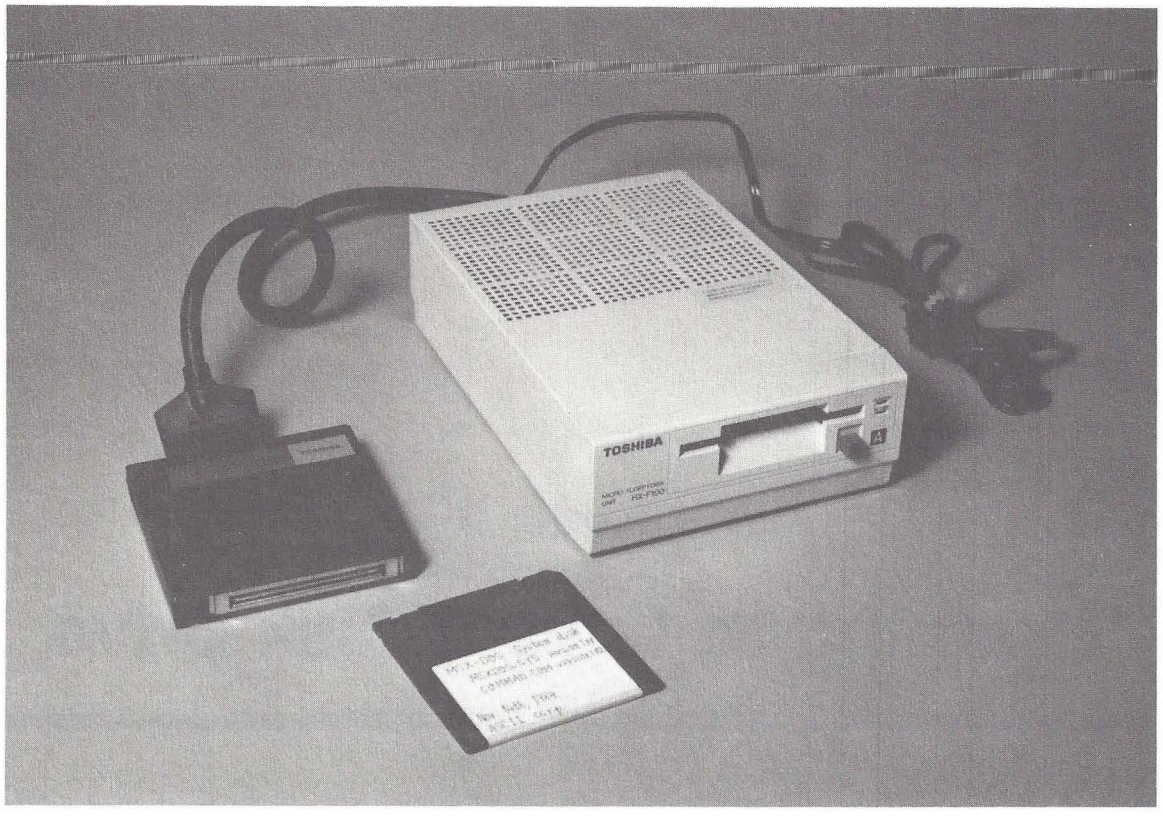


Fig. 9-1. A 3 1/2-inch MSX disk drive (courtesy Qest Publishing Co.).

MSX computers with MSX-DOS are supposed to run CP/M programs without modification, but MSX-DOS will not respond to the commands CP/M users have learned to type into their machines at CP/M prompts. Thus, experienced MS-DOS users can merely skim this chapter to learn the minor differences between the way MSX-DOS works and the way MS-DOS works. Experienced CP/M users must learn all the commands in it, but that's not too hard, because everyone agrees that MS-DOS commands are much easier to remember than CP/M commands.

MSX-DOS consists of two system files; MSXDOS.SYS and COMMAND.COM. They should be on every disk you use that contains programs which aren't written in BASIC.

STARTING UP THE COMPUTER UNDER DOS

The disk operating system is distributed on a system disk, which comes with a manual or two. The system disk contains the system files and a number of auxiliary programs, most of which you can ignore until you've learned a good deal more about computing.

MSX omputers are designed to load the disk operating system and turn control over to it every time the computers are turned and they find a copy of the system files on a disk. So you can start up MSX-DOS by simply inserting the system disk in a disk drive, making sure the disk drive is plugged properly into one of the computer's slots, closing the disk drive door if there is one, and turning the computer on. The computer should ask you for the date and time or in the case of MSX-2 comuters, read it from an internal clock, and then produce the prompt:

```
A>
```

This prompt tells you that the disk operating system is loaded and the computer is waiting for further instructions. The letter *A* indicates that the computer is ready to work with disk drive A, unless you tell it to do something else. If you own only one disk drive, the letter is not very important. If, however, you have connected several to your system, the letr tells you which is the *default drive* right now, the drive the computer will look to for information or a program if you don't specify another drive.

You always specify a disk drive to the computer by typing the letter of the drive followed by a colon. For example, if you have more than one disk drive connected to your system and you type in:

B:<Return>

The next prompt you see will be:

B>

The system will continue to use drive B as the default drive until you type in:

A:<Return>

to switch back. DOS can't tell the difference between uppercase and lowercase letters; so you could just as easily type **b: and a:** as **B:** and **A:**.

FORMATTING A DISK

Someday floppy disks will be sold in every corner drugstore, and by that time standards may be well enough established that you'll be able to pop a disk out of a package and use it in your computer immediately. For now, however, there are enough different kinds of computers using different data storage formats that disks must be formatted before you can use them.

Be very careful how you use the FORMAT command. Formatting a disk destroys all data on the disk.

MSX-DOS can format a disk any time. There's no need to use the system disk to format a new disk (as you must under MS-DOS). In fact, it's a good idea to take your system disk out of your disk drive and put in the blank disk you wish to format before you even issue the FORMAT command. When you have the blank disk installed, type:

FORMAT < Return >

At this point the computer will ask you "Format which drive (A or B)?" This may seem a silly question if you have only one disk drive installed, but the computer is not only asking for information, but also giving you a chance to check to be sure you have the disk you want formatted and not some other disk in your drive. If you want to abort the whole formatting process you can hold down the Control key and type **C**. Control-C aborts not only the formatting processes but also many other computer processes. When you've made sure that the disk you want to format is in your drive, type the letter of the drive. ("A:" if you have only one drive.) The formatting process will continue to completion.

To start programs from your formatted disk, you must copy the two MSX-DOS system files to it using the Copy command, which I'll discuss later in this chapter. Generally you should copy the two systems files onto every disk just after you format it unless you're sure you won't be storing any programs on it. (You might plan to use the disk only to store data files that some other program creates, for example.) The two system files are named MSXDOS.SYS and COMMAND.COM.

USING DISKS

Some programs will come to you on disks that automatically start the program when you put them into your disk drive and turn the computer on. It's not at all difficult to create this kind of disk; I'll show you how to do it before this chapter is over.

Many kinds of tasks you can do with a computer and a disk drive can't be done—or can't be done easily—unless you learn to issue commands to the operating system. Thus everyone—including people who have no interest whatsoever in learning to program in BASIC or any other language—

should learn the most important commands of MSX-DOS. The commands are a bit cryptic, and easier-to-use operating systems will undoubtably come along. Right now, however, you must learn to use an operating system to use a computer properly. (The operating system of the Apple Macintosh is widely considered easier to use than operating systems like MSX-DOS and MS-DOS, but the very software techniques that have made the Macintosh system easy to use have made it difficult for software developers to complete programs which run on it.)

To operate your computer under MSX-DOS, you must at a minimum know how to:

- ☐ Format a disk.
- ☐ Take a directory of what's on a disk.
- ☐ Start a program running.
- ☐ Copy programs and other information from one disk to another.
- ☐ Delete programs and data files.
- ☐ Change the mode of your display from 40 characters per line (suitable for a television set or other low-quality display) to 80 characters per line (suitable for handling a lot of data on a good-quality monitor).

In addition, you'll probably want to know how to:

- ☐ Make the computer "type" the contents of a document file on the screen.
- ☐ Rename files.
- ☐ Create a *batch* file, which will execute programs and commands automatically.
- ☐ Make programs begin running immdiately when you turn on the computer with a particular disk in Drive A.

This chapter will teach you all these procedures.

Taking a Directory and Copying Files

Insert the system disk back in Drive A. Now type:

DIR <Return>

That's the directory command, and it gives a directory of all files on the disk together with the number of bytes each file occupies, the date and time when it was created, and the amount of free space it contains.

You can copy files from one disk to another using the COPY command, which is simply

COPY < what you want copied > < where you want it copied to >

For example, if you want to copy a file called SOMEFILE.COM from one disk to another, you simply type:

COPY SOMEFILE.COM B:

If you have two disk drives, the comuter will look for SOMEFILE.COM on the default drive and, if it finds it, copy the file to the disk in drive B. If you have only one disk drive, the computer will copy all or part of SOMEFILE.COM into its own random access memory, ask you to remove the disk you're copying from and insert the disk you're copying to, then copy to the second disk. If SOMEFILE.COM is too big to be copied all at once, the computer will ask you to put the original disk back in, and it will continue the process until the copying is complete.

The most common mistake in copying files is to forget to include the place you want the files copied to, usually disk drive B. If you forget, you'll get the error message, "File cannot be copied onto itself." If you find the syntax of the COPY command too difficult, MSX-DOX is designed to allow you to simply type **COPY** <Return>. The operating system will then prompt you, telling you what you should do.

Be sure, however, to include the colon after the letter that names the drive. If you don't, the computer will copy your old file not to the disk drive B:, but to a file on the original disk with the filename "B." Also, you must give both the filename and the extension (see the following) for MSX-DOS to do anything to a file. If you ever work with a program tha automatically adds extensions

to filenames you create (and many do), you must know the whole filename in order to copy any file with the COPY command.

Warning: If you copy a file onto a disk, it will write over and thus erase any old file with the same name. Thus the most dangerous error with the COPY command is accidentally copying an old version of a file onto a new one. Make a lot of backup copies of everything important. Every computer book tells people to do that, and every new computer user neglects it. You'll be sorry. I was.

Filenames under MSX-DOS

Everything stored on a disk—every program or file of words, numbers, and similar data—must have a filename so you can tell DOS to look for it. The main portion of every filename consists of eight characters or less. Then there is a period (.) and after the period there can be an "extension" of up to three letters. Most computer users use the extension to rmind them with what kind of file they are dealing. For example, my word-processing program automatically puts the extension ".MSS" at the end of filenames to remind me when I take a directory of a disk that those files are documents I've written. I use the extension ".IN" for files that contain invoices and ".SR" for files I have received from the on-line utility The Source.

Programs that can run under DOS must have the extension .COM or .EXE. (There are differences between these two types of program files, but you don't have to worry about them.) Normally BASIC programs have the extension .BAS.

Spaces and many punctuation marks are forbidden in filenames, and you can drive your computer crazy if you try to use them. Though you might be able to memorize a list of punctuation marks legal under your version of DOS, it's easier just to avoid all but one or two. I generally use only the apostrophe (') in filenames, and I suggest you do the same.

Copying or Backing Up a Program Disk

At this point, you should make a copy of your system disk and, if possible, all other program disks you may have (unless you or someone else has already done so). It's easy to lose the data on a disk, usually by issuing a command that accidentally deletes something important.

MSX-DOS allows you to copy more than one file by using a "wildcard" symbol, the asterisk (*):

COPY *.MSS B:

for example, will copy all files with the extension "MSS."

COPY M*.MSS B:

will copy all files whose filenames begin with "M" and end with the extension "MSS."

If you want to copy all files on a disk, you must use two stars, one before and the other after the dot which separates the main portion of the filename from the extension:

COPY *.* B:

You should now use the command COPY *.* B: to copy all files on your system disk to a backup disk. It only takes a few minutes, uses up disks worth only a few dollars, and guarantees that the important programs on your system disk won't be lost.

Generally you should copy any other important programs you own onto separate disks. You'll find, however, that many moderately priced programs come on *copy-protected disks*, which means their disks have been modified so you can't easily copy the programs and give them away to people who haven't paid for them. Some programmers know how to "crack" these protection schemes so they can make backup copies of the disks, but I don't recommend you do so.

Running Programs from DOS

If you have some programs that you've been anxious to try, you can now run them. Most programs come with directions to tell you how to start them, but often the directions involve unnecessarily complex maneuvers designed to make things easy

for people who haven't learned anything about how to use their computer's operating system. The reality is generally simple: you can start most programs simply by typing the main part of their filenames at any prompt, then hitting the Return key. The exceptions are:

- ☐ Some programs which bypass the operating system, as many fairly sophisticated programs do (Infocom's *Zork*, for instance). You can run these programs only by following the directions in their manuals, which generally require that you insert their disks in your disk drive when the computer is turned off, then turn it on.
- ☐ Programs written in BASIC, which you can generally recognize from the extension .BAS. I'll discuss these programs later in this chapter.

Additional MSX-DOS Commands

The COMMAND.COM program, which the computer loaded when you turned it on, gave the computer the ability to respond to the following commands. Enter any of them from any A> prompt. (You can't generally use them while a program is operating, even if it's a program such as a word processor in which these commands might come in handy.) The rest of the fundamental commands are:

DEL—deletes the name of the file specified. For example:

```
DEL SOMEFILE.COM
```

will delete the file SOMEFILE.COM on the default drive. If SOMEFILE.COM isn't on the default drive, the computer will tell you "File not found."

TYPE—Displays a file of text on your screen. If the file contains not text but a program, all sorts of funny things may happen. In fact, even some text files may look strange when you "type" them if they were created to work with a few programs such as the word processor WordStar. Don't worry. You can't do any damage to anything with the TYPE command.

REN—renames a file. If I decide that SOMEFILE.COM is a silly name for a file, I can rename it:

```
REN SOMEFILE.COM SUPER.COM
```

The directory will now show that the file is called SUPER.COM.

Other Drives. If you want to do something to a file on a drive other than the default drive, you must insert the letter of the drive where it is located, followed by a colon, in front of the filename:

```
DEL B:SOMEFILE.COM
```

The drive letter and colon together are called the *drive name.*

Batch Files

One of the easiest ways to control your computer is to create batch files. When you type at a prompt the name of a file whose extension is *.BAT*, DOS will act on each line in the file as a separate DOS command. For example, if a file on the disk in the default drive named *S.BAT* contained the lines:

```
DIR B:
SOMEFILE.COM
```

then you could simply enter the letter S and a Return. Your computer would automatically give you a directory of the disk in Drive B, then run the program, SOMEFILE.COM.

Batch files are easy to set up with a word processor (see Chapters 11 and 12.) You'll discover many uses for batch files, but one of the simplest is just to avoid typing out complex commands and programs names. I use a program on my IBM-compatible called PC-TALK, but because I'm unaccustomed to typing hyphens, it slows me down to type out that program name. (Aren't computers

making me intolerably lazy!) So I created a file called T.BAT with just the single line:

PC-TALK

The program runs when I merely type **T**<Return>.

One special batch filename does something nothing else will do under DOS: *AUTOEXEC.BAT*. When DOS starts up it looks at the disk in the default drive for a file named AUTOEXEC.BAT. If it finds an AUTOEXEC.BAT file, it executes the commands in it automatically before it does anything else. It even skips asking you for the date and time unless you include the words *date* and *time* on separate lines of the file. (I recommend that you do so, because if you don't set your computer's date and time when you turn it on, the computer can't accurately put date and time labels on the files on which you work.)

An AUTOEXEC.BAT file can be extremely useful if there are computer-phobes in your household who haven't learned DOS. If they regularly use a particular program, you can put the name of the program in an AUTOEXEC.BAT file on the program disk. Then if they simply put the disk in the disk drive and turn it on, the program will automatically execute.

MSX-DOS and CP/M Software

One of the largest advantages of MSX-DOS is its ability to run one of the biggest collections of free software in the world: the libraries of programs amassed by CP/M user's groups. Since CP/M has been in existence since 1976, this library is truly huge. Most of it, however, was written with sophisticated computer users in mind; so it may not be easy for you to use. It's certain that it will make it very easy for people who enjoy playing with computers to create a lot of free, easy-to-use software for MSX. A good portion of the CP/M user's groups, software—including telecommunications programs, adventure games, and utilities, such as programs that give you sorted directories of the files on your disk—may prove highly useful for MSX owners even without modification.

It's not clear how free CP/M software will be most easily available for MSX, but it is clear that the availability of this treasure trove makes it worthwhile for you to look for a keep in touch with a local CP/M user's group. If you know a bit about computers, you can get a complete list of public-domain CP/M programs by sending $2 to:

Lifeboat Associates
1651 Third Ave.
New York, NY 10328

DISK BASIC

BASIC programs cannot be run or written while your disk operating system is in control of the computer. To write or run a BASIC program from DOS, simply type:

BASIC <Return>

at any DOS prompt.

You'll then be in Disk BASIC, which does everything ordinary MSX BASIC does (see Chapters 7 and 8) and also provides commands to work with a disk drive.

The FORMAT and COPY commands in Disk BASIC work exactly like they do under MSX-DOS. Here are the other essential commands you should know to use Disk BASIC:

FILES—provides a directory like the DIR command under MSX-DOS.

KILL—deletes a file like the DELETE command under MSX-DOS.

LOAD—takes a file from disk into the computer's memory where it can be RUN. Load must be followed by quotation marks.

SAVE—saves the BASIC program in memory to disk. It also must be followed by quotation marks.

NAME—renames a file.

CALL SYSTEM—returns control of the com-

```
10  REM "JESU JOY OF MAN'S DESIRING," BACH
100 PLAY "T120L3V12", "T120L1V9"
110 PLAY "R8 O6GAB O7DCCED", "O4G O5GE"
120 PLAY "DGF#GD O6BGAB", "O4B O5E O4E"
130 PLAY "O7CDEC O6BABG", "O4AB O5C"
140 PLAY "F#GADF#A O7C O6BA", "O5DF#D"
150 PLAY "BGAB O7DCCED", "GGC"
160 PLAY "DGF#GD O6BGAB", "O4B O5ED"
170 PLAY "E O7DC O6BAGDGF#G1", "CC#DG" "CC#DG"
```

Fig. 10-1. "Jesu, Joy of Man's Desiring" program.

out the Yamaha synthesizer. If you doubt that a computer can really be a worthwhile musical instrument, I suggest that rather than skipping this chapter entirely you skip the next few sections for now, type that program into your computer, and RUN it. You'll find that a computer's music can be beautiful.

Any MSX computer can play in three-voice harmony. You can vary the volume, tempo, or length of notes, or specify a different envelope that will change the sounds dramatically.

To do all this you need a little knowledge of BASIC programming,an add-on device that will let you handle the music chip more like some other kind of musical instrument, or a piece of software that will allow you to create music in other ways. If you get an add-on device, I suggest you insist on one that will give your computer digital music synthesis capability. Digital synthesis is such an important, and today such an inexpensive, technology that I suspect it will become part of most people's homes over the next few years.

Good software can add a lot to your enjoyment of life at very low cost even without digital synthesis, however. Since the BASIC language is built into all MSX computers and the commands for creating music are simple, I'll explain them in the first part of this chapter. Then I'll talk about more expensive ways of handling music on an MSX, especially the state-of-the-art products from Yamaha.

How BASIC Represents Music

If you've never learned to read or write music any other way, I suspect you'll find that programming music in BASIC is a simple, easy-to-learn, flexible way of writing melodies and harmonies. If, however, you've already learned to read and write music in the traditional way, you'll immediately notice BASIC's limitations. It's much more difficult to gain a quick feel for a melody by looking at the lists of letters that make up a program than it is to recognize a melody written on a conventional musical staff. Sophisticated musical software displays a conventional musical staff on your screen.

Here's how BASIC's music commands work. When you typed:

PLAY "CCGGAAG" <Return>

your computer played the first few bars of "Twinkle Twinkle, Little Star." You probably remember from some long-ago music course that musical notes can be represented with letters. MSX BASIC uses those letters. Think of a piano keyboard (Fig. 10-2). If you simply enter:

PLAY "CBA"

the computer will play the notes from the octave which begins with middle C—octave 4. You can specify any other octave with the letter **O** and a

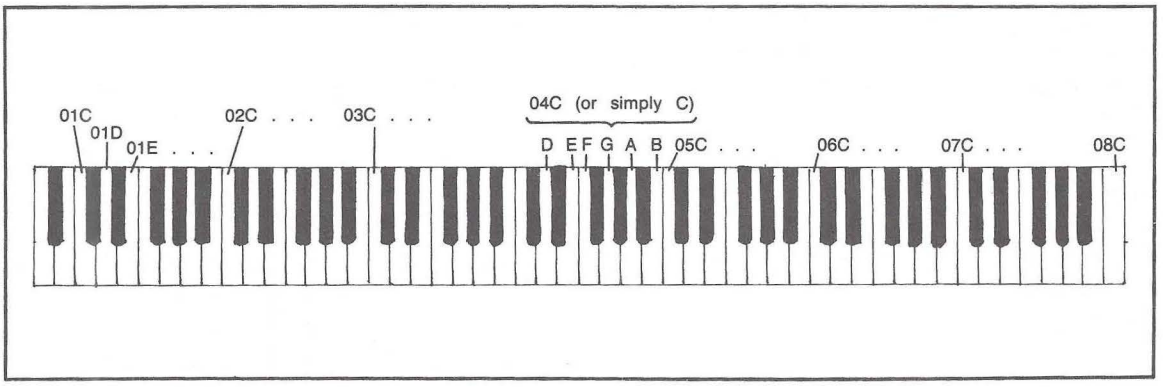


Fig. 10-2. Translating piano keys into MSX BASIC. The letter *O* followed by an octave specifies an octave. If no octave is specified, MSX BASIC will play a note in octave 4. Notes below O1C cannot be played in MSX BASIC.

number. For example,

PLAY "O1C"

will play the lowest note MSX BASIC knows.

If you don't specify any octave, MSX BASIC will play in octave 4, which is the middle of the range of the piano and the human voice, and is probably the octave where you first started if you ever took piano lessons.

Thus if you want your computer to play a scale, you type:

PLAY "CDEFGABO5C"

MSX-BASIC ignores spaces within PLAY statements, so you can make this easier to read by typing:

PLAY "CDEFGAB O5C"

Incidentally, it's a good idea at this point to set up one of your function keys to input the command PLAY. As discussed in Chapter 7, use the command:

KEY 1, "PLAY" <Return>

or

KEY 1, "PLAY" + CHR$(34) <Return>

Specified Commands Say Specified

Remember one rule: Once you've specified an octave (or, as you'll see in the next few sections, a tempo, a volume, an envelope or, generally, a note length) any voice in MSX BASIC continues to use that octave (or tempo, volume, envelope, or note length) until you specify something different. For example, if you want your MSX to play a scale in the deepest bass possible, you simply type:

PLAY "O1CDEFGAB O2C"

Incidentally, it makes no difference whether you type musical letters (or other BASIC commands) in upper or lowercase. Letters to be PLAYed must be enclosed in quotation marks, however.

Note Length and Tempo In MSX BASIC

MSX BASIC will play quarter notes at the rate of two per second if you don't specify a note length. You can easily write any kind of note.

Musicians express note lengths as fractions of the length of a whole note, which normally gets four beats. A quarter note normally gets one beat. This may not sound sensible. If you had no experience with music you'd probably prefer to have notes expressed as fractions of something that gets one beat. Musicians have been writing music this way for centuries, however, and MSX BASIC is not about to challenge the system.

Specify the length of the notes you want MSX BASIC to use by writing the letter *L* followed by a number that indicates the kind of note you'd like. Thus:

```
PLAY "L1C"
```

will start MSX BASIC playing whole notes—four times as long as the quarter note you get when you simply type:

```
PLAY "C"
```

If you type:

```
PLAY "L2C"
```

you'll get a half note, which is worth two beats.

```
PLAY "L4C"
```

will produce the same quarter note you'd get by typing simply

```
PLAY "C"
```

If you type:

```
PLAY "L16C"
```

you'll get a sixteenth note, one fourth as long as a quarter note.

Of course, you can specify both the length and the octave of a note:

```
PLAY "L1O1C"
```

will produce a whole note in a deep bass.

This way of writing notes may seem awfully complex when you look at a single note. It's not nearly as complex as it seems, though, since you usually change octaves and note lengths only a few times in a musical phrase. If you want to change the note length for one note only, you can write the note length after the letter that represents the note:

```
PLAY "O1C1"
```

would produce the same note as the previous statement, but would not change the length of the note following it.

Three More Commands

You need to know only three more items before you can write sophisticated melodies with your computer. First, the letter *R* indicates a *rest*, a pause in the music. It can be modified with the same length commands that modify notes.

Second, you can indicate sharps with a + (plus) or # (number) sign, and flats with a – (minus) sign.

Third, the addition of a dot after a note—typed with the period key on your keyboard—will produce a note 1 1/2 times as long as the note would have been without the dot:

```
PLAY "L2C."
```

will be 3 times as long as a one-beat quarter note; that is, it will be 1 1/2 times as long as:

```
PLAY "L2C"
```

Writing Whole Melodies

Thus we can write a more sophisticated version of *Twinkle, Twinkle Little Star* with only a few more characters:

```
PLAY "O5CCGGAA L2G. R FFEEDD L1C"
```

What? You think there's no such thing as a sophisticated version of "Twinkle Twinkle Little Star?" Well, then, try this melody, Hayden's "Glorious Things of Three are Spoken:"

```
10 PLAY "E-2.F4 L2GFA- G L4FD L2E-
20 PLAY "O5C O4B- A- GFGE- L4B-
```

WRITING HARMONY

Once you've mastered programing melodies,

writing harmony is simple. Your MSX will play everything on a line up to a set of quotation marks and a comma with one voice. If, however, you enter another set of quotation marks and more notes after the comma, the MSX will play it in a second voice. If a line contains a second comma, another set of quotation marks, and more notes, the computer will play with three voices. Try:

```
PLAY "C", "E", "G"
```

You'll get a nice chord. Note, however, that the commas must come outside the quotation marks which mark the end of what each voice should play, just as they do in PRINT, LPRINT, and INPUT statements.

Be sure to remember one other point when programming harmony: you must make sure you program the same total length of music for each voice. It's very easy to write two parts that come to an end at different times. Rather than sounding harmonious, they are likely to sound silly.

Now you're ready to write a real music program. Type in Fig. 10-1.

MUSICAL "ENVELOPES"

Your MSX computer also allows you to vary the sound your machine makes. This feature can create the impression that you have a whole ensemble at your command. The effect created with the Envelopes commands is the effect of a cheap electronic organ, however, while the effect of a digital synthesizer can be incredibly realistic.

Envelopes are specified with Shape (S0-S15) and Modulation (M0-M65535) commands. Try:

```
PLAY "S9M3000 CDE"
```

This gives a reasonably good approximation of a stringed instrument. Try giving this voice to the first voice of the previous Bach program by replacing line 100 with

```
100 PLAY "S9M3000 T120L3V12",
"T120L1V9"
```

BUILDING A GREAT MSX MUSIC SYSTEM

Dozens of MSX products will ultimately expand on these musical capabilities. If you select add-on musical products, I suggest you look for products with musical instrument digital interfaces (MIDI). To use them, you'll have to plug an interface card into an MSX slot unless your computer comes with a MIDI (as at least some of Yamaha's do).

MIDI is to electronic music what MSX is to home computing. It's the product of a large association of musical equipment manufacturers who have recognized that their products should be able to communicate with each other. MIDIs allow you to control the sounds of one instrument from the keyboard of another instrument. A great many other capabilities can be built around that one.

Some MSX music products that lack a MIDI; may appear some may offer good value. Possibly you can add a MIDI for your computer later if you buy a product without one today. If, however, one of the points of buying an MSX computer is that MSX allows you to start building a system today without fear that the products you're now buying will all have to be thrown out when something better comes along, it makes sense to buy only products which you know can work with MIDIs. Any electronic music product that lacks a MIDI is likely to be utterly obsolete in a few years.

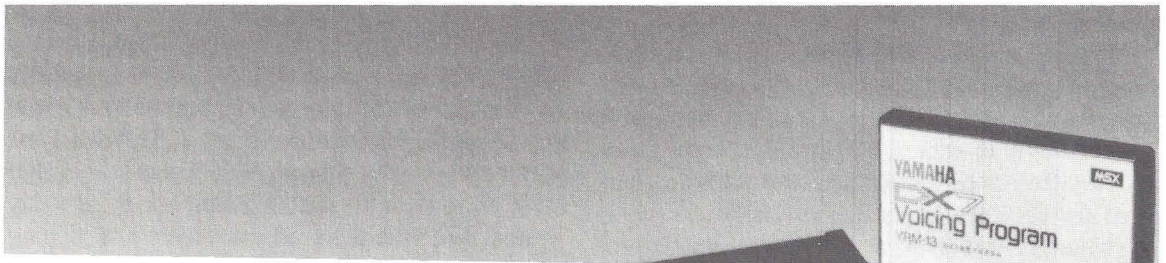
THE YAMAHA CX5M AND SOPHISTICATED MUSIC

The Yamaha CX5M and related gear brings advanced audio technology into homes. I'll spend most of the rest of this chapter on this Yamaha product, partly because it's a true state-of-the-art item, partly because the price of a state-of-the-art Yamaha system is a reasonable $500 or so, and partly because Yamaha has produced—and hopefully will be selling in the United States—an add-on card that will give other manufacturers' MSX computers comparable capabilities. See Fig. 10-3. The digital audio chip used in some other manufaturers' MSX machines is also designed by Yamaha but is slightly less capable than the chip in the music computer.

Yamaha's CX5M looks much like any other MSX computer, but it has a very important additional feature built-in. In addition to the standard MSX sound chip, which can produce the sound of an ordinary electronic organ, the Yamaha contains a digital music synthesizer which works much like professional digital synthesizers that cost thousands of dollars. A digital synthesizer like Yamaha's contains four highly precise digital tone generators. The outputs affect each other, producing a whole spectrum of harmonic frequencies capable of closely emulating the tone of any other instrument.

The Yamaha computer/synthesizers work with either of two inexpensive keyboards: the under-$100, 44-key YK-01, and the under-$200, 49-key YK-10, whose keys have a more professional feel.

Perhaps the most impressive single activity you can do with the machine is simply to play it. The computer comes with 46 preset voices, many of them designed to sound like natural instruments. You can play any two voices at once, one of them with only one note sounding at a time and the other polyphonically (with up to seven notes sounding at once). You could play the trumpet with your left hand and a harpischord or electric piano with your right, for example. The computer also contains a variety of rhythm sections—drums, bass guitar,



etc.—that can play without you making any contribution. You simply turn them on and let them go. You can also control the rhythm section's chords with one hand as you play a melody with your other hand.

You can also record a performance in the computer (up to 2,000 notes), play it back, and accompany the recorded music on the keyboard live.

A Yamaha program called *Music Composer* allows music to be entered to a staff and played back using as many as eight of the computer's 46 voices. This composition tool can help composers just as word processors help writers.

The MIDI allows the computer to control voices on other electronic musical instruments, as well as those built into the synthesizer. If you don't like the 46 voices preprogrammed into the machine, you can modify them subtly or dramatically. Preprogrammed voices include, in addition to trumpet, electronic piano, pipe organ, flute, piccolo, oboe, and clarinet, such exotic sounds as a train, an ambulance, the chirping of a small bird, and the sound of raindrops.

I've heard an inexpensive digital synthesizer imitate a human whistle so convincingly the audience broke into applause. That was not a Yamaha synthesizer, however, but a Casio synthesizer. You can use a Casio synthesizer with the Yamaha computer since both have MIDIs, but the combination will have limitations: you can't use the Casio synthesizer to input notes to the composer program.

DIGITAL SYNTHESIS AND THE IMPORTANCE OF MSX

Yamaha's digital synthesizer indicates the importance of the MSX standard. It's a revolutionary product, but not entirely a Yamaha invention. Other, non-MSX manufacturers are creating similar products.

I don't believe digital synthesizers will make old-fashioned pianos obsolete. There will always be sounds that they can't quite produce. I suspect, however, that digital synthesizers will become the standard home instruments of the future, at least as much as the piano has been the standard home instrument in the recent past.

As that happens, the products will be improved. I don't know how; it's much to early to tell exactly how Yamaha's approach to music synthesis or anyone else's should be made better. As they are improved, though, people who have bought machines that use operating systems and hardware configurations supported by only one manufacturer are likely to be stuck. If the improved products are not manufactured by their companies, there will be nothing they can do. Their old machine will be able to talk with their new machine through a MIDI, but the only way they'll be able to access their old music disk files, for example, will be to keep their old computer around.

On the other hand, as new technology appears, you can be confident that some of the members of the MSX group will make it available on MSX machines. What's available may not be state-of-the-art; you may always have to throw out everything you've got and buy new equipment to get true state-of-the-art performance. Your system will improve as times change, however, and it's a safe bet you won't have to throw away your old disk files. MSX guarantees you'll be able to advance reasonably comfortably into the music technology of the 1990s.

Chapter 11

MSX and Your Education—Whatever Your Age

No area of computing contains more junk than the "educational software" market. Children enjoy computers and can learn a lot from them. It's hard to predict exactly what they will enjoy and respond to, however. So far few educators have figured out exactly what can be taught by computer or have developed the kinds of programs that would teach it well.

One company, Spinnaker Software, actually made a big hit in 1983-84 with an "educational" program that was nothing more than an electronic version of the old children's toy, Mr. Potato Head. It encouraged children to select eyes, noses, mouths, etc. from a computerized collection of eyes, noses, and mouths to create faces. It cost more than $20. To my knowledge, no one ever explained exactly why selecting eyes and noses by computer was more educational than selecting eyes and noses from a box of plastic parts. Children loved it, though, at least or a while.

Many parents have wasted a lot of money on educational software, and that's sad, because education really is one of the most important uses of home computers today. Although fashionable people jeer at computer ads which suggest your children will be left behind in the world of the future if you don't buy them a computer, there's a large measure of truth in the claim. (In fact, technology is moving fast enough that there's a reasonable chance some of us will be left behind even if we do all buy computers. That's a subject, however, that I'll leave for a brief word at the end of the last chapter.)

Parents who've bought computers find the children do use them and benefit from them enormously, but not generally by running "educational software." The children benefit by learning to program, and do word processing.

A third function, telecommunications, is just now becoming a worthwhile educational activity, as more good, moderately priced, on-line services become available.

I shouldn't leave you with the impression that all educational programs are a waste of money. At least two fields include some excellent products: typing tutor programs, and fun-with-math programs.

It's fairly easy to create games that relate to typing and arithmetic. I've never met anyone, however, who believes either he or his children gained more from educational software than they gained from learning to program and do word processing.

Finally, MSX' ability to work with a laser disk player will open important new opportunities for education, both in production of better educational software and in delivering enormous reference works on moderately priced laser disks. I'll discuss the future of laser disks and other advanced storage media in Chapter 15.

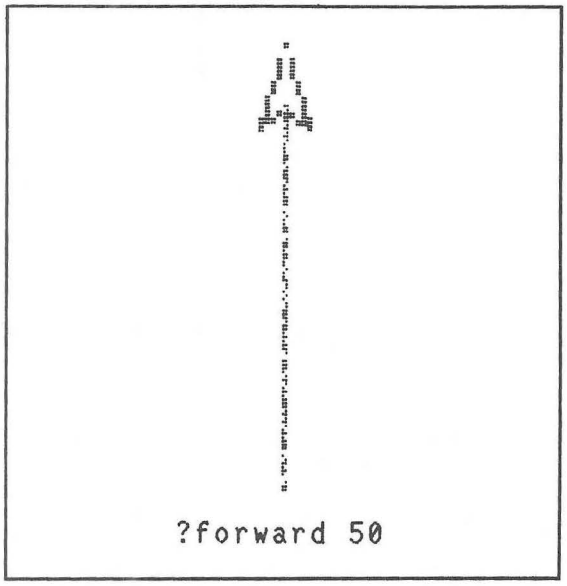


Fig. 11-1. The computer language LOGO, unlike BASIC, can give a picture at all times of a small graphic shape (called a Turtle). You tell the shape what to do using simple commands. It can leave a tracing of where it has been. The commands you type can appear on the bottom of the screen as they are being executed at the top (Dr. Logo software courtesy of Digital Research Inc.).

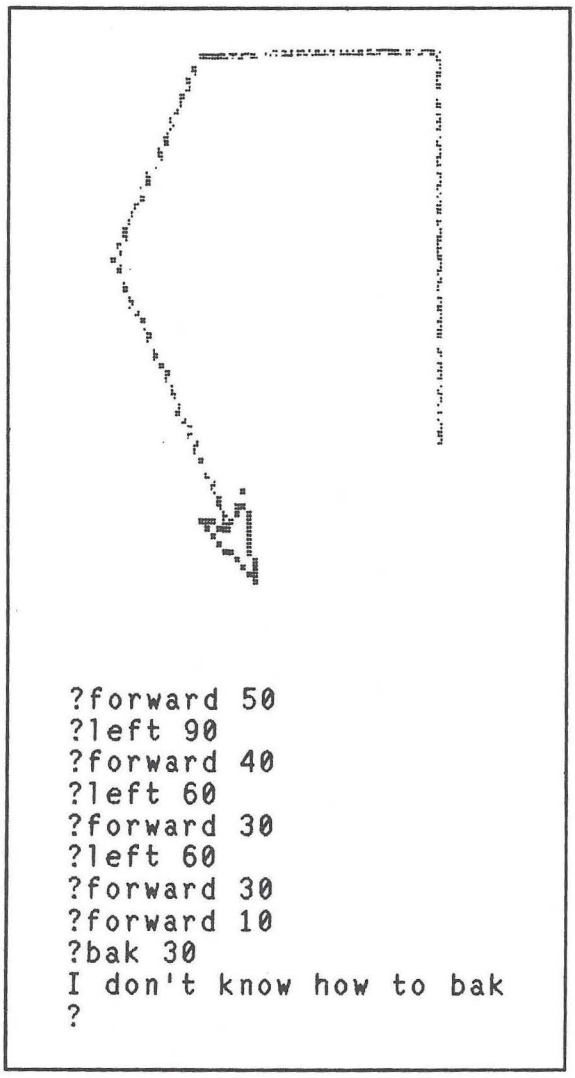


Fig. 11-2. Several LOGO commands used together can create a complex shape. LOGO's error message (i.e., "I don't know how to bak") are also easier to understand than BASIC's.

PROGRAMMING FOR AGE 5 AND UP

Computer owners praise the computer language LOGO for its educational virtues more than all other educational products put together. LOGO differs from BASIC and all other languages in that a shape called a *turtle* sits on the screen when you start entering commands, and you can see it move immediately in response. (Figs. 11-1 through 11-4).

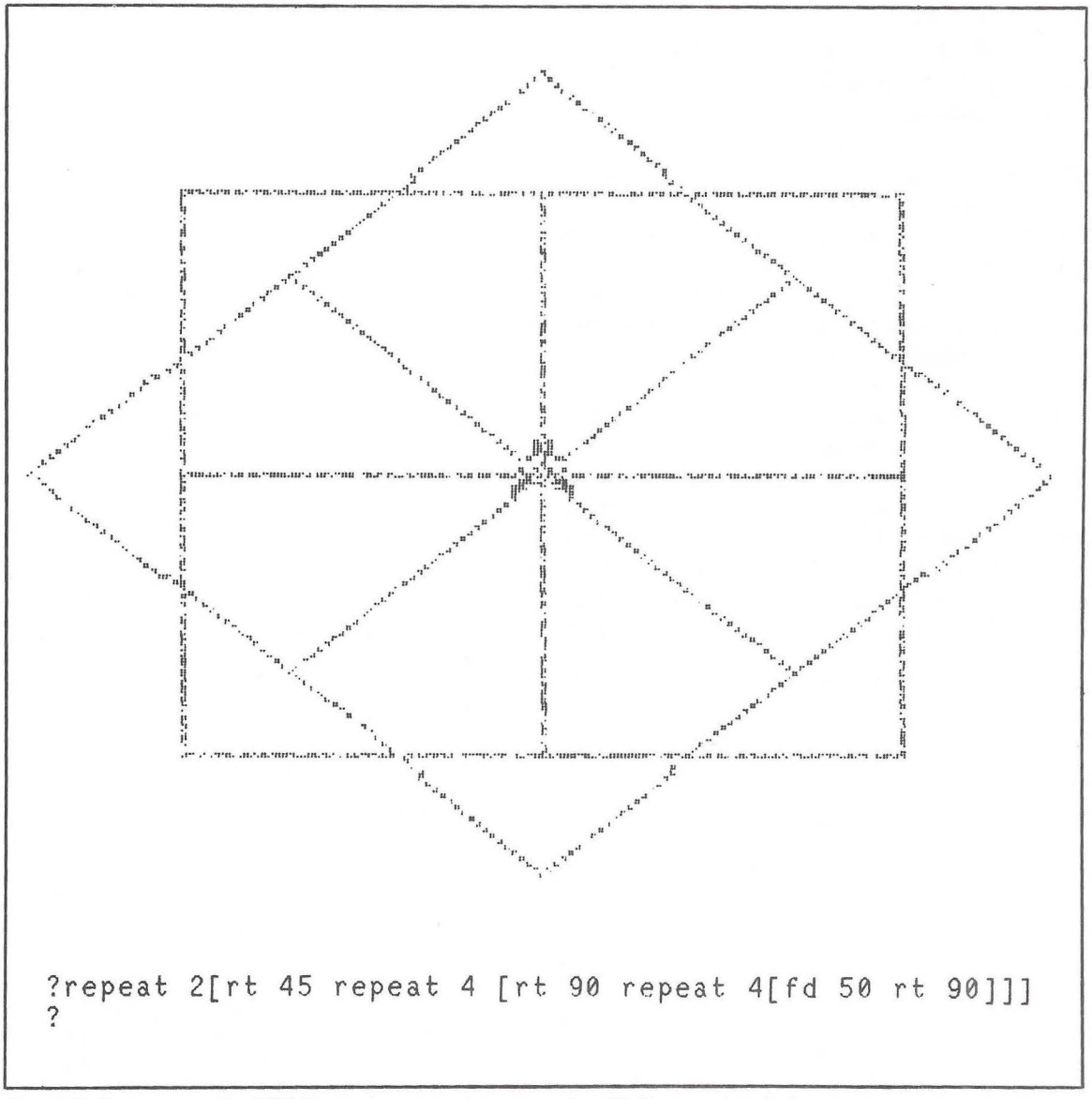


Fig. 11-3. A more complex LOGO set of commands can create a highly complex design.

LOGO is not just a graphics language; it has a full set of commands that will allow you to do almost anything you might want to do. Logo can be useful in writing programs that involve the integration of graphics and text, while BASIC would be easier for writing a highly structured data management program to handle a mailing list, for example.

LOGO derives from the computer language LISP, which was developed in the 1950s in an effort to mimic the workings of the human mind. FORTRAN had been written a few years earlier for the programming of IBM mainframes. LISP was written to handle ideas and relationships among ideas. BASIC is essentially a derivative of FORTRAN, and LOGO is derived from LISP in a somewhat similar way.

Computer languages have a way of coming into being through the inventiveness of a small number of people, and then metamorphosing into a dozen dialects as others use them in ways their founders hadn't planned; so it is with LOGO. LOGO was developed at MIT by Seymour Papert, who later founded a company called Logo Computer Systems Inc. It's not clear when or if a Logo Computer Systems version of LOGO will be available for MSX, but at least two other companies are ready to supply the market: The LISP Company of Los Gatos, CA, has a version completed, and Digital Research Inc., the creator of CP/M, has a product called DR Logo which may be distributed under manufacturers' brand names and even built into some of their machines in addition to BASIC.

LOGO gives children a chance to really control something before they're even old enough to spell. (Some LOGO commands can be entered with single letters.) It's a good educational experience, and enjoying LOGO also gives children an incentive to study more.

OTHER LANGUAGES FOR FUN AND PROFIT

Whether or not you or your family gets involved in LOGO programming, no one who's serious about programming should use only Microsoft BASIC, the language of which MSX BASIC is a dialect. Microsoft BASIC makes it relatively easy to get started in programming because you need to know very little about what's going on inside the machine, and you can ignore many rules. The first version of Microsoft BASIC was designed in a few weeks in 1975 by Harvard students Bill Gates (now chairman of Microsoft) and Paul Allen shortly after the first microcomputers became available to hobbyists. It was the only language, other than assembly language, that those early machines could run. Many computer owners believe you can still do far more with less computer power and less knowledge of technical details using Microsoft BASIC than any other computer language.

Microsoft BASIC doesn't encourage you to write programs with structure, however, which

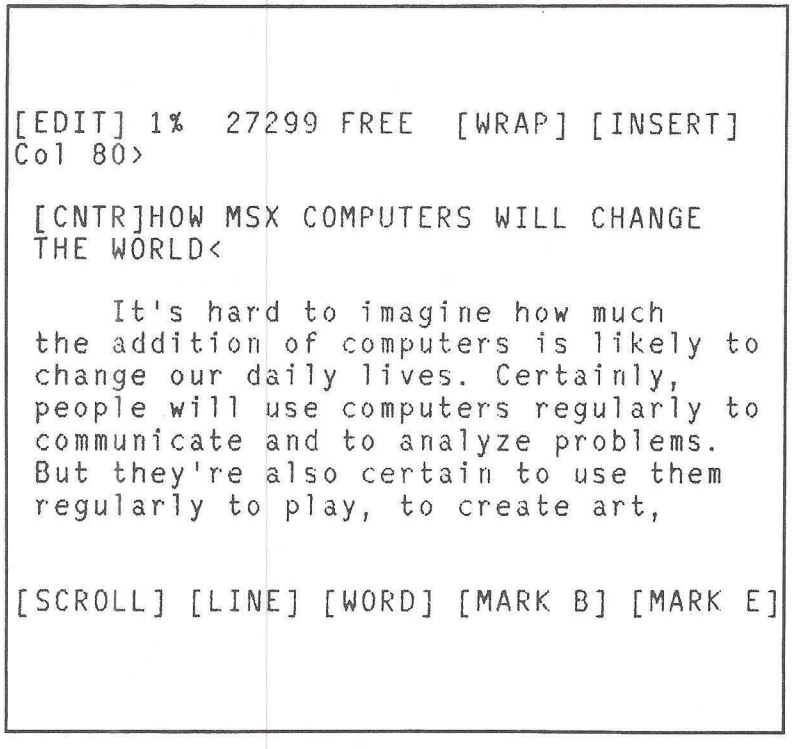


Fig. 11-4. A screen during word processing using JustWrite Jr. (software courtesy Mass Tael Ltd.).

most professional programmers consider essential to efficient computer use in the long run. People can find their way around well-structured program, just as they can find their way around a well-structured book. If you can find your way around the program you wrote, you can improve it or modify it to handle new circumstances better. The line numbers and GOTO statements of Microsoft BASIC don't help you follow the logic of a program.

I don't intend to take sides in the controversy between BASIC supporters and those who prefer other languages. One of the strengths of MSX is that versions of virtually all important computer languages are available for the Z80 microprocessor. There's no reason to be expert in only one language.

It's generally better to learn other languages such as Pascal, C, and Z80 assembly language in a class, not by yourself with a book. There will be plenty of opportunities for students to learn, and a lot of adult education classes teach older people as well.

WORD PROCESSING FOR STUDENTS

If programming helps you understand computers and the world of the future, word processing helps other people understand you. It takes the drudgery out of writing and makes good communication much easier. Both programming and word processing help people think more clearly.

For me, word processing often makes writing a note far simpler than communicating on the telephone (which sometimes involves several unsuccessful phone calls). Obviously, you and your children may never appreciate word processing as much as I do, but you certainly should own a word processor and learn to use it.

Essentially, *word processing* is simply the manipulation of written words by computer. When you type into the machine, it takes your words into its memory. The word processing program lets you easily modify them, reorganize them, or print them out neatly. Word processing not only helps people produce letters, schoolwork, and other data more accurately, it also helps you think. You can brainstorm ideas into the machine as fast as you can type. When you realize you've typed in a silly idea, you can easily modify it. For a school report, students can write down everything they know about a topic, then reorganize it into a coherent whole. Word processing is especially good for creating and modifying outlines. I don't think I ever organized my thoughts the way my teachers taught me in school until I got a computer. With the computer, creating and reworking an outline suddenly became much easier.

Buying a word processor is an enormously difficult decision. My description no doubt makes word processing sound simple. You'd think all word processors were alike or at least could all do similar things.

They can't. A word processor's commands become part of your thinking process; so word processor owners tend to be fiercely loyal to programs, often simply because they were the first programs they tried.

In this section I'll discuss some functions of a simple, easy-to-use word processor, then briefly touch on some of the additional functions in a more complex product. I'm obviously prejudiced in favor of some of the features in the word processor I use all the time (Perfect Writer). I'll refrain from criticizing any other word processor, however, because I've seen that people can benefit enormously from word processors I wouldn't touch.

How a Simple Word Processor Works

Figure 11-5 shows a word-processing screen as it might be displayed on a family television when using the program, JustWrite Jr, a simple, easy-to-use program designed especially for MSX computers. The version I reviewed was not the final version for the American marketplace and the program's U.S. distributor was not yet decided when I reviewed it; so if you have JustWrite or JustWrite Jr. you may find some differences between the way your program works and the way I'll describe it here. JustWrite Jr. has also been sold in other countries, and may be sold in the United States under the name "MSX Write." In addition, I've omitted

```
                HOW MSX COMPUTERS WILL CHANGE
                        THE WORLD

   It's hard to imagine how much the addition of computers is
likely to change our daily lives.  Certainly, people will use
computers regularly to communicate and to analyze problems.  But
they're also certain to use them regularly to play, to create
art,
```

Fig. 11-5. Printed output from JustWrite Jr.

some special characters from the screen display which I couldn't reproduce here. They're unimportant in understanding word processing or in operating the program.

This display shows the first part of a school report about MSX computers. Except for the control code in the first line, which will center the title when it is printed, I could enter everything you see here just as if I were typing. Entering text in the computer is the same as typing except that you don't have to hit the carriage return key to end a line. The computer moves a word down to a new line automatically when a line is full. When you fill the screen, earlier parts of your work will merely scroll off the top. You can return to them by using the cursor keys. In addition, you can easily fix mistakes by backspacing over them, or by using a great variety of other commands. If you discover a mistake long after you made it, you can use the cursor keys to go back and correct it.

Because this JustWrite screen was created in a mode designed to work with a home television or other low-quality monitor, it is only displaying 40 characters per line. Since ordinary typing normally contains at least 50 characters per line, in this mode JustWrite cannot display text as it will eventually be printed. When you make a correction, however, it cleans up your mess. If, for example, you delete several words in the middle of a paragraph, JustWrite will bring additional words onto the line so the paragraph will be properly shaped.

JustWrite is designed to be easy to use; so you issue virtually all commands by using the five function keys F1 through F5 and the special editing keys at the upper right-hand corner of your keyboard. As in BASIC, the bottom line of your screen explains each function key. Function keys work very differently in JustWrite from in BASIC, however. The strength of the computer is its flexibility, and we pay for that flexibility in the amount of confusion we put up with. While in BASIC each function key simply enters some specific characters as if you had typed the same characters from the keyboard, in JustWrite no single function key does anything by itself. The words SCROLL LINE WORD on the bottom of the screen indicate types of action JustWrite can perform. If you hold down F3 for WORD, for example, you'll see on the top of the screen the names of several keys that will do special things to words while F3 is held down:

bs del < - - >

While F3 is held down, the backspace key will delete the previous word; the delete key will delete the next word; the left arrow key will move you back one full word, and the right arrow key will move you forward one full word. While holding down the F1 key for SCROLL, special keys will scroll the cursor arrows back a line, forward a line, back a screen, forward a screen, and to the beginning or end of your text. Holding down F2 for LINE will show keys which operate on lines as the same

keys operate on words when F3 is held down. F4 and F5 mark the beginning and end of blocks of text, which are then highlighted on the screen and can be moved anywhere in your manuscript using options that appear on the screen when you push the SELECT key.

JustWrite Jr. will hold up to 28,000 characters of text at a time in a 64K MSX computer—a bit more than a chapter of this book. To print on paper, you go to the program's main menu by pushing the ESC (escape) key, and enter a **P** for PRINT. Figure 11-6 shows how the screen in Fig. 11-5 would print.

To use word processing effectively, you need a printer and at least one disk drive. If you have only one disk drive, JustWrite Jr. is a very useful program because it comes on cartridge. Plug the cartridge into the computer, and you can use your disk drive exclusively for storing files. Most other word processors come on floppy disks, although some manufacturers (Toshiba, for example) have shown machines with word processors built in on read-only memory chips. If you have a disk-based word processor and only one disk drive, you'll spend a lot of time pulling a disk out of your computer and putting another into it.

A Fancier Word Processor

What do you give up when you do your word processing on a television set with one disk drive and an easy, cartridge-based word-processing program like JustWrite Jr.? A lot.

Unfortunately, however, every expensive program omits some highly useful features—often

```
@center[HOW MSX COMPUTERS WILL CHANGE
 THE WORLD]

     It's hard to imagine how much the addition of computers is
likely to change our daily lives. Certainly, people will use
computers regularly to communicate and to analyze problems. But
they're also certain to use them regularly to play, to create
art, and to control their homes.

     Probably communications will be the most important use of
all.  Once home computers become widely used, they will become
necessities of life because shopping will be both less expensive
and easier with a computer than without one.  Already there are
computer shopping services that offer lower prices than
conventional stores or mail-order houses on a wide variety of top
products such as videotape recorders, television sets, and
cameras.

     An artist like a Walt Disney is likely to find many
opportunities to create new forms of entertainment using a
computer.  But so far,


Perfect Writer Version 1.00 (Wrap) justw: REPORT.MSS -71%-
File Written
```

Fig. 11-6. By letting you see much more of your text, an 80-column screen makes it much easier to think about your document (software courtesy Thorn EMI Computer Software Inc.).

some that are available in JustWrite Jr. Also, no one has figured out how to provide all the features most people, or even most high school students, would want while still making their programs easy to use.

Here's a list of features that aren't in JustWrite Jr. but are in Perfect Writer, a powerful yet relatively easy-to-learn word processor that requires two disk drives:

UNDELETE—The ability to recover text that has been mistakenly deleted. A very important feature (though even if you've got it, you still should save a lot of backup copies of your writing). A few word processors even have UNDO, which will let you undo any command, including commands that reorganize a document.

MULTIPLE BUFFERS—The ability to keep several documents in memory at once so you can easily work on them at the same time and transfer text among them. You can switch to your outline while working on a school report, for example. As your ideas change (and they always do in the middle of report writing), you can modify the outline so you always have a clear map of where you are going.

VIRTUAL MEMORY—The ability to swap text from random access memory to a computer disk so documents bigger than the computer's memory can be handled.

WINDOWS—The ability to show two different documents, or two parts of the same document, on the screen at the same time.

SPELLING CHECKER—A program that will compare the words in a file with the words in a dictionary on the computer's disk. (Some spelling programs will suggest a correct spelling when a word doesn't match their dictionaries, but Perfect Speller won't.)

THESAURUS—You can insert a different disk in your computer, and it will offer a list of synonyms to a word you think isn't quite right.

AUTOMATIC FORMATTING—An ability to automatically adjust the spacing in a document when it is prepared for printing so it will hopefully have a pleasing, consistent appearance throughout; extremely useful in longer documents.

AUTOMATIC TABLE OF CONTENTS—An ability to keep track of sections of a document automatically and create a complete table of contents.

AUTOMATIC INDEXING—The ability to create an index.

Some of these capabilities may seem awesome. In fact, when they work well, they are awesome. Somehow, however, programmers manage to leave us with agonizing choices. Perfect Writer lacks some simple, obvious features available in JustWrite Jr. It won't reformat a paragraph when you make a change in the middle. Thus, your thoughts can look unfinished even when they aren't. It won't emulate a typewriter. JustWrite can cause your computer to send characters directly to the printer. This can be vital in filling in forms or addressing envelopes, for example. Perfect Writer can't do it.

Perfect Writer could be a wonderful thinking tool, but the failure to reformat paragraphs especially makes it a bit cumbersome. Perhaps the best policy is to buy a simple, cheap, easy-to-use word processor when you get your computer, or get a computer with a word processor built in. Don't begrudge your children a little bit of spending to make their word processing work really well. Word processing is a central part of thinking in the computer age.

ON-LINE COMMUNICATIONS AND EDUCATION

I suspect most parents who have bought modems—the devices that connect computers to telephones—have done so with the idea that the children would use them to further their educations. In reality, the devices have proven educational in a very unconventional way. Children use them to learn how to be computer "pirates," copying software illegally. Although fine information sources exist online, most of the good ones have been designed for well-financed businessmen and professional researchers. Tapping into them legitimately has been extremely expensive.

```
100 REM      MATH PRACTICE PROGRAM

200 PRINT
210 PRINT "This program will provide you
220 PRINT "with a variety of addition,
230 PRINT "subtraction, and multiplication
240 PRINT "problems.
250 PRINT
260 PRINT "You'll have four chances to answer
270 PRINT "each question. After four tries,
280 PRINT "the computer will give you the
290 PRINT "correct answer.
300 PRINT
310 PRINT "Hit any key to begin ..."
320 A$=INKEY$:IF A$="" GOTO 320
330 A=RND(-TIME)
340 FOR N=1 TO 10: NEXT N
350 B=RND(-TIME)
360 FOR N=1 TO 10: NEXT N
370 C=RND(-TIME)
380 X=INT (A * 100)+1
390 Y=INT (B * 100)+1
400 Z=INT (C * 3)+1
420 IF Z=1 THEN 450 ELSE 500
450 R=X+Y
460 A$="+"
470 GOTO 800
500 IF Z=2 THEN 510 ELSE 600
510 R=X-Y
520 A$="-"
530 GOTO 800
600 IF Z=3 THEN 610 ELSE 800
610 R=X*Y
620 A$="x"
630 GOTO 800
800 CLS
810 PRINT X;A$;Y;"="
820 INPUT Q
830 IF Q=R THEN 900 ELSE 1000
900 CLS
```

Fig. 11-7. Math practice program.

```
910 PRINT
920 PRINT "You're right!"
930 PRINT R; " is the correct answer."
940 PRINT
950 PRINT
960 INPUT "Press 'return' to continue";X$
970 T=0
980 GOTO 330
990 PRINT
1000 T=T+1
1010 IF T=4 THEN 1200
1020 PRINT "Sorry, that's a wrong answer."
1030 INPUT "Please try again - "; Q
1050 GOTO 830
1200 PRINT"The right answer is "; R
1220 PRINT
1230 PRINT
1250 INPUT"Press 'return' to continue";X$
1260 T=0
1270 CLS
1280 GOTO 330&ns of the BASIC words I haven't
     covered up to this point:
```

Fig. 11-7. (Continued from page 90.)

I'll deal with going on-line in more detail in Chapter 14, but while I'm talking about education, I want to mention that, in the last year or so, two reasonably priced services have emerged that provide real value for education.

Knowledge Index, the evening consumer service of Dialog Information Services Inc., the largest provider of on-line data for professionals, truly gives you a sense of the power of on-line computing. You can access abstracts of all important articles in virtually every major field. Although the cost seems a bit steep at $24 an hour, you can get in, learn a lot, and get out far faster than you can when using any lower-priced service. Budget $20 a month, and an inquisitive family can gain a great deal from it.

The Academic American Encyclopedia on CompuServe is a less-spectacular, but still high-quality, product that contains good information on almost everything. Other versions of the Academic American Encyclopedia are available through other on-line services, but the mechanics of searches on CompuServe are the most reliable and useful.

See the discussions of Knowledge Index and CompuServe in Chapter 14 to decide whether you want to sign up for these services.

A DRILL PROGRAM

Here's a simple program that does what educational software handles best (Fig. 11-7). It gives practice in math. Your computer will generate random numbers. (Technically, they're pseudorandom umbers, but I'll get into that in a moment.) If you want, you can use the graphics commands I showed you in Chapter 8 to add color and sound to this program. The following explanations will also tell you how to customize it in other ways—to provide a lower or higher level of difficulty, for example.

```
100 REM     MATH PRACTICE
            PROGRAM
200 PRINT
210 PRINT   "This program will provide you
220 PRINT   "with a variety of addition,
230 PRINT   "subtraction, and multiplication
240 PRINT   "problems.
250 PRINT
260 PRINT   "You'll have four chances to
            answer
270 PRINT   "each question. Aftr four tries.
280 PRINT   "the computer will give you
            the
```

Here are explanations of the BASIC words I haven't covered up to this point:

Lines 330, 350, and 370. RND—BASIC's "random number" command. No number generated by computer can be random; computers, after all, are thoroughly programmed machines. The RND function, however, when applied to the current time in the computer's memory, produces a number between 0 and 1 which is "random" enough for purposes like creating math problems. Lines 340 and 360 simply slow the program down to ensure that the TIME used in lines 350 and 370 will be different from the TIME used in line 330.

Lines 380-400. INT—rounds a number off to the nearest integer.

To create easy problems for a younger child, simply eliminate multiplication from the program, and multiply the random numbers "A" and "B" by 10 instead of 100 in lines 380 and 390, and the random number "C" by 2 instead of 3 in line 400. You'll probably be able to find all sorts of ways to make the problems more difficult.

Chapter 12

Running Your Life

I have to own a computer. I spend all day typing articles, books, and consulting reports into it. That's not all my computer does, however. My wife and I correspond with old friends, keep track of the addresses of her college classmates, maintain lists of things that need doing, and create and analyze our budget by computer. Your MSX computer is ideal for all these jobs. Moreover, as MSX devices are refined over the next few years we'll all learn to use MSX computers to control our homes, our security systems, and our utilities. We're just starting to benefit from computers today.

WORD PROCESSING FOR NON-STUDENTS

Perhaps the computer task whose benefits for their lives are most underrated by adults is word processing, which I discussed for students in the last chapter. Many adults write few letters and don't know how to type. They think they don't want to learn.

Virtually all the adults in families I know who have gotten beyond basic game-playing on the computer have found themselves captured by a word processor. My mother uses a home word processor to write long, interesting letters to her uncle in a veterans' home 500 miles away. Her notes to him used to be almost short enough to fit on a postcard. My father uses it to prepare business letters at home. My wife uses our word processor sometimes as I do, just to help her organize her thoughts.

Typing tutor games can make learning to use the keyboard almost as much fun as playing with toys. In addition, consider word-processing applications like these:

- ☐ Sending a personalized note to every friend and relative at Christmas or other major occasions. I write a general letter to

everyone, then make copies on disk with the computer and include little individual tidbits appropriate for each person.

- ☐ Maintaining lists of things that need doing around the house. It will be much easier to make sure nothing gets forgotten if you keep one list constantly in one place where you can add to it or take jobs off it as they get done.
- ☐ Keeping notes about individual and family goals or projects. On the computer, different family members can easily add to or modify the list and help develop a family consensus.
- ☐ Keeping notes on anything else. Once your typing speed is adequate, you'll find that entering data on the computer speeds note-taking on books or any other long document. You can also find what you want within your notes using your word processing software's Search function. (For the simplest, shortest collections of notes, however, plain old paper or file cards remain more efficient.)

DATA MANAGEMENT

Once you've discovered the power of word processing, you'll probably become interested in other kinds of data management on your computer, and there are dozens of programs in stores that promise to help manage your data. They range from specialized programs with titles like Recipe Filer to immensely powerful professional tools like dBASE II, which can do almost anything you might ever want to do with your data, but which are as hard to learn as a new programming language.

These programs can do a great deal that your word processor can't. Working with data in a word-processing environment has several disadvantages. The computer can take as long as 30 seconds to search a large word processing document for a word you seek. If you want to reorganize your data, doing it with a word processor's Move command can be more difficult than reorganizing index cards.

Data management organizes records into a number of fields such as shown in Fig. 12-1. In seconds, or fractions of a second the computer can search for all the people who live in zip code 12345 or everyone named Jackson. You can quickly print out reports of everyone in your database sorted by state.

Nonetheless, I'd advise you to go slow in buying database software. More computer users have done more swearing at database software than at any other computer product.

The reason is that the same elements that make database software powerful also tend to make it inflexible. If you have said in the "comments" field of the record for Tom Jackson, "likes tennis and volleyball," and you later want to find all your friends who like tennis, there may be no simple way to do so. If there is, it may be a good deal more cumbersome than finding the same information with a word processor. Normally when a database program searches for something, it searches only for fields that exactly match what what you asked it to find. If you asked a database program to search for fields that said "tennis," it would pass right over a field that said "likes tennis and volleyball." There are, of course, a lot of ways to cope with this. You can, for example, set up special fields in your database labeled "keyword." Some database programs will conduct word-processor like searches for any string of characters anywhere in the data fields, but they'll generally do it no faster than a word processor would.

The key point is that database software only benefits you if data is highly structured. If you're going to be looking up telephone numbers or employees' ages all the time, it's highly useful. If you're simply accumulating facts that you may someday use in letters to the editor denouncing high taxes, database software will probably be more trouble than it's worth. The key question is: do you manage enough data and is its structure sufficiently consistent that the structured form of a database management program will really serve you better than a "notes" file created on a word processor?

For many people, the answer is no. If you do decide to experiment with data management software, try to start out with a program that is recom-

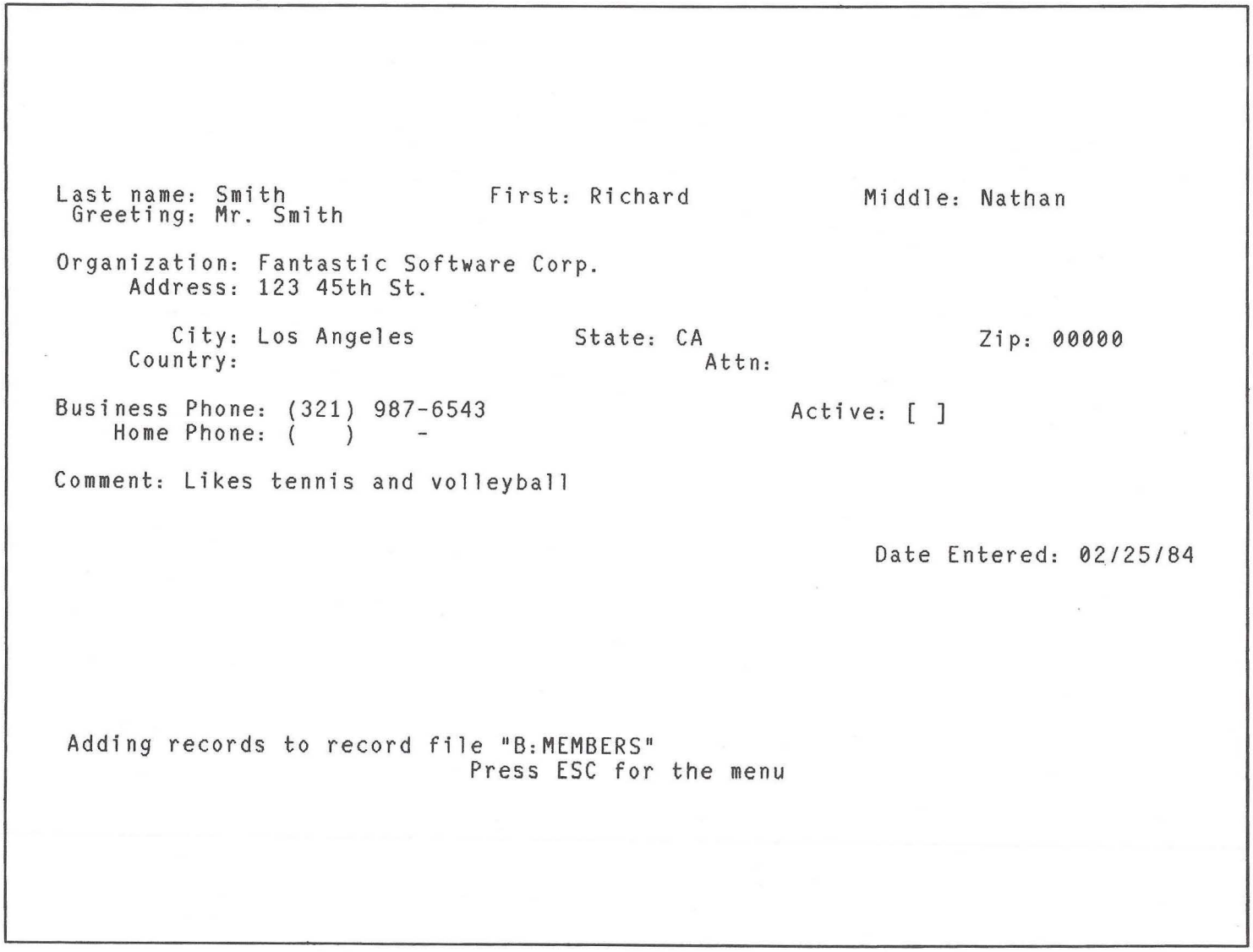


Fig. 12-1. A data record from a names and addresses database. (software courtesy Thorn EMI Computer Software Inc.).

mended by at least one experienced friend and will easily operate as much as possible like an old-fashioned index card file. That way, your data management system will resemble something you know.

FINANCIAL MANAGEMENT

There's one kind of data that truly demands a specialized program for management—financial data. With the right kind of program your MSX computer can be a tremendous help in compiling budgets, keeping track of your investments, and even, possibly helping you figure your taxes.

You have two choices for financial management: special financial management programs or a generally more expensive, more useful type of program called a spreadsheet. Personally, I've chosen the spreadsheet route for my own finances, and I'm going to tell you why.

Inexpensive financial programs generally ask you a series of questions about your finances and then create a budget (or a list of stocks, tax deductions, or whatever) for you. But if the questions don't exactly fit you, however, you may find it difficult to do anything useful with the program. I gave up using cheap financial programs after I tried to do a budget on one and found that it was extremely difficult to tell the computer I wanted the budget to start in May, not January. Perhaps good, inexpensive financial programs exist, but I haven't run across any. I've got an equally low opinion of time

```
#1      1        2        3        4        5
   1
   2
   3
   4
   5
   6
   7
   8
   9
  10
  11
  12
  13
  14
  15
  16
  17
  18
  19
COMMAND: Alpha Blank Copy Del Edit Form
  Go Help Ins Lock Move Name Opt Print
  Quit Sort Transfer Value Window Xtern
Select option or type command letter
R1C3                          100% TEMP
```

Fig. 12-2. An initial screen from Microsoft's Multiplan (software courtesy Microsoft, Corp.).

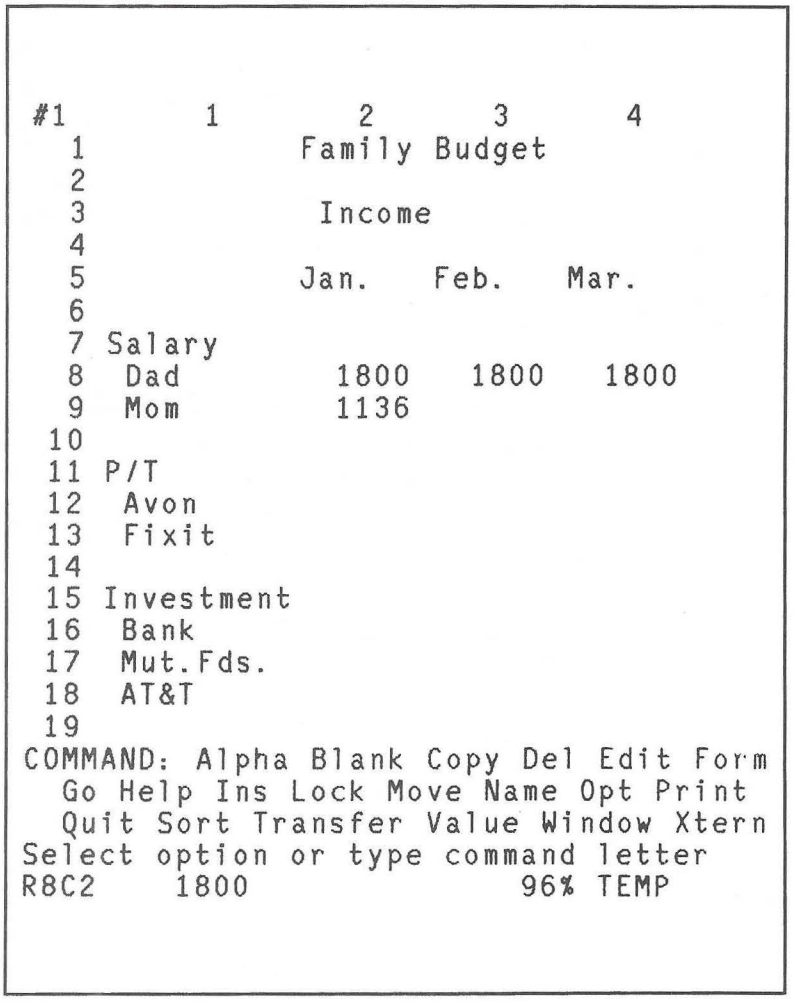


Fig. 12-3. A Multiplan spreadsheet with a few entries.

management programs; I doubt any will manage your time better than a calendar hung on your wall or a datebook you can carry in your pocket.

Spreadsheet programs, on the other hand, can analyze practically any kind of data and let you perform practically any kind of calculation on it. If you decide you don't like the method you've been using to analyze your data, it's easy to change it and analyze the same data another way.

Let's look at how Multiplan, a leading spreadsheet program, can be set up to analyze a family budget. Figure shows the screen as Multiplan starts operating in 40-column mode, appropriate for television sets. You can think of this view as a window onto an enormous sheet of paper which can extend to column 63 and row 255, if you should ever need that many rows and columns. You can see the other rows and columns by pushing the cursor arrow keys to move to the right or to move down (Fig. 12-2).

You can enter words or numbers on a spreadsheet using a method not too different from that used to enter words and numbers with a word processor. Figure 12-3 shows income figures entered in a family budget.

The strength of a spreadsheet program, however, is that you can also enter mathematical formulas. You can add up all the numbers in the

income columns to get the total income for a month. You can subtract expenses from income to learn whether you're in the red or in the black. Once you've entered a formula, the total will change every time you change one of the items. That's terrifically useful if you're trying to balance a budget. Every time you say, "Suppose I cut $10 a month from my grocery bills," the program will instantly calculate how that will affect your finances over the course of a year. If you think of some bills as monthly, others as weekly, and others as annual, you can even set up the program to instantly convert the weekly figures to monthly figures and project them out over a year. Figure 12-4 shows how a formula has been used to add all income sources for January.

Finally, COPY or REPLICATE commands can be used to enter the same number in dozens of different locations at once (to enter a monthly check under headings for 12 different months, for example) or to enter a dozens of similar formulas. In Fig. 12-5 that's been done with formulas for the family's total monthly income. It may take a little while to learn to use a spreadsheet program, but the time is well-spent.

COMMUNICATING WITH NON-MSX COMPUTERS

MSX machines are unique among inexpensive microcomputers in that they let you easily transfer data from an office to a home computer. If you buy

```
#1        1        2        3        4
  5               Jan.     Feb.     Mar.
  6
  7  Salary
  8   Dad          1800     1800     1800
  9   Mom          1136     1136     1136
 10
 11  P/T
 12   Avon          110      150      150
 13   Fixit         200      180      180
 14
 15  Investment
 16   Bank           20       20       20
 17   Mut.Fds.       30
 18   AT&T                    40
 19
 20
 21
 22  Total inco   3296
 23
COPY: Right Down From


Select option or type command letter
R22C2    R[-14]C+R[-13]C+R 95% TEMP
```

Fig. 12-4. Using a formula to calculate total income for a month.

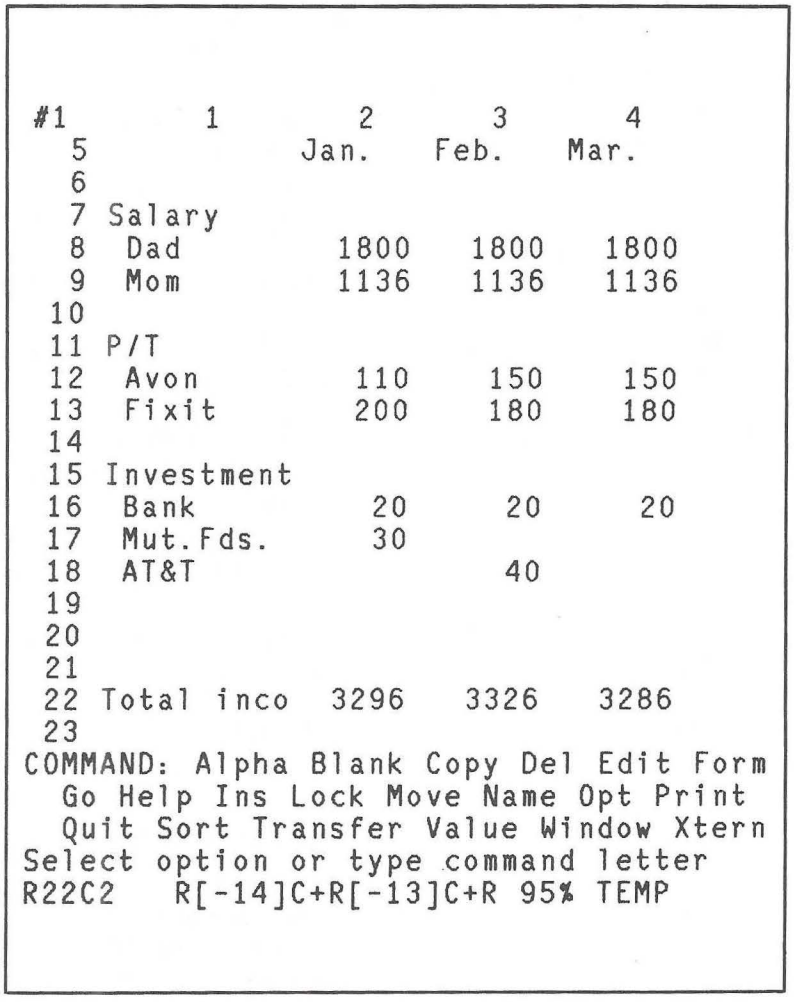


Fig. 12-5. Multiplan has replicated the formula to calculate income for the next several months. Whenever an entry in one of the income categories is changed, the appropriate total will now change automatically.

a 5 1/4-inch MSX disk drive, your MSX computer can read disks created on an IBM or compatible PC, and the IBM or compatible can read disks you create at home. If the office PC runs the CP/M operating system, on the other hand there's a good chance your MSX computer will run the same programs it does. This compatibility makes it relatively easy to use your computer to work at home, either on projects for your boss or on products that will help the guy next door.

Most offices aren't yet using computers to nearly the extent that they could. They don't know what powerful computer programs could do for them. You probably have a pretty good idea, however, if you've read this far. Thus, you can produce extremely helpful memos and spreadsheet analyses for your boss by using your home computer. Don't try to move data back and forth from your home to your office computer unless it's really necessary. Unexpected problems often develop in moving data from one computer to another, and if you waste hours of your or your boss' time trying to move data from home to the office, you won't endear yourself to anyone. People have been fired for getting so involved in problems of computer compatibility that they had no time to do their jobs.

It's important to know that data can be moved if necessary. Most word processing programs, for

instance, are fairly compatible with each other. You could take a file created on an MSX computer with JustWriteJr. or Perfect Writer, put the disk in an IBM, and read and edit it using a popular program like MultiMate. You will find that some word processor codes from one program do funny things in another program, but you can quickly learn which codes do and avoid them. (I don't use the automatic indexing feature of my word processing software on files that will be transferred to other programs, for instance.) You can also eliminate them with a word processor's Search and Replace function.

The major exception in word-processing compatibility is WordStar, which gives special codes to some letters to help it format text. Consult a local CP/M user's group for advice about converting WordStar files for use with other programs. It's a common problem, and there are several public-domain programs designed to do it.

Once you get outside the word processing field, you'll have more serious problems moving files. Many spreadsheet, database, and accounting programs use idiosyncratic data formats. Your computer can read a file created on an IBM computer at work, but your home spreadsheet or database program probably won't be able to do anything with the information.

You're probably best off getting an MSX or CP/M version of the same program the office uses if you want to work on office data at home. If your office uses a version of Multiplan, it will probably be easy to move data to Multiplan on your home MSX computer; if your office uses VisiCalc, you can obtain a CP/M version of VisiCalc that runs on MSX. There are ways to move data from one spreadsheet to another, but unless you've got a good deal more knowledge than this book can give you, you'd best not try it without help. Unless you can get the same spreadsheet, data management software, etc. for your MSX computer that your office uses, stick to doing your own analyses at home and showing the printed results to your boss at work until companies have produced products designed explicitly to help you move data from home MSX computer to office IBM.

MOVING FILES FROM CP/M FORMATS TO MSX

If the office computer isn't IBM-compatible, you have two options. Several programs, including Perfect Link from the same people who produce Perfect Writer, will convert data from a 5 1/4 inch MSX-DOS or MS-DOS formatted disk to a form that can be read by any of the major CP/M systems such as Kaypro, Osborne, or Xerox. If your version of a conversion program doesn't tell you how to move the data to an MSX disk format, just remember that the MSX disk format is the same as the IBM or MS-DOS format. Almost all programs will list either IBM or MS-DOS.

Your other option is to transfer your word-processing data by telephone. If anyone in your office is experienced in such transfers, this may be the easiest way. In fact, this may be your only option if the office computer is neither IBM, MS-DOS, nor CP/M-compatible. Apple products, for example, use idiosyncratic disk formats and it's hard to get Apple-formatted data out to other machines. It can fairly easily be telecommunicated, however. (See Chapter 14.)

RUNNING A HOME BUSINESS

Okay, so all that stuff sounds great in principle, but the reality is you hate your boss, and the last thing you want to do is spend your evenings trying to be more useful to him. Can an MSX computer make you more independent of your boss?

Sure. Home-based businesses are probably the second fastest-growing sector of our economy (with computers and related high-technology enterprises being the only sector growing faster). The growth of the two sectors is closely related. I work from my home, and my computer is to a large extent my secretary and my accountant. When I've finished an article or a consulting report, the computer sometimes even delivers it to the client through telephone lines.

That doesn't mean the computer has made running a home-based business easy. Developing any home-based business still takes months or years of

frustration while you develop a clear idea of what people really need from you and convince people that you can provide it to them. You can make only slightly more money putting a notice on the supermarket bulletin board that says "word processing services" than you can putting up a similar notice that says "typing services." Both may be worthwhile, but neither will easily generate enough money to pay for an expensive computer setup.

Nonetheless, the computer is a formidable ally in a home-based business. If you are an Avon lady, word processing and spreadsheet software can do everything for you that they can for a larger business. You'll find your computer can help enormously to keep track of how much return you get for the time you spend, and to watch your cash flow. (Just as I suggest you avoid specialized software for home accounting, I suggest you avoid buying small business accounting packages until you find one that's recommended by someone you trust. I keep track of much of my business finances with my spreadsheet program.)

Data management software, on the other hand, really comes into its own in a home-based business. Customer lists, containing information on what customers buy and what they'd like to buy, are the type of records that are sufficiently structured to benefit from a good data management program. The program can quickly produce a list of everyone who has bought perfume, for example.

For business use, be sure to get word-processing and database software that can work together with a Mailmerge capability. (The Perfect Writer/Perfect Filer combination, for example.) If you only send a lot of mail once a year at Christmas, you can do as I do and create new files for each letter with the addresses typed in by hand. If you run a business, however, you'll eventually want a program to pull names and addresses from a database file and insert them in form letters for you.

In fact, mailing-list maintenance companies are one of the most common home-based computer businesses. Lots of larger businesses have lists of people or organizations to whom they'd like to mail information regularly, but can't because they don't have the time or the computer know-how to do it themselves.

RUNNING YOUR HOUSE TOMORROW

Nothing a computer can do has been touted more and actually put into practice less than home control. Newspaper writers have been publishing stories since the 1970s about how home computer owners can control their homes with a computer—turning lights on and off, adjusting a stereo, and monitoring a home security system.

MSX brings the science-fiction scenario of the computer-controlled home much closer. Matsushita Electric has been exhibiting prototypes of the home-of-tomorrow for years, and has sold home control products in Japan. Several small companies are developing home-control products for MSX machines in the United States.

The most important application in the short term, and the one most likely to justify the expense of a home-control system, is home security. If you know anyone who has a burglar alarm system, you know that false alarms occur frequently. Matsushita's home control system, as well as others, monitor the sensors on your windows and doors and report immediately which one is showing something amiss so it can be easily checked out. That sort of application can even be arranged to run "in the background" so you can continue doing other tasks with your computer while the computer is watching the windows and doors. Once a system is installed to monitor security, it's a simple matter to have it turn off lights after everyone is in bed and perform other housekeeping tasks.

It's possible to wire up your house, program a home monitoring system in BASIC, and achieve many of the benefits of home control immediately. You can even buy products that will communicate with appliances by sending messages through your existing home wiring system, but I don't recommend that you do so. The job of managing your home's technology is just too complex for simple products from small companies to do it well. There's a lot of interference in home wiring systems and I certainly wouldn't trust my security

system to a product that communicates through them. Any maker of products that require you to rewire your home should address numerous difficult questions. Just as we want to avoid throwing away our computers after a year or two, we certainly want to avoid ripping out a house full of wiring.

I'd be conservative about buying home control products for the moment. Matsushita and other MSX companies hope to deliver products to the United States soon. I'd look for them in 1986. The initial ones may not come with interfaces for an MSX computer. (The makers think they can sell more if their products appear easy to control without a computer.) Computer/home control interfaces, however, will be easy to create once there is more progress towards standards. I expect them to be revolutionary in the long run (see Chapter 16); so I'd wait a while before putting oversimplified substitute gadgets into my home today.

Chapter 13

Expert Systems: The Next Application?

MR K.N. is an enthusiastic, innovative person who can always find a new way to skin a cat--from a computer's profile of Kazuhiko (Kay) Nishi, developer of the MSX standard.

An MSX computer produced these words running an "expert system" program called "Mind Prober" from Human Edge Software. Expert systems, together with some natural-language adventure games such as Zork (see Chapter 5) are the first fruits of artificial intelligence research to reach personal computers. They will run well on MSX machines, and MSX gives them a unique opportunity to serve you.

Donald Michie, a computing pioneer since World War II and a celebrated artificial intelligence researcher, says he expects that within 5 years "the consumer will begin to expect machine intelligence in entertainment equipment, autos, washing machines, cooking equipment and so on. Anything where you have an owners' book, that book can be replaced with an expert system. There will be a vast industry out there."

Since the MSX standard is designed to be built into appliances, there will be a lot of opportunities for MSX computers to help explain the gadgets of the future to you. Expert systems can also do virtually anything a how-to book can do, only—at least in principle—much better. In fact, an expert system can probably give you most of the advice a typical doctor, plumber, or business consultant could give you, although creating really good expert systems will be extremely time-consuming for software companies; so we may not see too many too soon.

Don't be too gullible. A lot of very ordinary programs get sold as "artificial intelligence" products. Even the best expert systems can produce wrong answers in fields like psychology where humans also produce wrong answers. I wouldn't recommend you turn to an expert system instead of a doctor for a few years at least, and if you finally do, I'd suggest you treat the advice cautiously. Even-

tually, however, you will find expert systems are a major reason for owning an MSX computer.

There's a lot of controversy over exactly what constitutes a "true" expert system. Some specialists argue that Mind Prober isn't a true expert system because it doesn't explain how it arrives at its advice and doesn't interact with the user in the same way a human psychologist does. Others emphasize that even though it's a well-written program, it often produces wrong answers just like human psychologists do. There's little quarrel, however, that it's a neat product which works much like a clinical psychologist in producing a profile of a person you know. More important for the long run, there's no longer much quarrel among artificial intelligence researchers that true expert systems, however they may be defined, can run on machines like MSX computers or IBM PCs. Michie and other programmers are working today to give our microwave ovens the capability of explaining themselves in a way that will fully meet most computer scientists' definitions of a true expert system.

THE PSYCHOLOGICAL "EXPERT"

The first sentence of this chapter comes from a Mind Prober profile of Kay Nishi, the father of the MSX standard. Using Mind Prober is like taking a psychological test, which isn't surprising, because Mind Prober is descended from programs that interpreted psychological tests. The tests themselves were invented to mechanize the process of evaluating people so psychologists could handle heavy case loads.

People were asked to agree or disagree with a series of statements. (For example, "Most people consider me a friendly person.") They might be asked to agree or disagree with a series of adjectives in evaluating themselves, or, as with the Mind Prober, they can be asked to agree or disagree with a series of adjectives or statements applied to someone else. The answers are used to rank the person being evaluated in terms of several key personality characteristics: quickness, morality, adjustment, ambition, extroversion, and likeability, for instance. A psychologist can look at the scores on the various measures and give a detailed description of the person being studied. After World War II, psychologists were surprised to discover that they produced more reliable descriptions of people when they relied on the test scores than when they relied on interviews. (The classic work on the subject was done in the 1950s by Professor Paul Meehle of the University of Minnesota.)

Mind Prober is designed to produce psychological profiles of people you've known for just 30 minutes or so. All psychological techniques are sometimes wrong, although good ones are significantly more reliable than simple human intuition. It's not clear how reliable Mind Prober is in evaluating people you've only known for a short time. No validity studies have been done on it yet, and users like me have found that it's often difficult to agree or disagree with all the adjectives Mind Prober suggests when you've only known someone for 30 minutes.

I generally find Mind Prober most useful in understanding people I've spent a few hours with over a period of weeks or months, but whom I still feel I don't understand. It's still important to remember that the computer can be wrong, but it's sometimes easier to recognize that the computer can be wrong than to remember that my own "gut feelings" can be wrong.

Here's the complete Mind Prober profile of Kay Nishi. Profiles are generally more useful when they contain more negative information than this one does, but I'm not anxious to distribute a critical profile of anybody. Remember that all I did to produce this profile was respond "Agree" or "Disagree" to a series of adjectives regarding Nishi. I believe most people who know Nishi will agree that this is highly accurate:

Mr. K.N. is an enthusiastic, innovative person who can always find a new way to skin a cat. He is likely to keep his friends talking about his new projects and endeavors. If you want to work or play with him, you'll have to hustle—he's not the sort of person who will waste time waiting around for others.

RELATIONSHIPS

Mr. K.N. pursues his own goals in relationships.

Confident of himself and clear about what he wants in a relationship, Mr. K.N. will stubbornly pursue involvements with people he considers desirable. The pace may be quick, and the game on his terms. He is smooth and persuasive, regardless of whom he is after.

He knows how to get others to go along with his plans, and usually can do so with such confidence that others may not even recognize that they are being led.

ATTITUDES TOWARDS WORK

Mr. K.N. is a leader of people and an instigator of changes.

Mr. K.N. will work hard to succeed. Expect him to be involved in multiple tasks or projects far into the night. Don't try to warn him that he is overextending himself—he won't listen. He is likely to be a real asset in the workplace.

He loves to be the leader and usually attracts loyal followers because of his energy and ambition. Mr. K.N. tends to be interested in ideas and concepts—the more confusing and challenging the better. Change and variety are likely to form the basis of any career he chooses.

COPING WITH STRESS

Mr. K.N. can handle most stress.

Mr. K.N. typically explains away any of his apprehension in a controlled, rational way. But count on him to feel stressed when something conflicts with his long-range goals. You can tell he is feeling pressured if he turns into a bundle of energy, doing too many things at once. He usually can take stress and channel it into solving the problem.

If the pressure persists over time, he may become argumentative or critical. Look out for his mean streak. His sarcasm can sting if he chooses to strike out at others as a reaction to stress.

PERSONAL INTERESTS

Mr. K.N.'s interests may involve competing against others.

You may find Mr. K.N. interested in famous or powerful people, using their achievements as a way to compare his own progress and set life goals. He thrives on competition and challenges. He is delighted when he has the edge on a discussion by having access to facts that others may not have. You are likely to watch him scheming about how to advance his own interests.

ATTITUDES TOWARD SEX

Mr. K.N. expects to win you over.

Mr. K.N. is shrewd at figuring out how to win the affections of his chosen companion. He can be lavish with flattery and gifts as he "wines and dines" his way into your bedroom. Sexually, he tends to be dynamic and innovative, willing to try anything new.

He tends to prefer someone with qualities that others prize and then to demand fidelity. From his point of view, this does not mean that he is obligated to apply the same standard to his own behavior.

WHAT MAKES MR. K.N. TICK

Mr. K.N. likes to be seen as an expert. He manages to get his say about everything that's happening. You may recognize him by the status symbols he surrounds himself with. He secretly craves admiration and success, which he defines as power over people and resources.

Mr. K.N. has a quick temper and will not hesitate to let you know if he disagrees with you. This kind of person does not take criticism well, and can be quite argumentative. Mr. K.N. is not bothered by confrontation, provided he wins, and may even enjoy fighting with others.

OTHER EXPERT SYSTEMS

Most expert systems aren't built like Mind Prober. The standard expert systems are descended from work by Professor Edward Feigenbaum of Stanford University. A few years after Professor Benjamin Kleinmentz at Carnegie-Mellon University and others began to automate the interpretation of psychological tests, Feigenbaum made a more

general discovery about how experts work. He found that they normally come to conclusions by using a few rules of thumb to make some initial guesses about a problem, then seek more information using other rules of thumb, and proceed in this way until they feel they have enough information to reach a firm conclusion. Feigenbaum did his original work looking at chemists analyzing unknown compounds, and the work was soon applied to medical diagnosis.

Feigenbaum and others concluded that you could program a computer to do more or less what the experts were doing. There were problems with this approach. Experts found it almost impossible to explain all their rules of thumb, for example, and products using his technique are moving to market very slowly, but it does work. A Feigenbaum-style expert system typically asks you a series of multiple-choice questions to reach its conclusions.

For years, however, Feigenbaum-style expert systems ran only on very large computers because they were all written in LISP and Prolog, two computer languages designed to mimic the workings of the human mind. As more people began to understand how the systems worked, however, they began to wonder why programs that consisted largely of rather simple decision rules had to run exclusively on $500,000 university computers. It turns out that they didn't. When the LISP and Prolog routines were recorded into more normal computer languages, they ran much faster and could fit on smaller machines.

Versions of LISP and Prolog were also produced for small computers, and special expert-system products have also been written in them. Developers still like to produce artificial intelligence programs in LISP and Prolog—they're easier to work with when you're trying to mimic the human mind. Two versions of LISP will run on MSX machines: TLC LISP is available from The LISP Company, Redwood Estates, CA. A public-domain version called XLISP is available from some CP/M user's groups. Today few well-informed people argue that you have to own hundreds of thousands of dollars worth of computer equipment to emulate an expert.

Still, creating expert systems is difficult, and you probably won't find many good expert-system programs in stores. Experts, after all, possess a lot of knowledge. Most kinds of experts—from doctors to garage mechanics—possess vastly more expertise than will fit in an MSX computer, and the best an MSX system can do is emulate them in a portion of their fields.

Even capturing experts' knowledge is getting easier than it used to be, however. Donald Michie recently produced a program that will ask an expert to list examples of the actions he would take in a variety of situations, and from the examples deduce a rule or collection of rules that will produce similar decisions in similar future situations. The package probably won't run on MSX computers very soon, but it shows what artificial intelligence-based programs can do. It will certainly be used to produce many expert systems that will run on MSX.

Human Edge plans to introduce several additional packages. At least one, Mind Over Minors, which is designed to help educators manage classes of children, should be ready on MSX computers soon. The potential array of jobs expert systems can do is unlimited, but the array of jobs they will do well anytime soon is limited by the amount of hard work that creating expert systems requires and the financial risk involved. Who's going to be first to put even a portion of a doctor's expertise into a home expert system when it's clear that a lot of people aren't going to trust their health to a computer?

It pays, however, to look a few years ahead in thinking about computers in your life. The range of tasks home systems will handle is pretty much defined by Mind Prober on one hand (what could be more exotic than psychoanalyzing people you've barely met?) and explaining how to use a microwave oven on the other. Try an expert system on your MSX, and expect to use a lot more of them in the future.

Chapter 14

Connecting with Tomorrow's World

FEW activities you can do with a computer cost less to start and offer more possibilities in the long run than telecommunications. A *modem*, the device that translates the computer's internal signals into sounds that can be transmitted over telephone lines, can cost as little as $50. The additional software you need may come free with the modem or be available free from user's groups. Some of the most interesting services you can find are on free computer "bulletin boards." Thousands of computer hobbyists all over the country have hooked their computers to phone lines; you simply dial the number connected to the computer and connect your modem as soon as you hear the special computer tone on the other end of the line.

That's the good news. The bad news is that despite all the excitement, telecommunications remains, in many respects, in a pitifully primitive state. Telecommunications software is often hard to use, and it is often hard to connect with telecommunications services. Free bulletin boards almost always have only one incoming telephone line, and the telephone lines of good, well-known boards are typically busy as much as 95 percent of the time. Good national "information utilities" also exist, but most of them cost $6 to $24 an hour. Moreover, the information utilities have been created so quickly and attempt to offer so much information that they're often extremely disorganized, confusing, and generally wasteful of the expensive time you spend connected to their systems. The MSX group can do little to improve matters because the problems are in the information providers in the United States. (Japan's own CAPTAIN videotext service was opened to the public last year after 5 years of experimental trials. Most American systems seem like they haven't received five weeks of experimen-

tal trials. But I haven't had a chance to use the CAPTAIN system, however; so I can't say whether it's any better than American systems.)

Eventually, low-cost "on-line services," locally based at first, will let you do much of your shopping, banking, and financial management from home, give you the power of the world's largest libraries in your study, and put you in touch with both new friends and professional journalists and artists. They may save you at least as much money as they cost. Today, much of the power of on-line services is available to you already, but you must be judicious in using them to get your money's worth. I'm writing a whole book about how to do this (*Connecting: The Beginner's Guide to On-Line Fun, Power, and Knowledge,* to be published in 1985 by Scott, Foresman and Co.). I can give you the basic information you need in this chapter.

Essentially, there are only a few secrets about going on-line economically. Just buy a modem and software cautiously, plug it into your computer and your telephone, check a few settings of the modem and the software if you have trouble communicating, and think carefully before spending money on anything else.

TOOLS YOU'LL NEED

To go "on-line" with other computers through telephone lines, you need:

- ☐ Any MSX computer.
- ☐ A modem.
- ☐ The proper cable and sometimes other interface to connect the modem to your computer.
- ☐ Communications software.

Probably MSX-compatible modems, cables, and software will be sold in a single package, possibly with the software built into the modem itself. This is generally the best way for a beginner to buy communications equipment. Packages like this are often less expensive than a modem, cable, etc., purchased separately; often they are significantly cheaper. Probably any standard kind of modem can be made to work with your MSX computer through its RS-232 interface. (Computers that lack RS-232 interfaces will need an RS-232 card to be plugged into one of their slots.) If you get a modem and the proper cable from a store, you can perhaps obtain software free from a user's group. Buying a package, however, especially a package put together by a leading Japanese brand name, reduces the number of problems you can have, since the various components of a package will probably have been matched together fairly carefully.

Your first major decision in buying a computer and a modem is how fast a modem to purchase. Cheap modems operate at 300 *baud,* which means essentially that they transmit 300 bits of information—enough to carry 30 characters—per second. More expensive modems operate at 1200 baud—120 characters per second—and typically offer an array of features which the cheap products may not contain. An expensive modem may allow your computer to automatically dial the telephone and automatically answer calls from other computers. It may also contain a speaker so you can listen to what the computer and modem are doing as they attempt to contact far-off computers, and it may recognize "Hayes-compatible" commands—the commands accepted by the modem most widely used in business, and the modem for which the largest amount of free public-domain software has been written.

Presently, 300-baud modems cost $50 and up, and 1200-baud modems cost $230 and up. At those prices, I advise beginners to buy the cheapest 300-baud modem they can find. There's less that can go wrong in a modem which operates at a slow speed, and the fewer features a modem offers, the fewer mistakes you can make setting it up. (Just be sure you consider the price of any cable and software you require before you decide a modem is cheap.)

The price of 1200-baud modems has been declining rapidly, and the decline should accelerate when modems using very-large-scale integration technology become available. Large semiconductor companies are combining all the major components of a 1200-baud modem on a single chip.

Computer engineer Steven Ting, one of the original designers of the MSX standard, plans to introduce a 1200-baud modem for MSX computers for only $100, for instance. MSX-compatible communications software would be built in, and the MSX interface and cable would be included in the price. Assembly would be done in mainland China. Since not even a mock-up of Ting's new device was available to me, I can't promise when it will be delivered or how well it will perform. Ting's plans, however, do indicate what's possible with today's technology and manufacturing techniques.

If you pay for software separately, make sure it includes *Xmodem protocol,* the standard method of sending free software and other items that require completely error-free transmission.

HOW TO GO ON-LINE

Standard modems are designed to plug into RS-232 jacks on the back of your computer, or on a special RS-232 card plugged into one of your computer's slots. Then the modem must be connected with a telephone line through a standard modular telephone jack like the one you normally use to plug phones into the wall. I suggest you run an extra telephone line to wherever you keep your computer, rather than moving your computer to a telephone. The wiring and other items you need to run a new telephone line will cost only $8 to $20 at an electronics hardware, or discount store.

Different kinds of modems plug into telephone lines and computers slightly differently; you'll have to rely on the manual that comes with the modem for details on setting up. Better yet, find a friend who has a modem and ask him to help; most modem manuals are written for computer nerds, not ordinary people.

Once everything is connected, however, the steps in connecting with another computer are fairly similar:

- ☐ Turn on your computer.
- ☐ Start running your communications software program. The software may start itself automatically. You can tell if it's doing so because it will display a message on your screen that differs from the "MSX Basic" message or the MSX-DOS prompt which normally appears when nothing is connected to the computer. The software, or the instructions that come with it, will generally tell you when it's time to take the next step.
- ☐ Dial the remote computer you're trying to reach. If your software and modem permit, you can dial the computer from your computer keyboard. If not, simply dial the computer on your telephone, and
- ☐ Listen for a high-pitched tone generated by the computer on the other end of the line. If your computer and modem did the dialing, they will generally connect automatically with the remote computer as soon as the modem hears the tone. If you dialed the call yourself, the tone is your cue to connect the telephone line to the modem. Generally you must complete this connection in 10 seconds or so, or the computer at the other end of the phone line will decide that communications have been fouled up, and it will disconnect from the line. Your modem and software should then recognize the carrier tone and establish a connection.

If connection isn't immediately established at this point, there are three common reasons:

- ☐ Something isn't plugged in or connected properly.
- ☐ You haven't connected the modem and computer to the phone line quickly enough.
- ☐ Your software is set to communicate at 1200 baud, and either your modem or the remote computer can't handle 1200 baud. Resetting the baud rate of the software is usually fairly simple, although the explanation of how to do it in your manual may not be.
- ☐ Once connection is established, the remote computer will normally wait for you to make the first transmission. Hit the Return

key. Occasionally you may have to hit it more than once, and sometimes remote computers expect you to transmit them something other than a simple <Return>. When services expect something else, however, their user's manuals usually tell you in advance what to send. At this point, the remote computer will usually transmit you some kind of sign-on message. If you can read it, you're on-line.

IF YOU RECEIVE GARBLED TRANSMISSIONS

Frequently the remote computer's transmission is garbled. Communications software operates with any of several different communications parameter settings. The most basic is the baud rate. Most 1200-baud modems can reset themselves to 300 baud if they encounter a computer communicating at that speed, but most software won't reset itself automatically. If you're unsure of the remote computer's setting, try 300 baud. Most remote computers will operate at 300 baud if a computer calls them at that speed.

The other important communications parameters are:

- ☐ *Word length*, the number of data bits used to spell out a character.
- ☐ *Parity*, the error-checking bit used.
- ☐ *Stop bits*, bits at the end of the transmission of a single character that tell the computer transmission is complete.

Don't worry too much about these parameters until you encounter garbled communications. Many modem or communications software manuals provide intricate descriptions of these parameters before they even tell you how to plug or load the product into your computer. Skip these descriptions. There are basically only two widely used sets of parameters, and many remote computers are set up so they will respond properly to either one. The first is 7-bit words, even parity, 1 stop bit. This is widely considered the most reliable set of parameters for transmitting text. The second is 8-bit words, no parity, 1 stop bit. This is a versatile set of parameters which can handle almost anything.

If you see a garbled transmission, simply wade through your software manual and play with the program to find out which of these two parameter sets your software is using. Then try switching it to the other.

There's only one other complication of communications you'll have to worry about at first: echo, or duplex. Most remote computers are set up to echo back the characters you type to them. If you type **hello** on your keyboard, the remote computer will echo back h after you hit the h, e after you hit the e, etc. Echoing helps you make sure that what you're typing is being received correctly.

Thus, you don't want your own computer software to display the characters you type as soon as you type them. When you type **h** you want it to display nothing until the echo comes back from the other computer. Otherwise, the words you type will look like this:

HHeerree iiss wwhhaatt tteexxtt ccaann llooookk lliikkee wwhheenn ssoommeetthhiinngg iiss eecchhooiinngg wwhheenn iitt sshhoouullddnn''tt bbee.

Unfortunately, some remote computers aren't set up to echo characters back to you. Thus, software must be able to operate either "echoing" your characters directly to the keyboard, or not. If you find when you type "hello" to a remote computer, your computer screen reads, "hheelloo," simply consult your software manual to learn how to turn the echo off (some manuals may refer to this as *setting to full duplex,* and call turning on the echo-to-screen function *setting to half duplex.*)

COMPUTER BULLETIN BOARDS

The cheapest computer services you can use are "bulletin boards" provided by local computer hobbyists. They're free. Once you find one, you can read messages left by other computer owners, leave messages yourself, and enjoy an array of other

features that may include free CP/M software available for transmission to your computer, games you can play on-line, and ongoing "conferences" on subjects ranging from the future of the world to pornography.

If you've found a computer user's group, a member can almost certainly tell you the phone number of at least one nearby bulletin board. The group may even maintain its own. If you haven't found a user's group, finding a bulletin board may be tougher. Try looking in local computer publications or asking at the stores where you've bought computer equipment or books.

Dialing into a bulletin board may be even more difficult. If the bulletin board is popular, a dozen people may be trying to call in at any given time. Some computer owners whose modems can dial phone calls program the modems to dial the same number once a minute until a connection is made. If you're a beginner and your communications software and modem don't allow you to do so, all you can do is keep trying until you get through.

Once you connect, the bulletin board itself should be self-explanatory. If it's not, don't assume that the problem is your fault. Many bulletin boards run on software that is unnecessarily hard to understand.

MSX owners with disk drives should remember that MSX-DOS is largely compatible with CP/M, the oldest computer operating system in wide use today, and an operating system with one of the strongest user's-group and bulletin-board communities in America. Unfortunately, because CP/M is such an old operating system, many of its user's groups and bulletin boards still operate as if anyone who owns a computer speaks all the jargon of technology. CP/M-oriented bulletin boards are generally the most incomprehensible. If you get lost on one, try simply typing **help.** The system may then give you some information on how to proceed.

Members of CP/M user's groups, on the other hand, are not bad guys at all. Although most CP/M user's-group software deals with arcane computer problems you're not likely to encounter, a CP/M user's group or bulletin board is well worth a try for free MSX-compatible software that will help with such tasks as continuously redialing a busy telephone number.

INFORMATION UTILITIES

Since it's hard to connect with most good bulletin boards, most modem owners should subscribe to at least one "information utility." Not only are these services easier to dial into than local bulletin boards, but they offer an array of information you can't get elsewhere. Often a discount coupon for a subscription to one of the services is included with the purchase of a modem (though you should be choosy before signing up—there are a lot of discounts on sign-up fees, and paying any fee at all to a service that charges a monthly minimum can be a great waste if the service does nothing useful for you).

Information utilities are useful not only for information; they can also be helpful because they operate toll-free telephone numbers which you can call if you're having trouble connecting your computer to the network. Thus they make it easy for you to get started in telecommunications.

From densely populated parts of the country, you can dial into these networks through special nationwide communications nets that make local telephone numbers available. The networks can make connection to the nationwide utilities significantly cheaper than a long-distance call to a distant "free" bulletin board. Since they don't cover the whole country, however, they don't solve one important problem that affects millions of computer users: if you don't live in a metropolitan area, there may be no one for you to telecommunicate with without racking up enormous phone bills.

Here are the four information utilities you should consider. Because of high national communications charges, none are truly cheap. All four are reasonably affordable if you use them only on evenings and weekends, when the prices mentioned apply. The first three are general utilities; they all offer such services as nationwide weather reports, airline schedules, opportunities for on-line bargain-hunting, games, electronic mail, and opportunities to "chat" on line with people all over the country. They differ substantially from each other in special

features and price structures, however.

- ☐ COMPUSERVE (5000 Arlington Centre Blvd., Columbus, Ohio, 43220) is clearly the premier information utility for computer hobbyists, and offers by far the best deal for owners of 300-baud modems. It costs $6 per hour (10 cents a minute) to connect with CompuServe's own data communications network in major cities. There are surcharges for some special services.

  CompuServe has by far the largest network of on-line computer user's groups, with groups for all major brands of computers. A large CP/M group already exists, and an MSX group is said to be in the works. They provide an overwhelming number of free tips for users, and considerable free software, although it's actually more difficult to receive a software transmission from a national utility which must send it through specialized networks and then through the phone lines than it is to receive it from a local bulletin board. CompuServe also offers an excellent on-line encyclopedia, but there's a surcharge for its use. In addition, there are some useful on-line shopping services.

  Unfortunately, CompuServe charges more than twice as much for access at 1200 baud as at 300 baud; this is outrageous. Using a 1200-baud modem with a service like CompuServe is rarely more than twice as fast as using a 300-baud modem. You wind up spending half or more of your time either responding to the service, holding up the screen while you read what has just been transmitted, or waiting for CompuServe's often sluggish computers to respond to your commands. CompuServe also adds a $2-an-hour surcharge if you don't happen to live near one of CompuServe's own communications lines and must use someone else's communications net to connect with it.
- ☐ THE SOURCE (1616 Anderson Rd.; McLean, VA, 22102) offers far less extensive services for computer users than CompuServe, but quite sophisticated business services and some excellent personal communications services. It provides full access to United Press International's news wires (though the software for searching them has been maddeningly difficult to use and wasteful of connect time), and a sophisticated (but also hard-to-learn) conference facility called "Participate," which lets you join large bulletin boardlike "conferences" discussing an enormous array of topics. Evening and weekend prices are $7.75 per hour at 300 baud and $10.75 per hour at 1200 baud. There is surcharge for using other networks to connect, but The Source requires a $10 per month minimum usage to maintain your account.
- ☐ DELPHI (3 Blackstone St., Cambridge, MA, 02139) is newer, less extensive, and cheaper than the other on-line utilities. It is also friendlier. On Delphi you use "usernames," for instance, rather than account numbers: If you want to send a message to me on The Source you must remember my account number, CPA088. On Delphi you merely use my username, RWOOD. Delphi costs $6 an hour, regardless of whether you dial in at 300 or 1200 baud, and regardless of whether you need to use someone else's network for connection. There's no monthly minimum. Unfortunately, however, there's not much on Delphi so far but the basics of an information utility. The electronic mail software is highly efficient, and allows messages to be sent to Source and CompuServe customers. There's also an on-line encyclopedia far less comprehensive (but also far cheaper) than the one available on CompuServe. For cost-conscious users, especially those with 1200-baud modems, it can be a good deal.
- ☐ The fourth service differs dramatically from the other three. KNOWLEDGE INDEX is the after-hours service of Dialog Informa-

tion Services (3460 Hillview Ave., Palo Alto, CA), perhaps the largest supplier of on-line information to professionals in the world. Its power is awesome. Knowledge Index enables you to search through almost 17 million descriptions of articles, reports, and books, including millions of excellent summaries of contents. It won't let you play games, send electronic mail, or buy a videotape recorder, but if you ever do research on contemporary topics ranging from computers to business to medicine, you'll be deeply impressed by Knowledge Index' power. And Knowledge Index' manual is a model of clarity.

The price of Knowledge Index sounds steep: $24 an hour whether your modem is 300 or 1200 baud. You'll find, however, that Knowledge Index is perhaps the only on-line service that moves as quickly as you expected computers to move. I estimate that even a beginner can conduct a highly useful search using no more than 30 to 40 minutes of connect time at 300 baud, 20 to 30 minutes of connect time at 1200 baud. Experienced searchers commonly search Knowledge Index databases in 4 minutes or less. You can sign up for Knowledge Index for less than $40, and you get 2 free hours of connect time with the subscription.

LOCAL ON-LINE SERVICES

I believe the great movement of the next couple of years will be neither to local computer bulletin boards nor gigantic, nationwide, general-purpose information utilities, nor to the high-priced services being developed to work through cable TV wires.

Instead, I think the computer communications medium of the next 5 years will be the local on-line service based on a computer slightly larger than the standard personal computer and connecting with a few dozen telephone lines coming in. Local entrepreneurs and nonprofit groups can now set up services like this for as little as $15,000, although finding the proper software remains a bit difficult. Because they need not pay nationwide communication charges, their costs can be far lower than the costs of similar national services—a dollar or two per hour should be sufficient. It takes great creativity for them to fill their services with information sufficiently interesting to get the critical mass of local subscribers they need for success. Once that mass is reached, however, they can expect subscribers to contribute much of the information that will make them popular—local sports coverage, buy-and-sell information, etc.

Only a few such local services exist today, but if there's one near you, it may be worth a try. Watch out before you send money—some very ordinary bulletin boards ask for money and call themselves "on line services." A few services worth mentioning are:

- ☐ Fantasy Plaza (a shopping service),
  Burbank, CA,
  (213) 244-1100
- ☐ M-Net
  Ann Arbor, Mich.,
  (313) 994-6333
- ☐ GameMaster
  Evanston, Il,
  information: (312) 328-9009
- ☐ Star-Text Metro,
  Fort Worth, TX,
  information: (817) 390-7832

REACH OUT AND COMMUNICATE

Eventually, I believe virtually everyone will own an MSX computer connected to the phone lines. If you connect now, you're merely tasting the future. You'll put up with a bit of aggravation at the primitiveness of the connections you're making. If you're careful to keep costs down, however, I believe you'll find it worthwhile.

Chapter 15

How Will MSX Revolutionize Home Entertainment?

I suspect anyone who has played with programs like Flight Simulator, Zork, or Astron Belt (see Chapter 5) should recognize that computers will eventually revolutionize home entertainment. The key questions are: how and when, and what specific home entertainment technologies will enhance your life over the next year or two and in the longer term?

A look at MSX systems confirms that the revolution is very close, but whether or not the revolution has arrived for you depends on your personal tastes. I devote a fair amount of attention to Flight Simulator, Antarctic Adventure, other games, and to telecommunicating for fun. I spend very nearly as much recreational time with the computer as I spend with television. I sent back a video recorder I was renting because my family rarely used it. For me, the revolution is well under way.

My father, on the other hand, has had a computer at home for a year and a half and still uses it mainly for word processing. I suspect that's largely because of my father's disposition. He wants to get beyond word processing into telecommunications, spreadsheets, and data management, but I don't know if he'll get involved with computer adventures. He'd rather watch a good movie on TV than play a computer game. It may be 3 or 4 years before the computer becomes central to the way he enjoys himself.

I'm sure the computer will become central to his recreation eventually, though. There's so much computers can do. There's a good deal of work ahead, however, before they'll be vital for everybody's fun.

"Right now only a small share of people use computers," notes Kay Nishi. "When we look at the media people bring into their homes—telephone, television, videorecorders—we find they

are the media that have the capacity to make people laugh, make them cry. Computers today cannot make people laugh and cry." Ultimately, however, computers will not only gain greatly improved graphics and better programs, they'll also be linked to networks. Computers will tie people to their neighbors, to like-minded people all over the world, and to professionals creating art and information—and responding to questions—on-line. "Then maybe computers will make you laugh or cry," says Nishi.

I think that's almost certain. Eventually, computers will add to everyone's enjoyment at home:

- ☐ Interactive adventures and travel with superb sound and color.
- ☐ Linkage to on-line entertainment services for conversations, games against other people, and the latest in software.
- ☐ The opportunity to create genuinely high-quality music and video: ensemble music that only highly trained classical musicians could have produced and "home movies" that only a million-dollar studio could have made even 3 years ago.
- ☐ Digital storage and management of sound and video, allowing quicker access, easier handling, easier editing, and near-perfect fidelity of both sound and pictures.
- ☐ Increased ease of use as software designers gradually teach these machines to explain themselves.

Unfortunately, none of these opportunities, except possibly excellent computer music (see Chapter 7), are available in fully developed form today, although somewhat primitive computer adventures, on-line entertainment, and videotape special effects can also be purchased.

So you face two home-entertainment questions as you contemplate the permanent installation of a computer in your living room, den, or recreation room. First, which of the home-entertainment activities you can do with a computer today are important enough to you that they're worth their cost? Second, how will you cope with the new opportunities in home entertainment you'll face over the next decade or so?

COMPUTER SIMULATIONS TODAY

What kind of revolution are we facing? Many software specialists see Flight Simulator as a prototype. As many real pilots have said, this game truly gives you a sense of what it's like to fly a plane. Your keyboard (or keyboard and joystick) becomes the controls of an airplane, and the screen reacts as a real airplane would to your actions.

Flight Simulator shows what the computer can do for you. With the right software, it can create any kind of adventure you want in your home, customized to your tastes.

Flight Simulator's graphics are mediocre, however. They are a great achievement with the technology of the early 1980s, but you'll never mistake a Flight Simulator view of Chicago for the real thing, or even for a televised film of the real thing, for two reasons.

First, until recently computers simply couldn't produce the kind of color detail necessary for graphics that would compete in realism with a good television picture. The first generation of MSX machines (sold mainly in Japan and Europe) was better than most home computers sold to date, but it produced its pictures with 256 × 192 dot screens. It could only produce 16 colors. Also, computers, unlike television cameras, have had no way of mixing primary colors to produce subtle shades.

Second, even if the computer could generate a sharp, clear display, there has been no way to insert a thorough description of, say, the landscape you'd see while flying over Chicago, into the computer's memory. No one has figured out how to convert color movie film to computer programs on a large scale.

Today's MSX computers already make important strides toward solving both problems. The latest MSX graphics chip more than doubles screen resolution and increases the number of displayable colors enormously. Today's MSX screens are formed from up to 512 × 212 dots, and can display up to 256 colors. Moreover, the use of a video digitizer allows video screens produced with or-

Fig. 15-1. An MSX computer and a laser disk player can produce the best graphics you can get in your home (courtesy Qest Publishing Co.).

dinary cameras to be converted into computer graphics screens that look like bright, but slightly grainy, magazine photographs. Sanyo was the first company to introduce a video digitizer for MSX. Most software available initially won't take advantage of the full capabilities of the new chip, but the new graphics chips and new programming techniques will ultimately allow MSX computers to display excellent commercial animation. The truly dramatic improvement in graphics today, however, comes with the connection of a computer to a laser disk player—a product which provides the best video pictures in the world today (Fig 15-1).

DIGITAL VS. ANALOG VS. BETTER ANALOG

In most kinds of home entertainment, engineers would like to move from analog processing toward digital processing or activities which are like digital processing. All television, radio, and telephone traffic up to now has been based on analog processing, but it can be done with higher quality and greater flexibility—and possibly lower cost eventually—if it is done digitally.

The difference between analog and digital processing is not hard to understand. Music, which with the introduction of digital compact disk players is just beginning to be digitized in the home, is a good example. Traditional analog recording techniques involve letting music vibrate a membrane in a microphone which creates electrical waves similar in shape and other characteristics to the sound waves being recorded. The word *analog*

comes from the same Greek root as the word *analogous*, and the new electrical waves are analogous to the old sound waves. In conventional recording, these electrical waves are then used to create more analogous waves embedded on tape or plastic. Unfortunately it's very easy for extraneous noise to be mixed into the signal in the recording process, and it's very hard for this junk to be filtered out once it's in.

Digital processing, on the other hand, converts sound waves to a digital representation of the sound waves soon after they have been captured by the microphone. The representation is still in a sense a picture of the sound waves that is analogous to the original waves. It is a picture drawn with numbers, however; so it's much easier to keep this picture intact than it is to keep any purely analog representation of sound pure. Because the digital representation consists of numbers, it's also fairly easy to test for any extraneous garbage and eliminate it.

Unfortunately, a high-quality digital image of anything as complex as sound or pictures requires an enormous quantity of digits. All the letters on this page could be transmitted with perhaps 16,000 bits (2,000 bytes) of data. The same amount of data, however, could encode no more than 1 second of voice transmission with the most advanced technology being developed in Japan. With the technology that's conventional today, it could only encode about a 1/4 second's worth. Also, high-quality digital music and video recording demand far more bits than telephone calls.

When you understand the amount of data required for these impressive new technologies, you can understand why today's technologists aren't happy with the seemingly enormous capabilities of today's disk drives to record as much data as an entire book or even an entire encyclopedia. Before the full power of the computer comes into our lives, digital recording media must handle hundreds of times more data than today's floppy disks.

Digital Disks and Computers

Two kinds of technology for today's homes approach digital precision. One, the digital compact disk, today delivers digitally recorded music. Engineers can put enough data for true digital sound on a 4.7-inch disk if they use a disk which cannot be modified aftr the data has been put on it.

Several ways of using digital compact disks with computers have been suggested, and the leading Japanese companies have started to ship these products, called *CD-ROM* for compact disk/read-only memory for special purpose uses. (The CD-ROM offered by ATARI is likely to be manufactured by an MSX Group member company.)

The same compact disk which stores a few minutes of music could store whole libraries of information—more than 500 megabytes or nearly 1400 times as much as a floppy disk can store. It could also be used to store the enormous amount of data necessary for truly realistic, truly interactive video.

Laser Disks: Advanced Techniques in Analog Recording

The other approach to bringing superior quality video recording techniques into the home today is the LaserVision system of video disk recording. LaserVision disks, developed by Pioneer Electronics in Japan, don't produce digital television pictures. By recording analog images with the same laser-based techniques that can be used for digital recording, however, they can produce images with exquisite clarity and detail.

Pioneer's MSX computer works with LaserVision. The computer can control the LaserVision player and command it to move from section to section. The computer also can superimpose its own images on LaserVision pictures. The result far surpasses ordinary computer graphics.

LaserVision used with computers is spectacular in three ways. First, the disks can bring the superb graphics of LaserVision to basically conventional computer games. When you play Astron Belt or Star Fighter, two games Pioneer sells for its LaserVision/computer combination, you're still basically zapping aliens, but you're doing it with the realism of a movie theatre, rather than with the cartoonlike graphics of old-fashioned computer games.

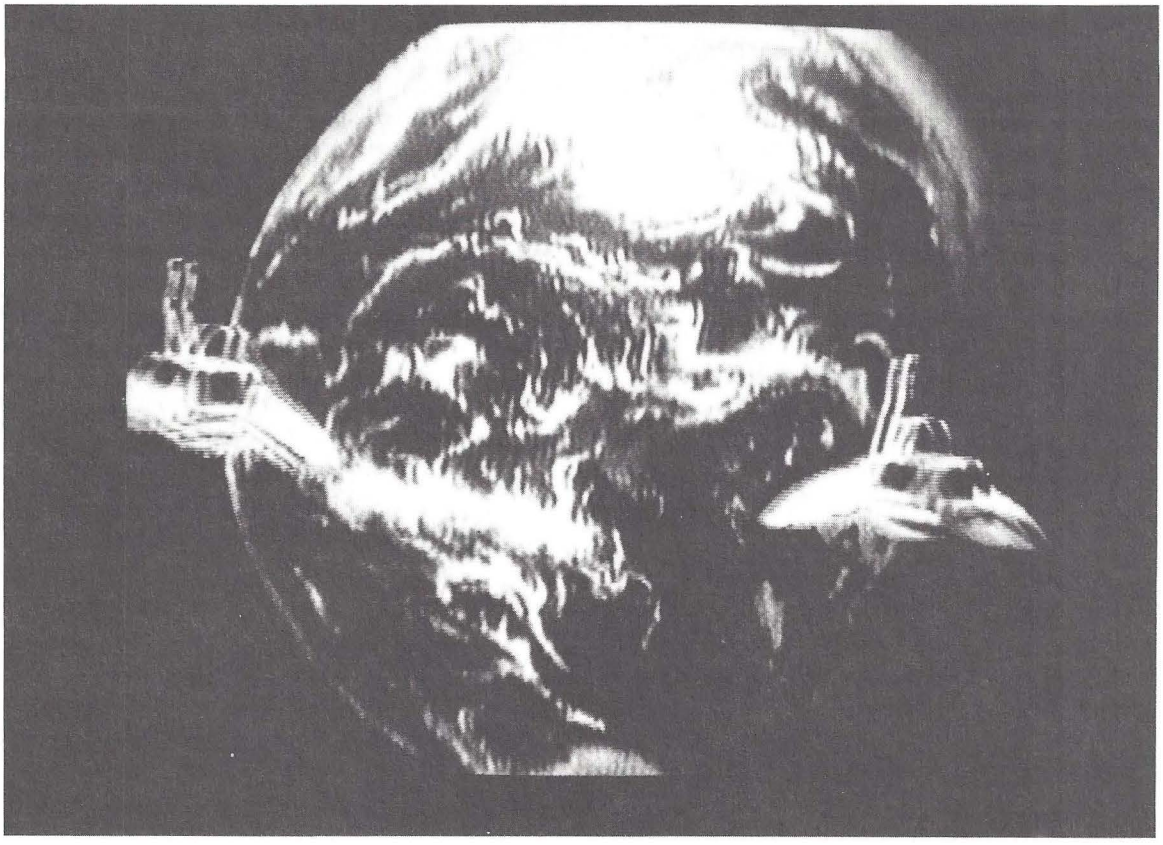


Fig. 15-2. Even in this black-and-white reproduction, you can see how much detail exists in a combined laser-disk/computer-graphics screen (courtesy Qest Publishing Co.).

Second, laser disks support new kinds of adventures and educational programs that old-fashioned computer game designers just couldn't have attempted. Pioneer has produced mystery titles including "Murder, Anyone?" that use the ability of the laser disk to display pictures clear enough for you to recognize clues.

Third, they allow you to work with thousands of excellently reproduced still pictures. Laser disks, unlike other video technologies, contain so much information that you can freeze a single frame and still get a high-quality picture. One laser disk, for example, provides a tour of a major art gallery. MSX computer power has not been added to these disks yet, but it's clear that the computer can let you do things with the collection of pictures that could never be done otherwise.

LaserVision isn't a complete solution to the problem of creating realistic graphics with the computer—at least not yet. The computer can't freely manipulate laser disk images as it can images programmed into its memory. The strength of Flight Simulator is not the realism of its graphics, but the fact that whenever you touch a key on the keyboard (or move a joystick) that corresponds to a control of an airplane, the scenery moves as real scenery seen from a real airplane would. Laser disks, at least in the programs I've seen, limit you to viewing whole screens created for the computer, plus computer graphics superimposed on them. The detail you'll see in piloting an Astron Belt spacecraft is breathtaking, but the program can't allow you to make a U-turn anytime you feel like it.

Still, laser discs and MSX computers provide

the best combination of graphic quality and flexibility available in home entertainment today (Fig. 15-2). I hope software producers create products that fulfill their promise.

Video Recorders and the Computer

JVC, Panasonic, and Sony have produced computers with the ability to superimpose graphics on videotapes. The superimposing system is roughly identical to the system used by Pioneer's laser disk system, but the capabilities are quite different because videotape is such a different medium from laser disks.

Videorecorders can't move from one section of the videotape to another with the ease that laser disk players can. A videorecorder can take several minutes to move from one spot to another on a videotape, while a laser disk/computer combination takes only a second or two to move around on a disk. Videotape quality will probably never equal the quality of laser disk video.

On the other hand, as millions of Americans have already discovered, videotapes are an exciting appliance because they allow you to record any video you want. If you have a video camera, you can even use them for high-quality home movies. If you have two videorecorders, you can edit your videotapes like a professional.

Today MSX computers are principally useful with videotapes in recording computer-generated images on tapes you want to save. You may want to use this capability to put images on tapes you've recorded from television—titles, dates, etc., or perhaps flying saucers attacking Johnny Carson. I tend to regard these efforts as mere gimmicks. The real usefulness of MSX computers with videorecorders comes if you are creating your own programming. Then you'll surely want to include titles, framing, and other special effects, and the major manufacturers' videorecorder/MSX interfaces all allow you to do so.

In addition, any videorecorders can be used with any computer hooked up to a television set to record what you've been doing; so you can check out the mistakes that led you to crash the plane on Flight Simulator, for example. Usually you can simply record from the television as you would if you were watching a program.

Computer Communications and Home Entertainment

Telecommunicating today tends to be a solo activity. If you expect to use a computer mainly to telecommunicate, the computer might as well be kept as far away from the living room as possible, because transmissions from the remote computer will be merely lines of text.

Screens will become better looking as the world moves toward digital communications. Transmission of computer data on today's analog phone lines means conversion of the digital data to analog data—essentially, noise—and conversion back to digital data at the other end of the line. When phones can carry digital signals, or when computers communicate routinely over cable television lines, they'll be able to transmit high-quality graphics as well as letters and numbers. Computer manufacturers are moving quickly to make at least some picture transmission widely available even over today's phone lines.

The first step toward the new era is built into today's MSX computers. Every MSX computer with the latest graphics chip is built with the ability to decode graphics sent in North American Presentation Level Protocol Syntax, or NAPLPS (pronounced NAP-LIPS). Though products to use this capability may not now be available—and though it's not clear exactly what kinds of graphics will enable the computer to make you "laugh and cry," in Nishi's phrase—it is probable that computers will be able to transmit graphics which are as important to the information being sent as pictures are to television's evening news. Because of Nishi's and other Japanese businessmen's strong belief in telecommunications, it's likely that progress in this field will be fairly rapid once products are shipped. Also, high-quality color graphics can and will be embedded in programs distributed free over telephone lines through such services as CompuServe and local bulletin boards, and will be designed to be run on your computer at home.

THE COMPUTER AS AN ENTERTAINMENT CENTER COMPONENT

The computer should become a component of your home entertainment system just as an audio amplifier is. In fact, computerization together with the laser disk/videotape revolution in video is likely to create a far greater array of ways for your home entertainment components to interact than you ever dreamed of before.

If you buy an audio amplifier over the next few years, try to get one with as many audio input ports (especially ports labeled "AUX" for "auxiliary") as possible. Even if you have no interest in computer entertainment today, it's a safe bet that you'll soon want your television, video playback devices, or computer to speak through your high fidelity system.

Ultimately, you may choose to have a computer or computers built into another appliance—a laser disk player or a monitor/television, for example. No one can yet foresee the diverse functions the computer will perform in home entertainment. Masao Morita, son of Sony chairman Akio Morita and Sony's product manager for MSX computers, says it will take 2 or 3 years before manufacturers and consumers really figure out how computers contribute best to home entertainment centers. He's undoubtedly right. Plan all your home entertainment purchases over the next few years to be as flexible as possible.

UNIVERSAL DIGITAL STORAGE AND THE HOME OF THE FUTURE

The digits that represent programs and data files on computer floppy disks are identical to the digits that represent music on the digital compact disks of today and that will represent video in the digital video products of tomorrow. In laboratories in the United States and Japan, dozens of companies are racing to produce high-density storage media such as read/write laser disks and hard disks using advanced magnetic technologies. Though these products will be aimed at business markets initially, the Japanese-language magazine *MSX* pointed out in 1984 that your home will almost certainly have these devices in the long run.

Ideally, you'd like all your entertainment and information to be stored somewhere centrally in your home and to be immediately accessible when you type a command or two (or speak?) into a computer console anywhere in your house. Certainly you will be able to do so for audio; it may even be possible for video recordings.

My own feeling is that now is not the time to buy first-generation digital technology—the digital compact disk—unless you're a true hi-fi purist. The digital equipment of the future will be so vastly much more capable than the digital equipment of today that it's not clear today's compact disk players have much more lift expectancy than the home computers of a year or two ago. Laser disks players and players that handle both laser disks and digital audio probably have a future. They provide significant value which you can't get any other way. The manufacturers will undoubtedly sell enough laser disk players that they'll want to make future high-quality video products reasonably compatible with today's laser disk format.

THINKING ABOUT THE FUTURE

An enormous array of possibilities are opening up for our homes. Your challenge is to think about what you really want in home entertainment and to buy products that will bring it to you. Don't lock yourself into anything you'll regret, and enjoy the fruits of the new age.

Chapter 16

Your Home In 1995

THE head of a major software research group laughed at me in early 1984. I had told her that I expected that by 1995, MSX computers would be built into microwave ovens.

"Come on, Bob," she said. "Don't be ridiculous."

Since that time I've talked to three American companies which are planning their future on the assumption that computers, probably MSX computers, will be built into appliances like microwave ovens.

Why would anybody want to build a computer into a microwave oven? More important, why would you want to own a microwave oven with a computer in it? If you wouldn't, why even care about such foolishness?

COMPUTERS AND COMMUNICATION FOR THE MODERN FAMILY

The answer to the first question is easy: many companies already build computers into microwave ovens. They're not sophisticated computers like today's MSX machines, but they are true computers. The fanciest features of many leading microwave ovens—timing, delayed action, complex displays that tell you what's going on inside, etc.—are controlled by a microprocessor, which is just a very simple computer. Though it's difficult—generally impossible for the ordinary user—most microprocessors can be programmed like any other computer.

We don't use the full power of the microprocessors in microwave ovens (and refrigerators and auto engines, etc.) today because their microprocessors can be programmed only by people who understand the special pecularities of those microprocessors. Appliance designers use those microprocessors because they're much cheaper than the chips used in MSX computers today. Nonetheless, there are computers in our microwave

ovens, and they're already useful.

The answer to the second and third questions—why you would want to own a microwave oven with a computer in it, and if you wouldn't, why even care about them?—is more complex. It depends on what kind of person you are. Personally, I don't own a microwave oven today, and it's quite possible that I'll never own one. I'd like the convenience of being able to reheat frozen foods more rapidly, but I don't have room for all the junk I've got in my kitchen already. There are lots of things I'd rather buy (including many pieces of computer software) before I'd buy a microwave oven.

Some people insist they don't want to own a microwave oven at all. They think the emphasis on convenient reheating of frozen foods discourages "real" cooking. Personally, I look for convenience everywhere I can get it; so I'm a prospect for a microwave oven eventually.

If I get one, I'll probably want one with a computer built in, and I'll want that computer to be MSX. Here's a sampling of what a microwave oven with an MSX computer built in could do:

- ☐ Connect with the telephone system so that I could call and tell it to delay dinner if I expected to be late coming home.
- ☐ Vary heat levels and microwave intensities during the cooking process to produce all kinds of cooking effects. (Nonmicrowave users often complain that a microwave won't brown foods properly. That problem can be solved by installing special heat elements to handle browning. Computers are useful to coordinate the heating elements and the microwaves.)
- ☐ Run expert systems or other explanatory programs that will explain the other advanced features of your kitchen equipment for you.
- ☐ Accept programming to accompany recipes either from the keyboard or from a cartridge plugged into it.
- ☐ Accept new programs relating to new recipes transmitted over telephone or cable television wires.
- ☐ Coach you interactively in the preparation of a recipe by giving you advice either on a screen or through a voice synthesizer.

I could go on listing indefinitely, but it would be obvious that the appliance I was talking about was a different appliance from, although a recognizable, highly computerized version of, the microwave oven of today. The technology to do all of this (with the possible exception of a cable television interface, which is still under development) has been available for a couple of years. Matsushita spokesman Ken Shimba says highly computerized microwave ovens were part of the home of the future Matsushita first showed in 1979. The Japanese and some American companies are working actively to make all this possible. In fact, all this technology is in many respects much simpler than the technology in a home video recorder and videotapes, which because of the enormous amount of data required to store television pictures must be made with enormously high precision.

Manufacturing costs for this MSX microwave oven would be modest if there were a mass market for it. Computer chip prices decline dramatically with mass production. The whole MSX program is designed to take advantage of that fact. Eventually MSX chips will become standard in all kinds of consumer products, and are thus almost certain to wind up costing little more—quite possibly less—than simple custom chips that might be built into an old-fashioned microprocessor-controlled microwave oven.

There are, however, big problems in bringing computerized cooking to the mass market. Even if everyone agreed that the world needed computerized cooking, it would take years to solve all the little problems involved to make computerized cooking work. Someone must design the interfaces between ovens and computer chips, redesign the ovens, and put together dozens of software packages to make the product worthwhile. There are dozens of opportunities for companies to lose money doing so. The first company with an MSX microwave oven may fail totally if consumers feel

the product is hard to set up, hard to use, or potentially dangerous, or if it simply lacks enough software to make its use worthwhile.

Probably in the long run the introduction of computing to the kitchen will lead not to marginal additions to today's microwave ovens, but to new electronic food preparation centers which incorporate microwave cooking, conventional electric cooking, special facilities for coaching you through recipe preparation, and who knows what else. It will take a long time, though, before anyone can figure out exactly how computers and cooking should be brought together. Thus, while I expect appliance companies will combine MSX computers and microwave ovens long before 1995, I'm sure it will take at least that long—and probably longer—before the technology can be regarded as perfected.

PROVIDING VALUE FOR YOUR FAMILY

None of this may appeal to you. You may have absolutely no desire to reschedule your food preparation center by telephone. The idea of letting a voice synthesizer coach you through a recipe may horrify you. You should still care about the ability of the computer to do all these things, however, because the way MSX could revolutionize cooking is just an example of how it could revolutionize everything in the home.

Probably the most exciting opportunity that MSX creates is the opportunity for fantastically creative value analysis of every product we deal with in our lives. The computer can make every product in the world function the way we'd really like it to function, if only we can figure out how we'd really like it to function. The Japanese are great at figuring out how we'd really like products to function and making them function that way at reasonable cost, often by using techniques invented and largely forgotten in the United States. Understanding a bit about value analysis, a technique developed in the United States that's particularly well-used by the Japanese electronics industry, will give you important hints of how yet-undeveloped MSX devices are likely to change your life over the next decade or so.

Value analysis consists essentially of defining the desired function of a product, or of a portion of a product, in two words, a verb and a noun. Such clear statements break old habits of thought and result in new (though not necessarily high-tech) ways of doing things at lower cost and with better performance. You can see a classic result of value analysis by looking at the back of a refrigerator (except frost-free models). Larry Miles, a farm-boy engineer who developed the value analysis techniques at General Electric during World War II, was unleashed after the war to try to work some magnetic on GE's struggling refrigerator division. He got together with other GE people to define the functions of various refrigerator parts clearly. He was able to cut costs by as much as 70 percent. The function of the heavy metal plates that had been used to radiate heat drawn from the interior of the refrigerator by the compressor, for example, was defined as "dissipate heat." Once that definition was agreed upon, it was a short step to the invention of the refrigerator coils virtually everyone owns today, and GE took a dominant position in the refrigerator business, which it still holds.

The Japanese discovered value analysis in the 1960s and made it a key part of their effort to cope with the energy crisis in the 1970s—especially in the electronics and auto industries. In 1983 the Society of Japanese Value Engineering created a special "Miles Award" to be given annually to companies and divisions within companies that did the best job in using value analysis. The award is similar to the Deming Prize given annually for quality control and named after the American quality control expert Edward Deming. The Chairman of Japan's Chamber of Commerce presided over the award ceremonies and Miles, then 79 years old and living in semi-retirement on the Eastern Shore of Maryland, was flown to Japan to present the prize.

The fruits of value analysis are obvious today in such products as video recorders and cars, where hundreds of parts have been not simply miniaturized, but redesigned to do a better job at lower cost. (In the computer field, the best example I've seen to date is the Panasonic 1091 printer. If you get a chance, compare the ribbon cartridge

in the 1091 with the ribbon cartridge on any American or German printer. You'll find it is a small, elegant model of utility. Panasonic, along with Hitachi and the construction company Fujita Corporation, was one of the first winners of the Miles Awards.)

Historically, value analysis has rarely been able to totally redesign consumer products with utility in mind. The arrival of a true home computer standard, however, lets us ask some questions. What functions do we really want in our home appliances? What functions do we really want our homes to give us so we can do what we want with our lives?

The function of a microwave oven (and of the kitchen as a whole) is probably "prepare food." How can we do that better? What is the real function of our televisions, our stereos, and our vacuum cleaners? How can they be made to serve us better?

No one knows the full answer to these questions yet. Just as it will take years and hundreds of small, often unsuccessful innovations before we learn exactly how the computer will fit into kitchens, it will take just as long before we know how the computer will ultimately change the rest of our lives. If you thought the first 80 years of the 20th century was a period of rapid change, you ain't seen nothin' yet.

COMPUTER COMMUNICATIONS FOR YOU

The MSX standard is only one component of the big change. The other is a variety of computer-related communications systems now under development in Japan and, to a lesser extent, in the United States. If you hook your computer into the world's communications grid as I discussed in Chapter 14, you'll find a lot to fascinate you, but today you'll also find a lot of frustration. Computers are the fastest machines in the world, but when you use one to communicate, you often find it's like talking to someone with a stutter. The price (though it's come down quite a bit) can still be outrageous.

This doesn't have to be so, but making computer communications serve us in the home will demand even more careful analysis of details than making the computer itself a useful component of the kitchen. You can see that just by looking at what the Japanese electronics industry, the Nippon Telephone and Telegraph Corporation, the Japanese government, and such software houses as ASCII Corporation are trying to produce.

The information network system (INS) now under development by the Nippon Telephone and Telegraph Corp. would link any interested owner of a computer or other communicating electronic device, such as a telephone or television set, with all other computers everywhere in the country and the rest of the world. Home appliances would communicate at data speeds unbelievably faster than the 1200-baud modems we sometimes consider fast today.

Fiber optics cables instead of wires would carry cable television pictures and an enormous array of other data to homes.

A system currently under development by the Japanese Ministry of Posts and Telecommunications, leading Japanese electronics companies, and leading software companies is designed to replace electrical outlets in the homes of the future to allow "home bus" cables incorporating standard computer networking, transmission of two-way television and hi-fidelity music and voice, and electric power distribution throughout the house. Upgraded MSX computers—either standing alone or built into appliances—will be designed to plug into this network.

Universal digital storage of entertainment in the home would allow one or a few large disks to contain video presentations, music, and information you could call forth anywhere in the house through the computer/communications network.

Personally, I consider the MSX project, the information network system project (INS), and the home bus project significantly more important than the widely publicized Japanese "Fifth Generation" project that seeks to produce computers capable of artificial intelligence. The Fifth Generation will use techniques that Americans are exploring just as aggressively as the Japanese, if not in so well-coordinated a manner. It has become well-known in the West largely through the efforts of professors who stood to gain enormous increases in government and private funding if the project was con-

sidered a threat. That's not to say that there has been anything cynical about their cries of alarm, but there's certainly no danger that America will fall totally out of the artificial intelligence race. Even if we fail to produce the first of some supersmart breed of computer, there's little reason why we can't do to the Japanese exactly what the Japanese have been doing to us for the last 30 years: go to Japan and get one when it first comes out, bring it home, and either make one like it or put it to use in new, creative ways.

MSX, INS, and the home bus, on the other hand, represent revolutionary approaches which most Americans—who will be dramatically affected over the next decade—have been largely ignoring. They are aimed at transforming our daily lives. These projects are not merely inventing something which Americans can either buy or copy, they are setting standards designed to make the whole country work more efficiently than it could without them. There's no effort to limit the standards to Japan; in fact the Japanese are designing them to fit American and other non-Japanese conditions as much as possible. If, however, the United States continues to show anything like the ignorance of these developments it has displayed till now, Japan will have her whole nation wired for high-powered computer communication years before America does. There's no telling what powers such linkups could give Japan as a country, but they would certainly, for instance, make all kinds of knowledge work much easier in Japan than in the United States.

The whole approach of the Japanese to the computerization of the world shows how they've understood how business works and should work. They understand that people, companies, and nations create secure jobs for themselves and benefit their customers, not by flaunting the latest technology, but by carefully building up *know-how*—practical, often low-tech techniques that make technology useful and reliable. It's a knowledge that Americans largely imparted to Japan after World War II, but which Americans seem to have forgotten. American industry has already been beaten by Japanese know-how, not Japanese high technology, in cars, televisions, and video recorders. The more Americans try to rush fancy high-tech gadgets to market for the home of the future, the more they are setting themselves up to be beaten again.

Your home will change radically over the next 10 years, but a little bit at a time. American analysts have a tendency to dismiss the MSX as a computer lacking glamour, and the information network system—especially the idea that it will serve homes as well as businesses—as a pipedream. Those reactions, however, merely indicate how short-term are the visions of most professional analysts in the United States and how little they understand the meaning of the word *know-how*. In the United States, it's hard to get any home computer industrialist (except within IBM) to think beyond next Christmas.

Home bus and information network system products surely will not be important home items even 3 years from now (though some MSX home computers designed to work with these standards are likely to be available by then). By creating a national business consensus on these objectives, however, Japanese business has brought the minds of not only an elite group of technicians, but of the whole manufacturing and marketing apparatus of all her major firms, to focus on the know-how challenges of the home of the future. Home-bus- and information-network-system-related products could be enormously important, at least inside Japan, within 5 years. They, or something like them, are sure to be overwhelming important—comparable in importance to the telephone in the early part of this century—by 1995.

I don't know when you'll get intercomputer networking in your home or what exactly it will do for you aside from providing truly efficient computer shopping and access to a fine library of information services. I do know that by 1995 your home can be radically changed, and the changes can in most respects be for the better.

Beyond 1995, who knows how computers will change your life? "The consensus is that some time between 1995 and 2010 artificial intelligence will surpass human intelligence and artificial intelligence will start taking over across the board," says computer pioneer Donald Michie. Michie adds

that this is "a rather scary development," and I agree.

Just as many expert systems of the late 1980s will certainly run on MSX computers, much of the awesome artificial intelligence of the 1990s will no doubt run on the descendants of today's MSX machines. Japanese electronics companies are already working on an upgrade to MSX which will give it power comparable to today's IBM PC/AT, and the plan is to continue upgrading the Japanese home computer standard, while maintaining compatibility with previous software, as technology and improved manufacturing know-how continually increase the computer power that's affordable in the home.

The changes ahead will be truly incredible. So don't denounce American home computer makers for selling their wares with "Buy-this-computer-or-your-kids'-lives-will-be-ruined" sales pitches. Many kids' lives no doubt will be ruined in various ways by supersmart computers over the next 40 years. The right complaint against the American computer makers is not that they're pressuring people to learn about the machines that will dominate the next century or so, but rather that they're selling machines that are totally unsuited to fit into the world of the future. If you're raising kids today, you should plan to help them understand the psychology of computers and make computers their servants as much as possible. You should bring into your home machines designed to serve you.

If you haven't done so already, buy an MSX computer. Find a user's group that will help you learn to use it well. Play with it. Work with it. Enjoy it. Look for ways to bridge the enormous gap between the world of today and the computerized world of tomorrow. By learning to use today's computers, you're truly linking yourself with the future. See if you can use your machine to make your world, and perhaps everyone's world, a little better.

Appendix

Appendix

Regional Distribution Points for CP/M Software

SIG/M distributes what is probably the largest library of public-domain computer software in the world—thousands of programs on more than 200 disks. The initials SIG/M stand for "Special Interest Group/Microcomputers." Since these programs are designed to run under Digital Research's CP/M operating system, most should run on MSX computers with disk drives. The vast majority were prepared for serious hobbyists and computer professionals; so SIG/M programs tend to provide inadequate information for beginners, even when the programs would be of great interest for ordinary people. Moreover, some of these distribution points may not have facilities for loading the programs onto MSX-format disks, especially 3 1/2-inch MSX format disks. Computer user's groups are as unstable as other volunteer organizations; so some of these addresses are no doubt out of date.

On the other hand, some of these SIG/M distribution points can be good sources of information about computers generally. Much of the software—from the original, now classic, ADVENTURE game to recipe filers and telecommunications software—can be highly useful once you've figured out how to make them work.

Generally a SIG/M catalog costs $3, and disks are distributed for $6 plus a shipping/handling fee. In the following list, the word "Voice" preceding a phone number indicates a normal telephone line; "CBBS" or "RBBS" indicates a computer bulletin board system.

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David Wrobel
SIG/M - Chairman
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Dept. Electronic Engineering Technology
Trenton State College
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Robert Todd
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Dave Thompson
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Jorge Blat
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Charlie Foster
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Bob Stek
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Voice (416) 239-2835
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South Africa

Netherlands

Hank Berkhoudt
CP/M Groep
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Rotterdam

United Kingdom

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Inpholink, Ltd
Front Street WestSirus/Victor 9000
Bedlington, Northumberland
England NE22 5UB
Voice (011-44)0670-827480

Derek Fordred
SIG/M - Western Europe
CP/M Users Group of UK
72 Mill Road
Hawley
Dartford, Kent
England DA2 7RZ
Voice (011-44)0322-22669

South American Region

John Irwin
SIG/M - South American Coordination
Miami Amateur Computer Group
9159 South West 77th Avenue
Miami, FL 33156
Voice (305) 271-4592

Venezuela

Hans Stauffer
Caracas Computer Club
Apartado 66394
Caracas, Venezuela 1061A
or
Hans Stauffer M-105
Jet International Airport
P.O. Box 520010
Miami, FL 33159

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Edited by Suzanne L. Cheatle