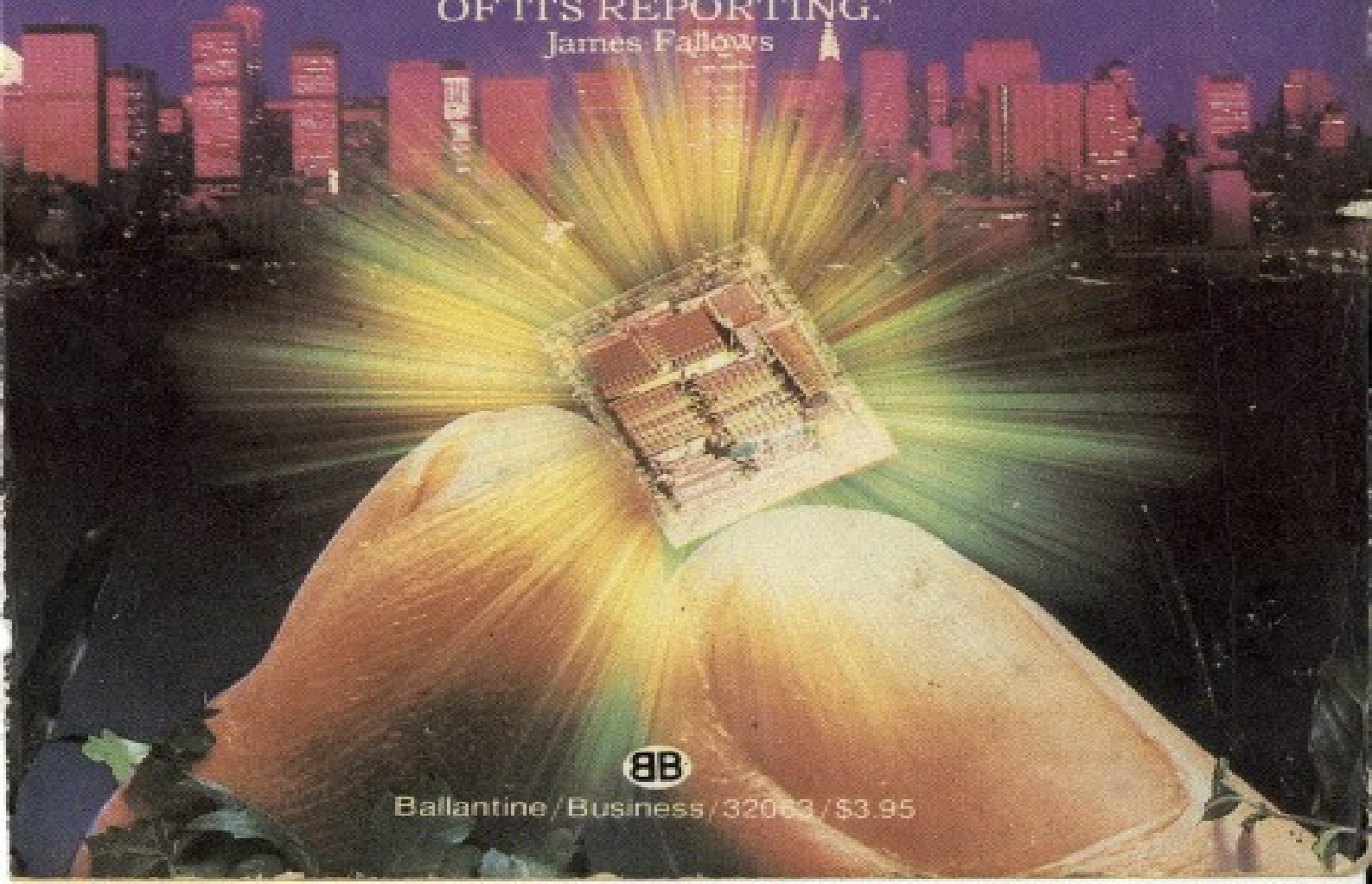
DAVID H. ROTHMAN

The SILICON JUNGLE

"AMONG THE MULTITUDE OF COMPUTER BOOKS THAT HAVE COME ONTO THE MARKET, **THE SILICON JUNGLE** STANDS OUT IN SEVERAL WAYS—FOR THE LEVEL-HEADED HONESTY OF ITS JUDGMENTS, THE PRACTICAL USEFULNESS OF ITS ADVICE, AND THE BREADTH OF ITS REPORTING."
James Fallows



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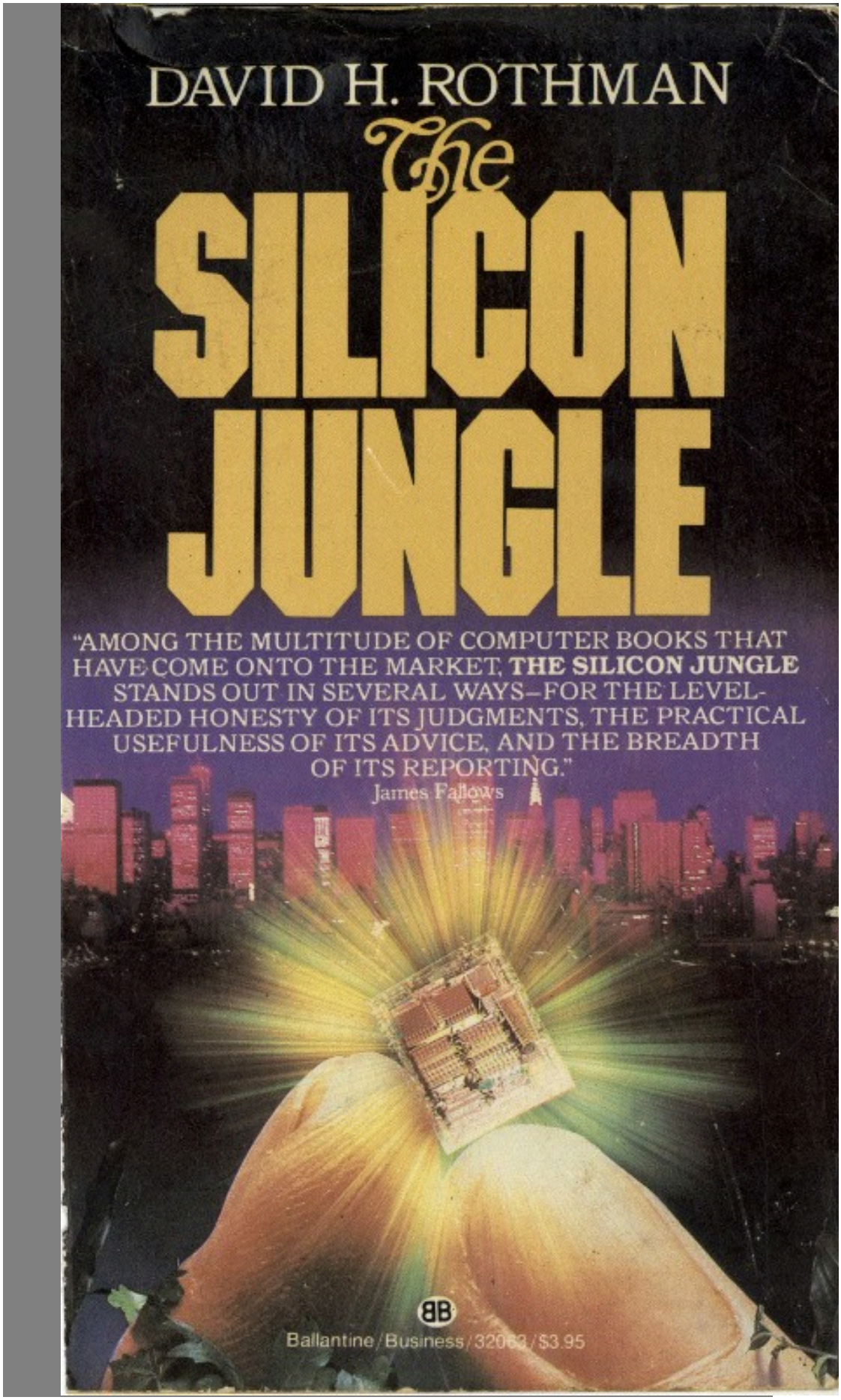
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"David Rothman's SILICON JUNGLE is an aphrodisiac for anyone interested in the computer revolution. There is a real sense of self-liberation for the reader, in whose mind the dawn lights up the incredible, awful, wonderful reach of the little computer chip."

William F. Buckley, Jr.

"Everything you've always wanted to know about computers but were afraid to ask for fear of not getting a straight answer in plain English. David Rothman is Indiana Jones, guiding us through the hype, hardware, software, and confusing jargon of THE SILICON JUNGLE."

Bettina Gregory
ABC News Correspondent
and IBM PCXT owner

"David Rothman's SILICON JUNGLE is an inspired, fast-paced, often maniacal view of today's microcomputer scene. While laced with hard facts, Rothman's anecdotal style makes the book fun reading.

The perfect book for the newcomer to the scene and the old-timer lost in the jungle."

John C. Dvorak
Technology columnist,
The San Francisco Examiner
and *InfoWorld*

"THE SILICON JUNGLE has proved helpful in both my business and personal use of computers. It is down-to-earth, easy to understand, and has made me and my computers better friends."

Ellen R. Gordon, President
Tootsie Roll Industries, Inc.

"THE SILICON JUNGLE is an insightful book that provides a foundation for dealing with the complicated world of personal computers."

Chris Christiansen
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The Yankee Group

"Of all the books about computers, THE SILICON JUNGLE is the best I've seen.... Fun to read and Instructional as well. David Rothman not only blazes a sure path through the jungle, but he has told us almost everything there is to tell about the computer world at this point—and told it very well."

Jerald F. Terhorst
Ford Motor Executive

DAVID H. ROTHMAN

The SILICON JUNGLE

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WITH LOVE
TO
HARRY AND HORTENSE ROTHMAN

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The
SILICON
JUNGLE

1 The Silicon Jungle

Americans are fighting each other not just in the marketplace but also in the Silicon Jungle.

The jungle isn't greenery. It isn't land. It's nothing more than the mineral in tiny computer chips that switch electronic impulses.

But a jungle it is:

- Airline X accused Airline Y of electronically sabotaging X's reservations operation and contributing to a $733-million bankruptcy. The charges may have been false. But their very existence dramatized the increasing link between computer security and corporate survival.
- Car thieves have computerized to keep better track of hot auto parts. That's bad news not only for police but also for rival thieves with antiquated record keeping. Meanwhile, a hooker ring, too, has automated. And a gambling operation analyzed its profits daily through a big computer hooked up to smaller ones in forty-three cities.[1]
- An editor confesses he snooped on the competition by figuring out the computer password of Brand X newspaper ("it's like playing Scrabble—a matter of time and an interested mind").
- Millions of more scrupulous Americans are increasingly relying on micros to outwit their rivals.

Consider two deadline-ridden lawyers locked in combat over the same case. Lawyer A might ferret out legal precedents through eye-straining research at libraries, while B could cover the same territory in minutes through the right taps on a new IBM personal computer.

Siliconized war is "in" between and among giants and gnats.

"One hundred years ago in Colorado, the Colt .44 was a great equalizer," a westerner once said; now he said his suitcase-sized micro was.

Today better machines sell for around $1,000. With trimmings they can:

- Electronically zip messages to other computers and people across the country.
- Be word processors, doubling some writers' production.
- Prepare spreadsheets, which help businesses quickly calculate the future costs of providing products or services.
- Keep records electronically.
- Help you whip up jazzy charts to whet your boss's interest in your work—in a nice way.

This book will tell you how to make the best use of portables and other business computers wherever you are—large company, small, or on your own. Big bureaucracy is here, also, complete with the Case of the Missing Cafeteria (explained in Chapter 7).

Instead of hearing just about computers in the abstract, you'll learn about them in life. Arthur C. Clarke, the world-famous science-fiction novelist who wrote *2001* and *2010*, will tell how WordStar software made him "a born-again writer." And the FBI, top consultants, and a felon named Captain Zap will warn against electronic crooks.

There'll be computer tips, too, from obscure but savvy business people, such as a New York real estate executive whose micro skills lead to his six-figure income.

You'll also hear from some stars of the industry, including WordStar's creators, and you'll learn how their lives and philosophies tie in with the products on sale at your local computer store.

We begin with the Ten (Micro) Commandments:

DON'T FALL FOR THE SOFT SELL—OR HARD SELL. THE COMPUTER BUSINESS IS A JUNGLE.

"This machine here is a Mercedes," a Radio Shack man once told me. "Apple's the Ford. You want to buy a Mercedes

or a Ford?"

How do you cut through the hype to buy a machine that is better than your competitor's?

You've got your own jungle to survive, and, by learning how computer firms make and market their offerings, you'll be a better shopper.

Especially beware of the computer hawker who says he's a "technician" with your interest in mind.

BUT REMEMBER THAT GOOD GUYS CAN FINISH FIRST.

The New York executive saved his blue-chip company a fortune and won his $100,000-plus salary without firing anyone, groveling before his boss, or cheapening a product or service.

By picking the right computer or program, you just might get a head start on the office toady.

AVOID THE SNACK-FOOD PROGRAMS—THE ONES EASY TO LEARN BUT LESS SATISFYING TO USE.

With press agents and flashy boxes for disks, the software market is going Hollywood.

It's also, however, becoming more like the cupcake industry —geared not to nourish but to please instantly.

Some marketeers are trying to displace good, solid business programs with Twinkie-like products that *sell* well but don't *work* well.

LEARN ABOUT COMPUTERS AS THEY RELATE TO YOUR JOB.

Normally, you and your employees needn't become true computer experts.

In most cases you'll lack the time or talent to write the programs you need to be fully competitive. Very likely you can use off-the-shelf software instead.

Also, you can find the right computer consultant and carefully oversee his work; this book will help you avoid gobblers.

BE HUMANE—PROFITABLY.

Micros can be efficient and humane at the same time. Don't confuse *The Silicon Jungle* with *Winning through Intimidation*. Often, for instance, some humanity can improve your efficiency by lowering the number of errors your people may make. This book tells how to choose equipment that's easiest on your people's eyes and backbones.

BONE UP ON COMPUTER CRIME—BUT DON'T NEGLECT ROUTINE WAYS OF MAKING YOUR ELECTRONIC RECORDS SAFE.

You should worry about computer crime, while not neglecting garden-variety problems of "data security," like coffee spilled on floppy disks.

Pity a poor wedding-cake maker. The other day on the radio I heard that he couldn't fill his orders because a forgetful computer had wiped them from its memory.

"WIRE IN" TO TELECOMMUTING IF IT'S RIGHT FOR YOUR COMPANY—AND PERHAPS SAVE THOUSANDS IN OFFICE RENTS.

Working at home on a computer isn't for everyone. Some jobs will always require face-to-face contact.

Telecommuting, however, is a nifty new way to gain an edge on the competition while ending some workers' rush-hour woes. Say, you now spend $4,000 annually on rented space for each employee. Allowing home work may save you more than $8,000 per telecommuter, totaled up over five years, if your tax rate is 35 percent.

REJOICE! MOST LIKELY YOU'LL JUSTIFY YOUR TRAVAIL.

Computerization is harder than your friendly computer store might lead you to believe, but most likely you'll justify your travail.

Someone once said he never knew of an author who gave up his computer and returned to a pen. I'll buy that.

THROUGH IT ALL, KNOW WHAT THE OTHER GUY'S UP TO.

You're better off if you know what the other guy—or woman—is up to.

This book is, frankly, for top executives and mid-level people, small businessmen, and professionals. And if your employees read it? Well, so much the better.

"You" here is many people.

Some of my most enterprising readers, by the way, won't just be interested in computers for themselves or their companies. They'll also see them as marketing opportunities involving the rest of the world.

Take Mike Bell, a Xerox executive. We talked about munytels—neighbor centers offering child care and other services for people "commuting" to the office via computer. And Mike had an idea. Why not *franchise* the munytels like McDonald's hamburger stands? Maybe Xerox will start a Munytel Division.

The "other guy" principle also applies to small businessmen selling to the Xeroxes of this world. If you know how the data-processing people think in a large corporation, you may be more understanding if you're having problems hooking up to a large customer's computer.

Likewise, the "other guy" idea can help businessmen keep up with competitors and appreciate their own employees' computer-related fears.

In short, this book is for people who want to survive—and make money—by *listening*.

Ranging over many topics, it may come across as a series of essays rather than a normal guide. So be it. I'm not going to cheat you of helpful facts that *most* readers won't care about or that are far removed from the main thrusts of the chapters. You may be desperate for this very material. And items at the ends of the chapters will refer you to "Backup: More Tales and Tips from the Jungle." "Backup" follows my main book.

BREAK OUT OF THE USERS-GUIDE GHETTO.

You already have. *The Silicon Jungle* is for owners and prospective owners of Radio Shacks, Apples, IBMs—all kinds of machines.

Do buy a guide for your model of computer or your pet software program; this book isn't a replacement.

It offers, however, more detachment than a guide touting the virtues of a single machine. I'll write about the computer I own—yes, I have my biases—but it'll be as an example, not as the final answer. Frankly, *for graphics work alone*, my Kaypro II would not suffice. The screen isn't good enough. The Kaypro's electronic brain just is not very visually inclined, and all in all, I'd be far better off doing charts with an Apple Macintosh.

Many good paths wind through the Silicon Jungle.

■ ■ ■

There's no doubt—the computer business *is* a jungle. While I was writing this book, Osborne Computers filed for bankruptcy under Chapter XI. "I'm just devastated," said Adam Osborne. The previous year, his firm had sold 110,000 portable computers listing at $1,795.

I, too, was sorry he'd failed. Osborne's was the first company to produce a bargain-priced business computer with good, free software thrown in. If his company hadn't revived itself under new management, the industry would have offered buyers that much less choice.

Part of Osborne's problem were his marketing blunders. Also, however, an arch rival, Kaypro, had come out with a better machine. I bought one.

Chapters 2 and 3 tell how Kaypro has fought Osborne and other foes—wars of interest to you, since you'll win a better deal if you know about micro-makers and the origins of their computers. While this chapter and the next one focus on Kaypros, much in them would apply to other machines.

Most microcomputers don't emerge from tile-floored laboratories; instead, they come from companies that refine existing technology and carve out niches in the marketplace. But what's "refine"? High tech is enough of a gamble for the more solid computer makers. Shakier ones can be reckless, and often at customers' expense. A newspaper perceptively observed, "Computers are hyped before they're ready,

announced before they're shipped and sometimes outdated and outpriced before they reach retailers' shelves."

I'll try to *help* you find the machine that's best for you—not necessarily the one that computer hustlers envision on your desk. Beware:

- In Maryland, a sail maker ended up with a micro useless as anything but an anchor.
- A midwestern company sued a major micro maker for $456,000 because an $8,000 computer allegedly didn't perform as advertised.
- A construction executive invested over $9,000 in a name-brand computer but could do next to nothing with it, while a colleague was making out fine with a little Zenith micro selling for around half the price.

"I've seen too many company presidents march through there hoping to make a final decision in less than an hour," said a sales manager at a Michigan computer store. "In almost every case he's ended up paying either too much for the right equipment or too little for the wrong equipment."[2]

Just as important as the hardware—the computers and other machines—are the programs on those plastic disks. In fact, you should even think "software" before you do hardware, because your machine will be useless if it doesn't do the tasks you want it to. And the programs supply these necessary instructions. More than thirty thousand programs for micros are on the market; so *The Silicon Jungle* can't say which one is exactly right for you, but it can help you find out for yourself by showing how a software classic comes into existence.[3]

I talked to Seymour Rubinstein and Rob Barnaby—the subjects of Chapter 4, "WordStar: The Creators"—and learned that Barnaby and I had some common work habits. Maybe that's why I like WordStar so much. I feel as if the people behind it used ESP to discover how I liked to move words around on my spooky green screen.

Some complain that WordStar is too complex. I disagree. New versions of WordStar and other programs, however, will become simpler to learn as the machines themselves grow more powerful. The new WordStar 2000 is an example.

Smart production-minded buyers meanwhile should avoid the "user-friendly" software that's easy to learn but hard to use. One example is the Select, a clunky word processor discussed in Chapter 5 after WordStar. I expressed my loathing with my wallet. Although Select came free with my Kaypro, I junked it. Had I not spent my $250 on WordStar, I would have taken much, much longer to write this book.[4]

In Chapter 6, "Three Software Stories," businessmen tell how they coexisted—or didn't—with their software. One of them is the New York real estate executive mentioned earlier. He saved his new employer $200,000 a year by boning up on software and using micros rather than expensive time and an outside company's mainframe. A Maryland construction executive did well, too. He thinks his software knowledge helped him snare a new job as a company president with one-third interest in the firm. Like the New Yorker, he successfully concentrated on micros as they related to his job. Another man, an accountant good at his work but uneasy around computers, offers some observations on the failings of existing software and his difficulties finding the right program.

Graphics will be one of the hotter software topics over the next few years, now that cheap computers can do more visual tricks. And in Chapter 7 and Backup VII, you'll learn (1) the basics, (2) when charts are worth the trouble, and (3) how to select the best programs in that category. Most existing computer guides are overly technical about graphics, or they just about shun the subject. That's too bad. Graphics can actually save your company money; computerized charts can help you set priorities and keep your projects on schedule. At times, too, there are other advantages. A little Macintosh won't replace your art department, but it might enable you to whip up flashy graphs to impress your customers.

Even with the supposedly simple Mac-style machines, however, you may still need a good consultant—one of the topics of Chapter 8, "People."

He or she can help you select the right software, for instance, or teach you how to use it. But you can't always trust credentials, and here you'll read of a young company that wasted $40,000 on the wrong consultants and their bungles. One man was so learned in computers that he had helped

design the systems on an aircraft carrier, yet he lacked the exact technical expertise to help the company get *its* work done.

My old newspaper in the Midwest made another people-type mistake, letting a computer expert befuddle staffers with technical jargon. A white-haired editor suffered especially. Although he knew his town better than did just about any other newsman and had been a fixture in the scruffy city rooms since World War II, the paper exiled him from the copy desk after the training program failed him. His health gave out amid the strain, and he ended up on extended sick leave, done in partly by the course's scary talk of bits and bytes. You use a calculator without being—as one man put it—"calculator literate." Why must you be "computer literate"? Be so if you're an aspiring programmer or if you enjoy computers as a hobby. If, however, you don't, well, forget it. Instead, simply concentrate on (1) finding the right experts for the grubby technical chores and (2) helping yourself and your employees learn *the programs of use on the job*.

You can also treat people well by guarding against "The Hal Syndrome." I've named Chapter 9 after the uppity computer in *2001* and *2010*.

The best weapons against Hal are good, common-sense ones, like viewable screens and easy-to-use keyboards, which can cut down on headaches and backaches. Forget about the white tiles and bright fluorescents you see in traditional computer rooms. They can torture your eyes. As for keyboards, you'll learn the wisdom of using the detachable kind, which makes it easier for you to be the right distance from both the keyboard and the screen. Why not buy equipment that can adjust to both your eyes and your back? Foreigners caught on to this issue much more quickly than we did; some European firms even sawed the keyboards off American-made terminals. And now U.S. workers are demanding action. "They affected my stomach quite a bit," a former insurance company worker says of the machines that caused her to quit her job. "Most days I worked I would throw up in the ladies room." Whether you use micros or big computers, you'll get more work out of people—and be able to hire better ones—if the equipment is comfortable to use. Still

another precaution against Hal is good job design. See if you can rotate your employees' computer work with other duties to reduce the stress of being at the keyboard all day.

In the Hal Syndrome chapter, you won't simply read academic wisdom. Instead, you'll hear about the true health and safety concerns of people working the computer keyboards—eminently valid worries in many cases.

And you'll read in an accompanying backup about another hot topic in this era of contact between man and machine. It's the **mouse**, the palm-sized gadget that you push along your desktop to guide the **cursor** (the little blinking line or other marker that shows where you're typing on the computer screen).

Some manufacturers love the mouse as a marketing gimmick. And it's indeed nice for graphics. If you're a writer or secretary, however, and if you lack three hands, you may be better off mouseless. Why? See Backup X, "Of Mice and Men."

I'll also try some candor on another touchy topic—computer crime.

In Chapter 10, "Jewels that Blip," you'll learn how to protect your company secrets inside your computer and how to prevent the machines from suffering amnesia and destroying electronic records. Although electronic Willie Suttons exist, your real worries are often mundane. This book won't keep you from spilling coffee on a floppy disk, but it will tell how, using good software and good habits, you can help ward off both crooks and accidents.

Much of Chapter 10 is about larger computers, and quite logically so. Increasingly, your micros will be talking to mainframes, as the big machines are called, and your facts are only as safe as the electronic repositories where you store them.

Computer security will particularly matter in the era of telecommuting, a subject covered in Chapter 11, "Wired to Work," which will show you how "electronic cottages" often can be both productive and humane.

A California professor says by 1990 as many as 10 million U.S. workers could be tapping away on keyboards at home. In Chapter 11, you'll learn how you may be able to

"telecommute" within weeks or months if (1) your boss and company are sympathetic and (2) your office politics permit you to do so without harming your career. Why wait for official telecommuting programs from corporate headquarters? Chapter 11 advocates nothing less than a grass-roots telecommuting movement by corporate writers, programmers, salespeople, and working mothers. Toting up the savings that telecommuting can yield, more and more corporations will encourage experiments. Many people—though not all—thrive on it.

"It seems foolish for me to get in a car to go to an office," said a Washington-area telecommuter, "if I can go to that office by phone." Without the wear and tear of rush-hour driving he became more productive.

You needn't telecommute every day. The chapter, in fact, starts with the example of the rush-hour hater who made it a point to keep up with the office crowd in person on occasion.

Chapter 12, "How I Found 'God' on MCI (and a Few Other Odds and Ends about Electronic Mail)," tells more about sending computer messages over the phone lines. Some E-mail nets even link up with the old Telex networks. During the writing of this book I corresponded via computer with people ranging from William F. Buckley, Jr., to Captain Zap and the MCI mail-Telex connection transmitted last-minute changes to my publisher.

In Chapter 13, "Net Gain$," you'll learn how different computers in your own office can share the same programs and exchange information without people constantly having to carry floppy disks from one desk to another. A Michigan company may be enjoying as much as DLR $1,000 a year more in effective work time from each staffer as a result of its internal computer net.

Of course, with today's imperfect technology, such hookups can be a real struggle. But so often they're worth it.

You could say the same, indeed, of micros in general—today and in the future.

It seemed especially true when, for my last chapter, I tried to reach Arthur Clarke's micro in Sri Lanka. I wanted him to answer questions about microcomputers in 2001—the year in which his Hal was killing humans. Did our phone-computer

connection succeed? Read Chapter 14, “As the Jungle Thickens.”

Struggles notwithstanding, computers often *do* pay for harried professionals and business people. “This $5,000 machine has saved me from hiring a $20,000-a-year assistant,” said a New York investment adviser using an IBM PC to write reports and make financial calculations at home. A young trader forsook the bedlam at the New York Cotton Exchange for an electronic office in his apartment. Now he can go to work in his bathrobe and delay his shower until lunchtime. “It’s more challenging this way,” he said. “More contemplation, less raw instinct.”[5]

Another self-employed man, Jimmy Carter, composed his memoirs on a word processor—perhaps inspired by the example of a former Carter speech writer who wrote a well-reviewed book on national defense.

Then there’s Isaac Asimov, the legendary science-fiction novelist, who, even with an ancient manual, could write faster than the old Teletype machines could clatter along. But he didn’t always produce the neatest copy. “How different now!” he exulted in an article. “Staring at a page of type on a television screen, I eagerly look for typos so I can have the fun of changing them.” You needn’t be a professional author, however, to benefit from computerized writing. In Maryland, an architect-consultant, once typewriter shy, is now churning out reports several hundred pages long on his IBM PC.

“A boon to the small businessman” is how Hugh Hunt, a son of the late oilman H. L. Hunt, described micros. “Now he can compete with the larger corporations as far as obtaining data and processing it quickly.”

Hunt himself was using portable computers in his land-development business. But he also noted their helpfulness in law:

“Computers are one of the ways that small attorneys can compete with large corporations. By joining a computer bank, they can research briefs and do word processing, just as the large companies can.”

Many Americans apparently shared his views. In 1985, they might buy six million computers for business use, and within two more years, that number might almost double.[6] While I

was writing this book, the United States was emerging from the worst economic ordeals since the Great Depression; a few college graduates had been reduced to shopping-bag ladies, but the microcomputer business was still growing, even if at a reduced rate. You might wait three months or more for your Macintosh or IBM. Some companies died, but others took their places; and even in times of inflation most prices on micros were dropping; years would pass before scientists could no longer keep dramatically increasing the silicon chips' powers. Forget about the physical smallness of the chips. It was as if the entrepreneurs in Silicon Valley—in exploiting the scientists' advances—were opening up a vast electronic territory. "The only thing you worry about with computers," Hunt said, pleased, "is 'Should I wait until something better comes along?'"

"I'm sort of a computer groupie," said Art Buchwald, the syndicated humor columnist. He was caught up in the new pornography of the era: those luscious, ad-packed micro magazines crammed with the vital statistics of IBMs and Apples. "It used to be that when *Playboy* arrived at the house, my wife would say, 'Your *Playboy*'s here,'" Buchwald told an advertising magazine. "Now she says, 'Your *InfoWorld*'s here.' I'm not sure which she prefers. I have a feeling that *Playboy*, at least, she could discuss with me."

It was like radio during the 1920s, this micro craze.

Time had proclaimed the computer "Machine of the Year" in 1982, and I recalled a song that a friend of my parents, an old woman, had written years ago. "Marconi, Marconi," the lyrics went, "the world is at your feet." How long until the novelty of microcomputers seems just as quaint as that of radio? The parallels could be there. Two San Francisco-area authors, Andrew Fluegelman and Jeremy Joan Hewes, in *Writing in the Computer Age*, urged readers to "become full-fledged computer citizens—as writers, poets, artists, musicians, programmers, number-crunchers, networkers...." The Fluegelman-Hewes book was useful and well done. But "computer citizens"? The phrase grated. I was a user at the keyboard, a "citizen" in the voting booth.

Still, I could understand why Fluegelman and Hewes called themselves "computer evangelists." I felt the same way. After

having brought us Muzak and junk food, technology for once was making life better.

I say this with reservations. Educators correctly warned of the computer literacy gap between Harlem and Scarsdale—of the dearth of machines in the slums and the bounty in some suburbs. Rich and poor clashed at school-board meetings. In my own county, Fairfax County, Virginia, a well-off PTA reportedly saved up for micros, then withheld purchases until it learned whether the school board would spend tax money helping other schools catch up. And what about unemployment as automation cost more jobs? Or U.S. firms using computer-satellite hookups to pipe in the work of $3-an-hour clerks? The People's Republic of China was even preparing to sell programming skills to the rest of the world. A billion *programmers*, maybe? So much for high tech as a refuge for the American jobless.

How could you make computerization a joy to all? That was one answer you'd never find in a computer store.

You could, however, set up the right retraining program for valued employees to see them through automation. You could fight the Hal Syndrome. You could work to end boring tasks. In short, you could do your best to make your computers benefit both your employees and your company's earnings.

2 The Kaypro Phenomenon: How Solana Beach Took on Silicon Valley

As *The Silicon Jungle* was lighting up my Kaypro screen one September day in 1983, several similar machines were whirring and clicking in the Washington offices of Walter Mondale's presidential campaign.

Kaypros kept track of donations and the $18-million budget. They helped churn out news releases, speeches, and letters to voters in important primary states. Just eighty people worked at headquarters seven months into the campaign; Kaypros and other affordable micros were a major reason why Mondale wouldn't need legions of back-room staffers in Washington later on. I didn't know if Mondale would win or lose the primary, but whatever happened, it wouldn't be for want of computing power.

Forty-five miles away, near Baltimore, Kaypros at a Westinghouse plant were receiving computer messages from defense installations abroad. Other Kaypros sat on the desks of William F. Buckley, Jr., ex-Governor Jerry Brown's research director, and the president of Tootsie Rolls; and still another, some months earlier, had helped study Barney Clark, the first man with an artificial heart. A Kaypro in the Midwest was tracking something else, the milk and manure output of cows.

All of us, Mondale's people, the others, and I, had benefited from the struggle between Adam Osborne and Andy Kay.

Osborne, a brash ex-columnist for computer magazines, had marketed the first mass-produced portable computer. Andy Kay had soon followed with the Kaypro.

Adam Osborne was a dark-haired, mustached man in his forties who enjoyed toting his product within sight of photographers. His father, a British missionary of unconventional stripe, had tried to convert Christians to

Hinduism. Nor did the younger Osborne himself blend into the crowd; he founded his computer company in 1981 and was soon comparing himself to Henry Ford and the Osborne 1 to the Model T. “I give you,” he said, “ninety percent of what most people need.”

His rival, Kay, was shorter, about five feet seven inches, but also slim; like Osborne, he had studied chemical engineering and was a maverick and newcomer in the personal-computer business. There, however, the resemblances ended. Kay was soft-spoken, graying, an old electronics hand; his friends depicted him as a quality-obsessed engineer and Osborne as a flashy marketing man. They said Osborne had seemed technically incapable of making a good portable with a nine-inch screen. Adam Osborne, in turn, spoke of Kay’s computer as if he were a four-hundred-pound wrestler forecasting an instant demise for a foe: “The Kaypro’s gonna die.”[7]

The computer magazines had portrayed Osborne as a lone maverick taking on the Silicon Valley establishment with the portable that the rest of the industry said couldn’t be built. But Kay claimed a similar idea had hit him at the same time.

Andy Kay had seen his son-in-law struggling to carry an Apple and its trimmings between home and office and decided that a market might exist for a small machine for engineers, architects, and other professionals. *Then*, Kay said, he had heard of the Osborne. Modifying their original plans somewhat, his people at Non-Linear Systems had homed in on their rival’s weaknesses, giving their own computer a better screen and a better keyboard and the ability to store more data. Adam Osborne had struck back with a jazzed-up version of his first machine. By 1983, many other companies were in the fray, including Seequa Computer Corporation, a Maryland manufacturer whose computer sold for less than $2,000 and ran most IBM-style programs.

In mid-1983 an industry expert was saying Kay and Osborne might together enjoy $200 million a year in micro sales at the retail level. That was just a fraction of the $5-billion-a-year market for business micros, but the two firms then seemed the largest makers of portables in the $1,000-$2,000 range.[8] Their fight was pivotal. Lines were fuzzing between economy business computers and the home

machines; the winner of the portable battle might go on to fight Apple and IBM, provided it survived the onslaught of $1,000 computers that Japan was expected to unleash. By the end of the decade, powerful portables with a quarter the bulk of the Kaypro II might jam the shelves of the discount stores.

Kay waged his marketing war from several hillside buildings in Solana Beach, a small town near San Diego, hundreds of miles south of Osborne and the rest of Silicon Valley. His was a family business. Kay's personal housekeeper served salads and fruit juice in the corporate lunch room, and his eighty-six-year-old father, known around the plant as "Grandpa," repaired electronic equipment and ran a forklift. Andy Kay's wife was secretary of the company. One son, David, was the vice-president for marketing and had helped develop the Kaypro; a second son worked in personnel, and a third ran the print shop; and Andy Kay's daughter and her husband had designed the buildings—which were now the same light blue as the "KAYPRO II" lettering on the computer. Altogether, some 450 people worked for Kay's company by mid-1983. That was more than twice the number a year earlier when the Kaypro II was just hitting the market and Kay was counting on a mere $10 million in sales.

Bulldozers were growling away amid the expansion, and the company newspaper said equipment-cluttered grounds resembled a scene from a bad disaster movie.

No longer was Kay a semiobscure maker of voltmeters and oscilloscopes and other test equipment. Sales, once $4 or $5 million annually, were barreling along toward $100 million. Even his company name soon changed—from Non-Linear Systems to Kaypro—in recognition of the success of the division making his hot new computer.

Wall Street and Andy Kay were getting to know each other. That summer four million shares of common stock hit the market at $10 each; and the prospectus said Arthur B. Laffer, the "Laffer Curve" economist, would serve on the board of directors. Kay still owned most of the company personally. And now, with the new money, he could give IBM and Apple a better fight. "After 30 years in business," *San Diego Magazine* had said, "he's suddenly the new kid on the block, clutching under his arms a couple of excellent bags of marbles."[9]

Before the Kaypro, Kay hadn't exactly been on the verge of starvation—he owned an art-filled home overlooking the Pacific and gave to the local symphony and other cultural causes—but now he'd reached the point where his admirers were depicting him as a silicon-age Horatio Alger character.

That's a little exaggerated. Kay, though poor in his New Jersey days, was never an orphaned newsboy toughing it alone.

"Grandpa" prodded Andy. Frank Kopischiansky—an Eastern European immigrant and an ex-coal miner—worked in silk mills and wool factories and as a chauffeur. Frank had come to the United States from what is now Poland. Andy Kopischiansky would later become Andy Kay after his original name baffled some colleagues at work and they kept calling him "Kay" for short.

The Kopischiansky home lacked a bathtub. "But," Andy recalled, "we always had food, and I always had a nickel in my pocket." Frank enjoyed fixing broken-down cars and tinkering with electrical equipment, and Andy himself built a shortwave radio when he was only twelve years old. Math was another love. Andy even considered a career as an actuary after Prudential Life told him he could eventually make $15,000 a year. "I flipped out," Andy said, "because it was a lot of money in 1935." Frank shrugged off the $15,000, however. "That's not very much," he said. The words, incredibly, came from a man who seldom made more than $1,000 a year during Andy's youth and who sometimes earned just $15 a week.

Andy, growing up in Clifton, New Jersey, took it for granted he could never afford college, but then the letters M.I.T. came up in a drafting class.

"What's that?" Andy asked. "I've never heard of the place."

Frank had lost most of his savings in a bank crash, but his wife somehow scraped up enough money to help Andy reach M.I.T. on a partial scholarship. Andy graduated in 1940 with a bachelors degree in chemical engineering, mathematics, and premedicine and worked for the Bendix Corporation and several other companies before founding Non-Linear Systems in 1953. Kay reached California through a job, although for years he'd been hoping to enjoy the warm climate there. He started his company in Solana Beach rather than Silicon Valley

because he was already working in the area. Osborne himself would found his own firm while living in Berkeley—he'd locate it in Hayward, a medium-sized city within twenty miles of the Valley proper, the Palo Alto-San Jose area southeast of San Francisco.

For Non-Linear Systems Kay developed the world's first commercially successful digital voltmeter. It was the result of some memories from World War II, when unskilled workers were constantly damaging voltmeters and having trouble reading them accurately. Kay's new machine easily survived the careless. The instrument displayed numbers and didn't require workers to make a reading off the thin needle of a conventional meter adjusted for the right voltage. "I don't look at myself particularly as an inventor," Kay said. "I'm a solver of problems. There are inventors who have many, many more ideas than I get." Instead, he tried to refine ideas in "ways that make sense from an industrial-engineering standpoint and a customer standpoint."

Kay's digital voltmeter was perfect for the military and for the National Aeronautics and Space Administration (NASA) and their contractors; unskilled people could help test thousands of voltages on American missiles. "The silos are full of our instruments," he said. But the NASA cutbacks of the Nixon era hit Non-Linear Systems hard.

"The seven vice-presidents went," recalled a trade publication, "as did their white Cadillacs." Frank Kopischiansky was willing to help see Non-Linear Systems through bad times, loaning thousands of dollars of painfully saved money. But that was hardly enough to sustain a corporation. What about the future? How to avoid the boom-and-bust cycle of government spending?

Kay decided to carve out a niche as a maker of rugged portable test gear for private industry. He wanted to offer many of the same wrinkles found in costly, bench-bound equipment, and one of those features was a microprocessor in a voltmeter: a miniature electronic brain that would make it easier to use. The idea came from an old friend, Bill McDonald, whom Kay had met decades earlier at M.I.T. Their gym lockers were next to each other's there; both men had loved handball and hated team sports. McDonald, a husky man of basketball-player

height, had worked for Non-Linear Systems in the early 1950s, then had returned East, where he had acquired a computer background. Then, in the late 1970s, he'd rejoined Non-Linear Systems, where his friend Kay hoped he would help develop a computer. Correctly or not, Kay believed that "ninety percent of the electronics business was computer and ten percent was test equipment, hi-fi, stereo, and stuff like that." Non-Linear Systems had offered other companies' minicomputers in systems it packaged for military contractors, but still wasn't making machines of its own. Maybe a small business machine would be one way to enter computerdom.

"Two months after Bill came to work for me," Kay recalled, "he showed me some microprocessor-based computers for doing accounts payable-receivable at the local computer dealer's place.

"They were very reasonable, so I bought some and was very intrigued with them. And I wondered: 'Why not make this stuff? I could make a better disk drive. And look at this: this connector doesn't work too well.' And Bill said, 'We could make them, all right, but I don't know where you'd sell them.' This was in late 1979. I said okay and dropped the idea."

Two years later, however, Kay watched his architect son-in-law, Michael Batter, struggling with an Apple and knew the time was ripe for an easier-to-tote portable.

Kay tried VisiCalc, the electronic spreadsheet, on the Apple and came away thinking the machine was too complicated, beyond being a hassle to move from home to office. So Kay told Bill McDonald, "Listen, we're selling instruments to engineers. Let's make a computer that we can walk in to an engineer and set on his desk and say, 'Hey, look at this. You can use it.'"

Still, Kay worried about the new technology. "It's a fairly stylized dance," McDonald reassured him in spring 1981. "You buy the chips, and there is black magic in getting them to work—but not in how they work."

"Okay," came the reply, "that's it. We'll get rid of the disadvantages of the Apple and cram our computer into one box without cables all over the place." In ads the Apple looked incredibly compact. Actually, though, serious computer users needed disk drives to store large amounts of information for

quick retrieval. They also needed a TV-like monitor to see the letters and numbers they typed out on the computer. And Kay wisely wanted everything squeezed into one box. If you bought his machine, you'd get the whole works except perhaps for the printer, which spewed out your calculations or typed up your letter. Also, it would cost you less than a full Apple system. Kay could bring down the cost of a complete machine if he planned on every computer being one.

All this was the logical culmination of Kay's skill in shrinking gear for the military and aerospace industry. For years he had been making printed circuit boards and filling them with components. And he could order the disk drives, keyboards, and other special computer-type parts from outside suppliers.

The way Kay tells it, he had no idea—at first—that he was about to take on Adam Osborne. "It was six months," he said, "before we ever saw Osborne's literature. He introduced his computer in March 1981, but I didn't know anything about it." Some would question that statement, of course, given the novelty of the Osborne 1 and its creator's flair for publicity.

Whatever happened—with Osborne in mind or not—Kay selected the same basic technology and essentially similar parts.

A Z80-Style Microprocessor

A **microprocessor** is simply the main brains that tie together the memory devices, the keyboard, and other parts of the computer. You can also call it a **central processing unit** (**CPU**).

Okay, but why a Z80 in the Kaypro?

That's simply a style of chip from a company called Zilog. "You could buy those all over the place," Kay said. "We wanted something proven and reliable." The Z80 was the only kind of CPU that could run **CP/M** (**Control Program for Microcomputers**)-style programs, then an industry standard.

The Z80, though, can't handle programs as complicated as the newer 8088 chip that ended up in IBM PCs and countless clones. Here's why.

A **bit** is a "1" or a "0." Patterns of bits form **bytes**. And what's a byte? Nothing more than a letter or number. So how does this tie in with the early Kaypro's Z80 versus the IBM's 8088?

Well, the Z80 processes information in **words** of only 8 bits at a time. The 8088 in the IBM, however, gulps it down in 16-bit chunks and works with larger memories—so that the IBM can run more complicated programs, like the more elaborate electronic spreadsheets for forecasting profit and loss. There's another benefit, too. A 16-bitter doesn't need to call up programming information as often from the spinning floppy disks, which are slower than the purely electronic memories.

The Kaypro II, however, won't *immediately* become a has-bit—er, has-been. "Converting the Kaypro to a 16-bit machine is no big deal," Kay observed. In fact, several months after he said it, his company announced a computer called the Kaypro II Plus 88 with both the 8-bit Z80 and the 16-bit 8088. It couldn't run all IBM programs, especially those boasting **graphics** or pictures as well as words and numbers. Here, as in many cases, the term "IBM compatible" is grossly misleading. There are degrees of compatibility, and even if a computer supposedly uses the same style of floppy disks, you must test it with the program *you* want to run. (Many computer

aficionados test for general IBM compatibility by running a game called Flight Simulator, or Lotus 1-2-3, a program combining a spreadsheet with graphics and several other capabilities.)

Some existing programs, by the way, are configured so that it doesn't matter much whether you're running the 8- or 16-bit version.

That will change as special programs come out for the 16-bit machines and as old ones, like WordStar, begin to take full advantage of 16-bit capabilities. Already Apple and other companies are writing new software for computers like the Macintosh, which, if not universally regarded as a true 32-bit machine, contains chips faster than the IBM's 8088.

For many small businesses, however, 8 bits may be powerful enough even for number crunching as long as the right programs are available.

The wisdom in the micro business is that no machine is ever obsolete—just so it does the job for you.

64K Random-Access Memory (RAM)

RAM, once the power goes off, will throw out everything you've typed.

This temporary computer memory, this electronic scratchpad, is like a bright student cramming for a quiz in a useless subject: he's a quick learner—and a quick forgetter. Don't confuse RAM with **ROM**, or **read-only memory**. ROMs keep remembering even after the power goes off. But you can't "write" new material on them; commonly, ROMs store programs used over and over again.

What about the RAM, though? How to get around the forgetting? You just transfer the information to floppy disks, which are slower but as stable as a music cassette.

Different computers hold different amounts of information in their RAMs. The Kaypro II holds 64K; **K** is normally a scientific abbreviation for 1,000. So 64K stands for a memory capacity of about 64,000 letters or numbers. No, I won't mess with the technical explanation of why it isn't exactly 64,000.

Okay, but why *64*K?

It's a magic number to the computer. Sixty-four K bytes is the largest memory with which the Z80 and other 8-bit microprocessors can easily communicate without too much technical trickery.

Also, you need at least 64K to make good use of some popular software like the WordStar word-processing program.

Moreover, the RAM must be roomy enough to handle electronic spreadsheets. Most small businesses will find that the 64K Kaypro can juggle around enough columns and rows on the sheets. But in some cases you *may* still want a micro with 500K or even 1,000K or more of RAM. To sum things up, that's because:

1. Bigger RAMs can work with more and larger numbers—a handy capability for a company with extremely complicated spreadsheets.
2. More RAM can accommodate programs more complicated for the computer. Note the words "for the computer." Some

of the programs most complicated for the computer may be the easiest for you to use.

Or they may be the most versatile. Lotus 1-2-3, a combination of a spreadsheet, a graphics program, and several others, is far too complex for an 8-bit machine with 64K RAM. Many 16-bit programs require 192K or more just to load the program before you even put in your reports or spreadsheets.

3. You may want the most sophisticated software to thwart computer crooks. That could be particularly true in a large company where many people can poke through a computer's memory either in person or via other machines connected by phone or other wires.

Never buy a computer without seeing for yourself that it *and* the software will together serve your needs. Don't take the sales rep's word. Instead, make him or his software specialist put the machine through its paces. Do so even if you're not buying software at the store. Of course, the sales rep may not have access to the software, in which case you may want to visit another store for a demo. And if no one can assure you, no ifs or buts, that the computer-software combo works fine? Then you may want to hire a consultant.

Use of CP/M Software

CP/M is a kind of **operating system**. It tells a computer how to do garden-variety jobs, like moving data from a memory unit to one that does the machine's electronic reasoning. CP/M isn't the only operating system that business microcomputers use. When I was writing this chapter, however, it was one of the more common, with variation present on more than half a million computers. A company called Digital Research marketed CP/M, selling to manufacturers, which, in turn, didn't have to create their own operating systems. In the early 1980s, the big software hits almost always came in CP/M formats.

"We wanted to use CP/M because 10,000 programs were available," Kay said. They were for computers with 8 bits, not 16—another reason he made the original Kaypro an 8-bitter.

"If we'd used 16 bits," Kay said with uncharacteristic profanity, "people would have said, 'Where the hell's the programs?' IBM could sell their computers without programs, which is what they did essentially and let the programs come later."

In contracting software design to outsiders, "Big Blue," as IBM is called, was defying its own tradition. It hired Microsoft —a Washington State software company headed by a brilliant young Harvard dropout—to create a whole new operating system. Called MS-DOS, the system would become an industry standard by 1984. And from the start, independent software houses hustled to market MS-DOS-style programs usable on the hot new machine for applications like word processing and spreadsheets.

The existing CP/M **applications programs** wouldn't work on an unmodified IBM Personal Computer unless the programmers converted them to MS-DOS or another compatible operating system.

'Two-Disk

They're the gizmos into which you insert the floppy disks through slots in the computer.

From the outside a disk looks square. It's inside a container that helps protect it from fingerprints and other threats to the plastic disk's magnetic coating.

You can't cover the delicate disk completely, though. Some of it must touch the **head** of a disk drive. A head "writes" magnetic patterns on the oxide coating of a disk; in other words, it stores information that you've typed into your computer or the results of your calculations.

And to fetch the information? Then you simply type out commands instructing the head to "read" from the disk to the RAM.

It's much like a tape recorder storing your voice magnetically. But a disk drive can read or write information much more rapidly than a tape-recorder-style arrangement could. That's because the disk spins so rapidly—hundreds of revolutions per minute.

Why twin disk drives, however?

There are two reasons:

1. You can quickly make safety copies of valuable disks—something that's more of a hassle with single-drive computers like the bare-boned Macintosh.
2. You can more easily work with long electronic documents.

With one drive I'm storing WordStar and a number of other goodies that take up almost all the space on the floppy; there'd be hardly any room for the information I'm typing out. All this is happening on my "A" drive.

The "B" drive is my **data disk**, devoted entirely to storage of my writing. I can easily squeeze the equivalent of about fifty pages of double-spaced typing with WordStar, which is one reason I bought a Kaypro instead of an Osborne. Brand O's earlier versions could store only half that amount of material. Before buying a computer, you should always analyze your paper records in terms of "K." Each K stands for 1,024 characters; and that includes letters, numbers, punctuation marks, and spaces in between. A double-spaced page of typing might be 66 (the number of columns across

each line) × 28 (the number of lines), or 1,848 characters. Bingo! That's 1.8K, plus a little slack for safety. Since Andy Kay allowed 191K of working space on each floppy, I'd have enough room for a document some hundred pages long, except that WordStar makes an electronic carbon copy for additional security. So my actual working space is around 50 pages. That's easily enough for this chapter to fit on one of the Kaypro II's floppies. And newer floppy disk drives can accommodate more than 2.5 million bytes.

Although the Osborne and Kaypro both used twin drives, there were also major differences between the two—beyond the **double-density** feature that allowed Kay to squeeze twice as much material on each floppy.

Osborne's first computer, for example, came with only a five-inch monitor. "Adequacy is sufficient," he once said. "All else is irrelevant." It was a neat excuse for his early machine's limited disk space and for the five-inch, black-and-white screen, which could display only 52 columns and which wasn't as kind to the eyes as green.

The production-model Kaypro, on the other hand, boasted a nine-inch, 80-column green screen from the start.

And the Kaypro keyboard made the Osborne board seem flimsy. "I like something I can feel when I'm pressing a letter down," said Kim DeFilippis, a dealer relations woman who was one of the touch-typists chosen to try out different keyboards for the new machine. "The board doesn't feel like one on a computer. It feels like a typewriter." And the keys, unlike the Osborne's, were in all the right places for people weaned on Selectrics. Kay had used the same Tiffany-quality keyboard found on computer terminals costing thousands of dollars more than his economy machine.

Kay, moreover, had given his Kaypro a metal case unlike the plastic one of the Osborne. Metal dispersed heat better, and that meant that the parts might last longer than those in the early Osbornes. Brand O tended to overheat floppy disks. Recalling that Non-Linear Systems made test instruments, however, one reviewer gibed that the metal case betrayed the Kaypro's heritage. I didn't care. The Kaypro reminded me of old Heathkits, of smoky soldering irons, of crisp, cold evenings in my youth when I'd listened through the static for

the whistling dots and dashes from my fellow hams. But many people shrugged off the Kaypro's appearance as unprofessional, and so I asked about the case. Kay said its contents dictated the shape. "Unless we created air space and made it larger," he said, "we couldn't have made the shape much different." A hood shaded the Kaypro's **cathode ray tube** (CRT; the TV-like screen). And as it turned out, that matched the comfortable slope of the keyboard that attached to the front of the machine for carrying. I noticed only a few adornments added for buyers' eyes. One was the blue "KAYPRO II" lettering on the case and the stripes on it and the keyboard; another was the blue color of the keys on the calculatorlike numbers pad. No, you couldn't mistake the Kaypro for a Gucci creation. And yet, as good, functional design, the Kaypro succeeded: at least one other portable appeared in a sharp-edged metal box.

The location of my Kaypro's two disk drives, to the right of the CRT, was especially logical. Kay and his engineers wanted them well separated from a high-voltage transformer on the left—an electrical component that was part of the video circuitry and whose magnetic radiation could interfere with the operation of the drives. Bill McDonald noted the Osborne disks were on either side of the tube. Circuitry for a nine-inch tube produced more electronic noise than that given off by a five-incher. And McDonald speculated that this was one reason Osborne had to make do with the smaller size.

Inside the Kaypro, atop the printed circuit boards, you saw integrated circuits with leglike leads of the kind that one writer compared to caterpillars. You found somewhat similar looking parts inside the Osborne. But there was a difference. "Oh, my God," said Michael Pond, owner of a Washington-area Kaypro dealership, the Computer Shoppe, "once you take the cover off the Osborne, everything sort of falls apart in your hand. It's held together by the wiring harness. It's like a jellyfish." That may have been a bit off target. Chris Christiansen, however, a computer analyst with the Yankee Group, a high-tech marketing research firm, compared the Osborne to a Chinese puzzle and said an Osborne user "in the next office gets very nervous when I come around with a screwdriver." By contrast the Kaypro looked eminently repairable. "When you take one

part of the machine off," Pond said, "the rest of the machine doesn't fall apart." Andy Kay's people had divided up the circuitry into several modules that repairmen could remove *easily*. His computer had far fewer chips than the old Apple II. And with fewer chips, repair people more often could locate glitches by replacing various parts until the machine was working again. Fondly, Pond said the Kaypro II was "over-engineered," like an early-model Volvo.

"Well," you're wondering, "what about the Kaypro I?"

It never existed except as a prototype. Of course, the II didn't hurt Kay's efforts to convince buyers that he had one up on Osborne.

The prototype's screen was between the disk drives, interfering with them, and another flaw became clear: the shortness of the cable between the keyboard and the main unit. Bill McDonald was worried. Suppose a customer crushed a finger while wrestling with the little cable? Why not hinge the keyboard to the twenty-pound console? And that's how Non-Linear Systems indeed built the prototype. But McDonald still fretted that someone might undo the latches; and so, driven by fear of a lawsuit from a klutzy Kaypro owner, the engineers redesigned the computer to accommodate a coiled cord several feet long.

Altogether, Andy Kay's people spent only a year and less than half a million dollars developing the Kaypro II.

"After we'd been at it eight or nine months," he said, "someone brought in some literature from Osborne, who had just announced his portable computer. I said, 'Oh, oh, somebody beat me to the punch.' But I saw he had a different idea in mind—a smaller screen, plastic case, different market."[10] The words "different market" are more than a little off mark. Andy Kay, like it or not, was in direct competition with Osborne. Kay might sell his computers at independent stores rather than at the ComputerLands and Sears stores where many of Osborne's machines ended up. But at meetings of Kaypro owners and "Ozzies," I found the same hodgepodge of small-business people and professionals.

Hearing of Osborne, Kay actually was grateful in a sense. "When he started telling the world about how many orders

he's got, I said, 'Well, if he's getting all these orders, I'll start making more of them.'"

Kay used an electronic spreadsheet on his newly developed computer to forecast its sales. The Kaypro II had better succeed, since the half million in expenses didn't include marketing costs and miscellaneous ones such as manuals—another million altogether. Kay, however, said the high-interest loans for the project "never really bothered me that much. I felt confident of getting it done. In one sense I place very little value on money. My wife, Mary, is quite different. She said, 'You'll lose your money.' She was secretary of the company. She had to sign mortgages on our home that we had paid for, property we owned, the plant site. It was a heavy burden for her. If you're in an airplane or car, going up a winding road on a mountain, the fellow who's driving isn't as nervous as if someone else is driving. I was involved in getting it done. She was on the sidelines worrying about it."

The Kaycomp—that was the original name before the Kays changed it because it resembled another computer firm's—first went public at a San Francisco computer fair in March 1982. Just a routine item appeared in *Byte*, the phone-book-sized microcomputer magazine. I wondered why. Maybe it was because Andy Kay's technology wasn't new, merely good repackaging, and he wasn't selling himself as God or Henry Ford. But dealers at computer shows were raving. The Kaypro's suggested retail price was $1,795, the same as the Osborne's, and Kay, too, threw in software: a word processor, an electronic spreadsheet, and other programs that could have cost more than $1,000 if purchased individually. Kay was smart. Osborne had pioneered by including business software for "free" with an economy-priced machine, and now Kay must follow with its own "bundled" programs.

"Has *Catch 22*'s Milo Minderbinder, World War II's greatest wheeler-dealer, hired on as a software buyer at NLS?" *San Diego* marveled.

"You don't think that took a lot of time to put together?" Kay said. "We purchased some software outright and pay royalties for some."[11]

By mid-1982, customers and dealers had placed several thousand advanced orders. Kay's production lines cranked up,

though the pace was slow at first as his people searched for bugs. They did not always stamp them out. A disk drive on my Serial #3083, lasted only a year; my warranty was for the industry's usual ninety days. Moreover, despite visits to several dealers, my computer still streaked lightly across the screen when I typed, and finally I had to have the monitor replaced. But the view easily beat the Osborne's. And later, modifying the circuitry and positioning the disk drives horizontally instead of vertically, Kay ended the streaks on new units. "In an emergency I get all the senior engineers on the job," he said. "We don't let problems go on like old man river."

Andy Kay rewarded his top problem solvers with benefits like stock options, and the stock offering prospectus from Prudential-Bache Securities anticipated that in 1983 Kay himself would earn $187,000 in salary, bonuses, and other remuneration.

Not everyone fared so well; Kay said his labor costs were half those of competitors. "The wages on the line are so low," quipped a disgruntled ex-employee, "I'd call them south of the border." Kaypro was typical of many high-tech companies; the production workers were mainly women, many of them foreign born, some of them incapable of speaking English, all of them nonunion. Adam Osborne, too, tried to cut labor costs to the bone. And Atari had laid off scores of Americans and farmed out jobs to cheaper labor abroad, reddening the faces of the politicians known as "Atari Democrats" who believed that high tech could fight unemployment.

Regardless of the low wages, Kay's own company at least appeared to be the antithesis of a sweatshop. His hillside buildings didn't look like normal factories; they were long and narrow, well windowed, split into small rooms without the racket of mechanized production lines. Kay described his workers as "always moving, interacting constantly. If one piece is missing, they work around that. If one person is slow because he happens to be new, they work around him and help him out. It's exactly the same approach we used for stuffing printed circuit boards on the voltmeters. It uses the least amount of capital equipment, and it's the easiest on the

assemblers, because they aren't just sitting or standing in one spot."

Lacking a conventional assembly line, Kay said he needed few mid-level managers; and even after Kay went public, he still hated to bring in MBAs. Managers built empires. They feuded. They got in producers' way. That was how Kay felt, apparently—a legacy of the 1960s when Non-Linear Systems had splurged thousands on those seven vice-presidents and their white Cadillacs. But some practices from the go-go years lingered. One, said Kay, was participative management, the philosophy that had led to the formation of those small, friendly assembly teams. The atmosphere around the plant was informal. "We have very few written policies on anything," he said. No dress code existed, save for an informal ban on attire like short shorts—a policy bent to accommodate workers who labored in the hot Southern California sun.

Also, Andy Kay's company at times hired people with unusual backgrounds. Clifford Odendhal, a musician-dancer-songwriter in his thirties, had come by way of COJO Wind, David Kay's alternative energy firm. David asked Odendhal to help Non-Linear Systems catch up on back correspondence, leading to a customer-service job there. Eventually, Odendhal was helping with public relations. "This is the first job outside of entertainment that I have ever cared about beyond my paycheck," he said.

Andy said of David, "He's less cautious about hiring people than I am. If they don't work out, he just lets them go."

David, a six-foot-three-inch surfer with a degree in math and a hobby of collecting dictionaries, had himself started with the company several years before the birth of the Kaypro. Now he was vice-president for marketing, and when an investment banker asked Andy if David was a vice-president because he was Andy's son or because he was the best man for the job, Andy replied: "Both." He believed that David's role in the development and marketing of the Kaypro "was extremely important. In thirty years I've never seen a man in marketing who measures up to one-tenth the dedication and performance he's shown."

Andy's son used what the *Wall Street Journal* described as "idiosyncratic" marketing techniques. Dealers couldn't sell

Kaypros by mail. They didn't enjoy extended credit. The Kaypro Division, in fact, did not even spend much at first on national advertising.

Examined closely, however, each policy seemed logical. Most customers couldn't just walk out the door of their computer dealer and wave an eternal good-bye. Chances are that they'd be back for advice or repairs. So Kaypro wanted local dealers not to face competition from cutthroat mail-order houses that left the customer on his own.

Without a strong network of local stores, Kaypro might perish. Andy Kay appreciated this. "If a fellow does mail order and the contract says he can't," Kay said, "David cuts him off without a qualm. Maybe the dealer says we need him or he won't be able to support his family and kids. Well, forget it. This is a business, but it's also our livelihood, too." Of course, not all mail-order establishments in the computer trade were unethical: I knew of some good ones. But from a manufacturer's viewpoint the policy made sense. The Kays at the time wanted to befriend the independent dealers, who were less likely to flood the market with heavily discounted computers than the chains were.

However sympathetic to the independents, Kaypro didn't follow the lead of some expansion-minded computer companies and grant extended credit—a sensible policy in this volatile business. A California chain folded, owing hundreds of thousands to Apple as well as customers. As to how he originally picked up many dealers, Andy Kay said, "The orders just started rolling in. Now we're sort of clearing out dealers which are operating out of backs of cars or whatever."

Kay was also benefiting by selling through his own network rather than being at the mercy of distributors—and supporting their profit margins.

By the summer of 1983, Kaypros were selling at some thousand dealerships. Christiansen observed that Kaypro gave dealers "30 or 40 percent margins. So does Osborne. That's how they get the dealers to carry the damned things. You know, when you have fifty guys a week knocking on your door, you pick the one who's going to put the most money in your pocket, and Osborne and Kaypro both know how to play this game as well as or better than anyone else. How do you

think Kaypro went from nothing in 1982 to 100,000 units in 1983?" Kay disputed this. He said that the Kaypro's quality sold the computers, that he hadn't offered more than 25 percent dealer discounts, and never would; and his claim seemed creditable enough when some stores dropped the Kaypro because the markup wasn't big enough. Whatever the facts, Kaypro in 1983 boasted sales offices in some fifteen U.S. cities and one in the Netherlands. One-third of the computer-store ads in the *Washington Post* business supplement of August 8, 1983, mentioned the Kaypro.

The limited *national* advertising was equally wise. Why not depend at first on local ads telling where people could buy the product? And what was the use of creating a demand for more computers than Kaypro could make? Andy Kay had learned from Osborne's example. Adam Osborne's splashy ads had helped create the market that the Kaypro was now enjoying.

Besides, Kay was benefiting from something better than advertising: the articles of friendly writers. And why not? Writing was just another form of word processing—a category for which most Kaypro owners had bought their machines. Certainly the Selectric-style keyboard and 80-column screen had impressed *me*. Peter McWilliams, the very same writer who had led the cheering in the micro magazines for the Osborne, was a Kaypro convert. "Put simply, as a personal computer, the Kaypro II is superior to the Osborne 1 in almost every detail," he wrote—"yet it retails for the same $1,795. As David Letterman might say, 'Unbelievable!'" James Fallows, the Washington editor of the *Atlantic Monthly*, free-lancing for *TV Guide*, called the Kaypro "the best value" for "complicated accounting" or "heavy-duty word processing." I was used to seeing hype in and out of computer magazines for inferior products. The Kaypro, however, deserved the paeans. Granted, I didn't like Perfect Writer, a word processor included between 1982 and early 1984; and the sharpness of the monitor was no match for some more expensive machines. The Kaypro wasn't the best computer, period. But at the time Fallows praised the Kaypro to the millions of *TV Guide* readers, it may well have been the best dollar-for-dollar value. Fallows himself didn't own a Kaypro. He honestly reached his conclusion unassisted by a special offer from Kaypro: 40 percent discounts for

writers; the company said—convincingly or not—that it didn't attach any strings.

As production increased, Kaypro finally did trot out national advertisements. One, in *Esquire*, showed a young Kaypro user in an office swept by a fierce wind, blowing coworkers' papers away and tousling his hair, while he was typing happily away with his chair and desk raised a foot off the floor, "KAYPRO RISES TO THE OCCASION," said the advertisement. I didn't really see the point. The technical specs were buried in small print at the bottom of the page; why couldn't the ad tell me in large print and simple language what the Kaypro could *do*? A Kaypro staffer said the ad was to build name recognition. Then the company might unleash a campaign portraying its steel ugly duckling as the Volkswagen of small computers. It seemed a sensible-enough idea. Then, again, it was another indication that the computer business was becoming more like Detroit—selling not only economy but the *image* of economy.

Finally, the new ads came out. In simple, helpful language they told novices what to look for in a small business computer. And yet you could hardly confuse the ads' goals with *Consumer Reports*'. The ads for beginners recommended consulting with an expert before choosing a machine; at the same time ads in sophisticated magazines like *Byte* asked computer pros to suggest the Kaypro to beginners. ("Once you tell people about the complete business computer for $1,595," said an ad appearing after the Kays lowered the price $200, "they'll probably stop bugging you with a lot of questions.")

The public relations campaign was just as slick. No one lied. But Hill & Knowlton, the fast-track public relations agency, laced its Kaypro releases with quotes skillfully reflecting the computer makers' self-interest. In one, David Kay said, "If it isn't portable, it doesn't pay to buy it." That was hyperbole, pure and simple.

The nine-inch screen, for instance, was a major improvement over the Osborne, and it was entirely right for an economy portable from which many buyers would eventually trade up, anyway; but writers and other heavy-duty users might prefer a twelve-incher from the very start. For not much more than the Kaypro at the time of the release, you could buy a desktop computer called the Morrow Micro Decision with

good software and a twelve-inch screen. Milton Viorst, a Washington journalist, couldn't stomach the Kaypro monitor. He considered the Kaypro the kind of machine you might tote back and forth between home and the beach but not the best for heavy-duty viewing. He bought the Morrow, or two, actually: one for himself and one for his wife, Judith, a well-known poet and magazine writer. However pro-Kaypro, I could see why. The Kaypro, strictly speaking, wasn't even portable; instead, it was *transportable*. Unless you were a 300-pound tackle playing for the Pittsburgh Steelers, you weren't about to tote a sharp-edged, 26-pound computer and battery pack as casually as you would an attaché case.

Other "feature information" from Hill & Knowlton in spring 1983 offered more tips for computer shoppers in a way cunningly designed to steer them to the Kaypro without the customers' quite knowing what was going on.

"KAYPRO Division of Non-Linear Systems" appeared on the first page in big blue letters above the text. But the seven-page "feature information"—the part intended for publication—mentioned the computer by name just once and in an inconspicuous location. It laid out the specs for a good portable. Then, several hundred words after the Kaypro mention, it triumphantly concluded, "For as little as $1,795, you can already buy the only fully portable personal computer with a full-sized screen, one that offers large enough memory capacity to handle business, entertainment and educational programming and a service network that's available anytime or anyplace—just like the optimal portable personal computer itself." I recalled the canned releases from food companies that women's pages ran verbatim. How many newspapers and magazines would do the same with "feature information" from Kaypro? David and his father had made a good machine. And yet I wondered how many manufacturers of bad computers might start using similar tactics. Joel Strasser, at the time the Hill & Knowlton man handling Kaypro, later protested that he was engaging in standard public relations practice, but his remarks simply dramatized how the welfare of shoppers might clash with that of the manufacturers. Disguised puffery was hardly in keeping with David Kay's portrayal of himself as a consumer advocate.

Around the time the Kays were calling in high-powered public relations people, Adam Osborne himself went a step further. In January 1983 he hired a professional manager to be Osborne Computer's president, Robert Jaunich II, formerly president of Consolidated Foods. Osborne would later blame Jaunich for many of the computer firm's problems, telling a reporter that Jaunich wasn't fleet-footed enough for a young company in an industry with a fast-changing market.

Jaunich's recollections would differ. Recalling the discoveries he made during the audit before the never-to-take-place public offering of Osborne stock, he told the *Wall Street Journal*, "Every day you came in, the numbers got worse. Every number you touched went soft." He blamed the corporate chaos on Adam Osborne. "The real message," said Jaunich, who resigned as Osborne president in December 1983, "is the professional people got here too late to help."

Osborne was also critical of another executive; he accused him of cutting a deal with a supplier—while still working at Osborne Computer—to make a rival machine. Whatever happened, the internal squabbles at Osborne may have wasted time and energy that he and colleagues could better have devoted to their battle against the Kaypro.

He himself would later admit in his book *Hypergrowth* that "new product development moved slowly" until the second half of 1982. A smaller, cheaper Osborne 1, the Vixen, never reached the market while he was running the company. His $2,495 Executive computer—with a seven- rather than five-inch screen—did make it out the door. "Wayne" didn't. Introduced early enough, Wayne could have given the Kays fits. This $1,995 model was to offer a nine-inch screen and include a built-in printer and a pile of free programs for word processing, communications with other computers, and other tasks. But technical problems bedeviled Osborne. When Osborne finally caught on that IBM had established a new industry standard, he sought to make his Executive compatible, but he was aware of his own company's "dismal record in engineering development."

Osborne entrusted the task to a San Diego firm. By May 1983, however, Osborne realized that the firm's IBM-compatible prototypes were "expensive, late, and included

wholly unacceptable features such as circles that would be displayed as ovals when an Executive user switched from CP/M to IBM compatibility."

Adam Osborne was clearly losing his sales war with Andy Kay. He had talked to reporters about the Executive in early 1983, and in July newspapers said this had discouraged some dealers from ordering too many Osborne 1s. The story was that Osborne's cash reserves had fallen as orders for the older machines dropped from 10,000 a month to almost nothing. Apparently he'd forgotten one of the precepts of any business with changing products: you're always competing against yourself. If you make too many old models or brag too soon about the new ones, then you may imperil your cash flow and see surplus product inventory pile up. Your customers will keep their wallets shut as they await your coming attraction. It was a most plausible explanation for Osborne Computer's cash-flow problems but perhaps not the main one. In *Hypergrowth* Osborne revealed that his sales levels for his Osborne 1 had been dwindling even without all the puffery about the forthcoming Executive model; he confessed that he had lied to the press to throw it "off the scent of the real story." His bankers were threatening to call in loans; he was laying off workers, yet he still hoped to woo private investors.

As the end neared, Osborne dealers were fighting Kaypro ones with price reductions. An Osborne 1, discounted, sold for as low as $1,000 by late August 1983. Stores also were dropping the Executive's price, and with good reason: why so expensive a machine without IBM compatibility right off the bat?

The first prototypes of the new IBM-compatible Executive weren't being built until September 1983, or as Osborne later observed, "precisely at the time the company was filing for bankruptcy."

The bankruptcy papers showed next to no income and $45 million owed creditors. *Newsweek* ran a photograph of Osborne leaving his office without a portable computer in sight. Instead, a briefcase was shielding his face, and the caption read: "Founder Osborne exits: IBM was too big."

That was somewhat wrong. The IBM-compatibility issue notwithstanding, *Kaypro* had been Osborne's main

competition.

"I've always had a great deal of respect for Kaypro," he would later confess to *Popular Computing*. "You've got to make those statements [knocking the Kaypro]. It makes good copy, damn it."

It didn't make for the best-informed computer buyers, however. Bowled over by Osborne's marketing campaign and well-publicized disparagement of the competition, some consumers had ignored the information that mattered in the end: the numbers. The screen measurements, disk-drive capacity, almost everything, said the Kaypro was a better computer for common applications. Osborne had faced a moral dilemma. Should he badmouth the competition and help his company survive? Or should he tell the truth—that Brand X was better than his own product? Not surprisingly, Osborne, like any other computer manufacturer, had made the former choice.

In fighting Osborne, Kay had dropped his suggested retail price $200 in May 1983 to $1,595, an indication that small business computers were becoming no more impervious to price wars than the home ones were. He also offered a souped-up version of his II and beefed up his software. His Kaypro IV —the jump from II to IV reflected the substitution of two 400K floppy disk drives for the II's 200K ones—sold for $1,995.

Yet another weapon against Osborne was the Kaypro 10, a deluxe model with a 10-megabyte **hard disk**. It sold for $2,795, an amazing deal at the time. A hard disk is an aluminum platter coated with magnetic film, and 10 megabytes is the equivalent of 5,000 double-spaced typewritten pages; yet Kay was selling the computer and software for less than the prices of many hard-disk add-ons.

"Adam Osborne," said Kay, "has said he couldn't make a portable hard disk because the hard disks are so sensitive to shock. Well, engineering advances are such that hard disks now are capable of being moved. Our very first one was shipped to a show in Germany."

An *InfoWorld* headline was less sanguine: "Hard disk, portable 'newlyweds' face some problems."

Could Kay succeed with his hard disk? Another company made the disk itself, and Kaypro had to replace some drives on the early Kaypro 10s. But *some* glitches were hardly a surprise in any new micro, hard-disk style or floppy. Meanwhile, no less than Control Data, the computer giant, was planning to offer a 5-megabyte hard disk for portables. Already some smaller companies had put out portables with hard disks. And yet Kay, turning out thousands of the machines, was gambling more heavily on their reliability than the others. It could pay, however. New technology might or might not succeed; but in his fast-moving industry, old technology sooner or later would surely fail. To stay alive, he must be among the leaders. More than 150 companies were clawing their way through the micro business in late 1983, and some analysts believed that fewer than 20 could survive five more years. Many of the 150 had only what one expert called "press release products." But others were real threats; and without the resources of an IBM or Apple, Kay ideally would fight back through innovation as well as good marketing. He needn't invent any new micro technology. Yet as a survival-minded "solver of problems," he had better be prepared to make prompt use of the breakthroughs of others.

So major risks were ahead—inevitable—as Kay girded for his next fights with the valley.

Backups:

■ I, Twenty-Six Questions to Ask at (and About) the Computer Store, page 281.

■ II, A Few Grouchy Words on Printers, page 294.

3 After the War

The Silicon Valley gossips in late 1983 said Adam Osborne was trying science-fiction writing. Then, the next spring, stories suddenly blossomed about his new software company; he bragged that it would be the paperback publisher of the micro world, a mass-market operation that would undercut rivals just as his computer firm had. The name of the new company, in Berkeley, California, was Paperback Software International. And his quotes against competitors were just as colorful as in the old days.

"There's a helluva lot of software out there," Osborne told *USA Today*, "and a lot of it's overpriced garbage."

He planned to sell his programs at book chains and book racks at less than one-fourth the prices of the Brand Xs. The idea seemed apple-pie admirable, but most people would rather not buy more software than they had time to learn and use; how many hardcore buffs were out there itching to spend hours mastering cheap new programs? Circumstances might change as software becomes easier to use. But could you imagine a Word-Processor-of-the-Month Club or a spreadsheet rack to the right of the gothic romances? No, except for games programs and very cheap enhancements of existing business programs like Lotus 1-2-3, the paperback concept seemed dicey. Even Osborne wasn't infallible as a seer and market analyst. Once he'd predicted that IBM would fail in the micro market, and hadn't he been too slow to grasp the importance of IBM compatibility for his own products? Still, although Osborne Computer Corp. itself had floundered, it had not been for want of the right vision at the company's inception. His new software enterprise might indeed survive in the proper niche. First, however, he would need capital. In fall 1984 *InfoWorld* reported that Osborne had paid for a booth at a software show but had not set it up because, for want of

funding, his first products weren't ready. Investors may have shied away due to Osborne's earlier failure to overcome the classic entrepreneur's challenge: not just to start a company but keep it prospering.

In shrunken form, with Osborne having resigned as president in September 1983, his old company lingered on in early 1984, selling old machines and still promising a new IBM-compatible portable. Andy Kay at the time had no need to fear this corporate husk. For a while, in fact, Kaypro may even have been the fourth largest maker of personal computers *shipped to stores specializing in them*. And his hard-disk gamble was paying off for the moment—the same risk that Osborne himself had avoided as too perilous for a portable manufacturer.

Orders had kept piling up for Kaypro 10s. Then again, so had the problems with Tandon, Kaypro's major hard-disk supplier.

David Kay even claimed that Kaypro was receiving Tandon drives "with 'IBM' stamped on them that also have 'reject' stamped on them." Delivery delays allegedly had cost perhaps $30 million in sales of the Kaypro 10s over eight months. Tandon, while conceding that some rejected drives may have accidentally reached Kaypro, claimed that such problems were rare.[12]

The Kays' 1984 sales would exceed $100 million. But some rivals were growing faster, and IBM, Panasonic, and other household names were now muscling in on the portable market. "Kaypro's immediate prospects are good," said one analyst of the industry. "I don't know about the long-term ones." He told of a big white tent that the Kays had put up on a hillside to store badly overstocked computer parts. The Kays might argue that they wanted to keep expenses down. To the analyst, however, the white tent symbolized amateurish management. In September, Kaypro acknowledged that millions of dollars in computer parts might be missing from the tent and some large trucks; and whatever the cause, theft or bad accounting, the crisis hardly endeared Kaypro to investors. They now could recover only $4 per share—a fraction of the $10 offering price. Around the same time, some angry investors filed lawsuits charging Kaypro with falsely reporting

its finances. Kaypro denied this. I hadn't any idea of the validity of the suits. An official with Osborne Computers, however, discussing the tent and the general management problems it symbolized, appropriately observed: "It was déjà vu to hear about Kaypro's inventory situation."

Six regional sales managers had left earlier that year for a competitor. Former Kaypro executives griped that the Kays paid too much attention to trivia. Andy Kay even interviewed prospective security guards. Some employees relished this personal touch, but Blair G. Newman, ex-director of marketing and strategic planning, complained to *Business Week*, "There are too many Kays and not enough pros." Unconvincingly, a Kaypro spokeswoman shrugged off the resignations, saying a small clique of friends had left and plenty of people had lined up to replace them.

Andy Kay's antipathy toward professional managers was coming back to spook him. All along his attitude hadn't been so different from that of Adam Osborne, who, stubbornly, told a reporter after the Chapter XI filing, "The major lesson I learned from this thing is that I'm as good a manager as any of those guys." An ex-Kaypro employee complained to me: "The Kays are worried that professional managers will take away their power. Andy Kay wants to run the company himself. It's a feudal society there. A lot of employees call it the Kay fiefdom. It's like a training ground for young knights. You can learn a lot, but it locks you into a rigid structure. There are no changes from the bottom up. That's the big problem. I don't know how they get away with calling it 'participative management.' Ordinary employees never have any meetings with Kays to discuss major decisions. There's no checks and balances. If the guy at the top makes a mistake, there's no way to correct it. No one can call the king's bluff and stay."

The Kays fired someone close to the outspoken Newman. It was Clifford Odendhal, the bearded musician who a year earlier had told me, "This is the first job outside of entertainment that I ever cared about beyond my paycheck."

"Part of it had to do with salary," he said: his request for a raise.

"They'd been paying me no more than what an assistant manager makes in a K-mart. And I'd handled user groups,

done publicity, and edited their in-house newspaper."

The users groups were mostly local organizations of Kaypro owners who traded technical tips and gossip and bargained with stores for discounts on equipment; they kept Kaypro in touch with the best-informed customers, the trendsetters. They also relieved the strain on Kaypro's own technicians and stores. But Kaypro had cut back the money budgeted for sending people out of town to meet with the users groups; skeptically, Odendhal said the company had hoped to do this work almost entirely via a computer network.

Then there was the question of whether Kaypro had a true marketing department.

"They don't," Odendhal said. He and others around Newman had hoped that the Kays would sound out the need for products scientifically before turning the engineers loose. Odendhal may or may not have been right. If marketing men at the large computer companies were so smart, how come Kaypro and Osborne had been the first firms to make portables usable in business? And what about all the IBM clones? Couldn't the marketing men's me-too-ism have stifled innovation? Then again, another company dominated by engineers—Texas Instruments—had flopped in the home-computer market because it didn't pay *enough* heed to marketing.

The Kaypro Corporation, at least, still boasted a dealer network of more than a thousand stores in mid-1984. But some stores in my area had dropped or downplayed the Kaypro line in the earlier part of the year. One reason was that just about all the Kaypro machines were still 8-bit and didn't run the new IBM-style software. Also, ComputerLand and other big-name chains, a growing part of the business, complained that margins on Kaypros were ten percentage points under competitors and that the machines' software hurt sales of off-the-shelf programs. So ComputerLand shunned Kaypro.

It was a clear case of the interests of the consumers being at odds with those of the computer dealers. For the Kaypro II at the time was a remarkable bargain; Andy Kay had lowered his *retail* price in March to $1,295.

What a contrast to the overpriced PC*jr* from IBM. Just rumors of the machine—nicknamed the Peanut—had kept the

entire industry on edge. It bore the three magic initials. And as the pros said, IBM was compatible with IBM. Only it didn't work out that way. The PC*jr*, at least the first version, couldn't run some electronic spreadsheet software and other important programs written for the IBM. The introduction in November 1983 had been anti-climactic in other ways. *Jr's* little keys were like chiclets, horrors for the touch-typist, and by the time you bought your software and added a second disk drive, you'd be paying hundreds of dollars more. Even after IBM upgraded the PC*jr's* keyboard in summer 1984 and lowered the price to $999 with one drive, the Kaypro II was still superior for word processing. So were other machines. With two disk drives and WordStar, the Sanyo MBC550—a somewhat IBM-compatible desktop from Japan—listed for just $1,400. Not that the Sanyo lacked limitations of its own. Its keyboard, too, was no match for the Kaypro's.

In 1984 the Kays introduced the New Kaypro II, which offered only one disk drive but sold for just $995 and allowed for another to be added for a few hundred dollars more. Anyone using the New Kaypro II for business would be foolhardy to depend on just one drive. Not surprisingly, the $995 machine inspired jibes that Kaypro was guilty of using the same gimmickry as IBM and Apple had been with their single-disk computers.

Moreover, all the Kaypro models, despite their low prices, made *some* customers pay for their bargains with headaches.

Take Chris Jensen, a writer in Cleveland. He futilely tried for months before he could send his stories to his newspaper from home via the phone lines. His dealer had sold the Kaypro IV, promising that Jensen could. "It's really scummy to put this out," the *Plain Dealer* reporter said of his machine, "and know that the communications software has serious bugs in it. It's the kind of thing that the government would kick the shit out of the automobile companies for doing." A Kaypro employee admitted that the communications software for the Kaypro IV had come out with bugs, but not those of the kind that were plaguing Chris Jensen. He confirmed another of Jensen's complaints: that the Kaypro IV model with the modem couldn't use the most popular communications software at the time. Coincidentally or not—shortly after Jensen griped to me,

the *New York Times*, and computer writer Peter McWilliams—Kaypro released SuprTerm version 5.3. And that did the trick for him. The machine delighted Jensen in other ways, but he still wondered about all the ordinary customers out there who were unwilling or unable to wage a media campaign to get their software up to snuff.

Jensen's story was atypical—many Kaypro owners still spoke as if their computers were micro manna.

Still, the new Robie, introduced in early 1984, might be a sign of troubles to come. It was unique, a desktop selling for $2,300 with two 2.5-megabyte *floppy* disks. But disks didn't run as quickly as a hard disk, and as of late 1984, the Robie just hadn't caught on. The Robie looked so ugly—ungainly, plastic cheap, fit for a discount store—that even some value-minded buyers might have thought twice about bringing it into their offices. It was a computer that only a designer could love. And it was just an 8-bit machine.

In the 8- versus 16-bit battle, people were accusing Kay of living in the past. It was Osborne all over again, some might have said—just like Kay's old rival babbling on and on about the virtues of a machine with a tiny screen. This may have been unfair. For simple word processing, for instance, an 8-bit machine could be a terrific bargain. But many buyers still gravitated to the 16-bitters, worrying that future software might not appear in the Kaypro CP/M format.

Kay's attitude didn't help. He was showing less of the adventurousness that had led to his hard-disk portable.

And he now felt that the Kaypro II was just like the old Volkswagen bug and would always be around—an ominous parallel considering VW's recent fiascos in the auto market.[13]

Some software programs endured because enough people learned and liked them; and the Apple II in one form or another would last; but the Kaypro II? Even with hundreds of thousands of users? What about the ill-fated Osborne? No, computer buyers normally spurned antiques. Within a year or two Andy Kay might change his mind and ponder whether to update the Kaypro II drastically or kill it.

In November 1984, well over six months later than Kaypro had promised investors, a 16-bit IBM-compatible machine appeared.

"He'd rather not call it an IBM clone," said an industry observer. "He'd rather call it just a 16-bit computer. It's a matter of pride."

The 16-bit model, a portable with a 10-megabyte hard disk and 256K RAM, looked somewhat like the Kaypro II and IV. It had an **expansion slot** into which you could plug a device to hype up the performance of the machine or expand its versatility; and it offered free WordStar along with other software. At $3,295 it sold for $1,700 less than a hard disk portable from Compaq. But it faced stiff competition from machines such as the hard disk desktop from Leading Edge, which was discounted to as low as $2,000. The 16 just wouldn't wallop rivals the way the original Kaypro II had.

And it shared some of the drawbacks of the Compaq and many other IBM clones—especially the keyboard. The left shift key was in an awkward position like the IBM PC's, with a weird, nonalphabetical character separating it and the "Z"; imagine the reaction of touch typists who had enjoyed the Kaypro II's close resemblance to the traditional Selectric keyboard. Many makers of 16-bit machines had aped the horrid PC keyboard, causing one reviewer to liken them to idiot savante piano players who imitated the mistakes of true geniuses.

The 16, moreover, showed Kaypro's internal weaknesses. Dan Berger of the San Diego recalled how Kaypro had futilely struggled for more than eight months to design the computer in-house. The project had flopped. Kaypro farmed the design out to a San Diego firm, which did the job in a fraction of the time. Earlier in 1984 Andy Kay had told Berger that Kaypro was spending only 1 percent of revenues on research and development, compared to the industry average of about 10 percent. How frustrated he must have felt paying an outside firm. Osborne had had to do that, but technically Kay had placed himself and his company in a different league.

Kaypro was heavily depending on the 16. The company hoped it would provide 40 percent of income for the year ending August 31, 1985.

Early signs were good. A small dealer in Virginia, for instance, The Disk Connection, sold six Kaypro 16s in one week—half to existing Kaypro owners and half to new

customers. Some people had demanded an IBM clone, bungled keyboard and all; now Kaypro had given it to them with a vengeance. Appearing late, however, the 16 had lost much of its price advantage. In another six months IBM might well sell its XT hard disk model for as little as the new Kaypro portable. [14]

The 16, if successful, would triumph at a helpful time. In the 1983 budget year, the company had earned $12.9 million on $75 million in sales; the next budget year it had *lost* $267,683 on sales of about $120 million—blaming everything from advertising costs to price-cutting and inventory problems. No longer was Kaypro a success story. It remained strong in some stores specializing in computers; but the share of the whole domestic market for personal micros would be 2.5 percent in 1984—a drop from 1983.[15]

In the long run, moreover, unless Andy Kay made major production changes, his computers might lose what price advantage they did have.

Automation was improving rivals' quality control and whittling down their labor expenses. Eventually, they'd be just a tiny fraction of the cost of a computer. Apple already had built a $20 million plant to crank out the Macintosh computer, using Japanese-style manufacturing savvy; Macs even helped oversee the manufacturing of Macs. "I don't even know if the Kays could automate their plant," said the ex-employee who'd accused the family of running a feudal society. "You've got these four buildings no wider than a single room. They have a lot of windows, and that's great for the people—but hard on computer parts. Often people placed piles of parts on the lawn overnight when they didn't have space elsewhere." The Kays, to be sure, had put up a semiautomated warehouse designed by Andy's daughter Janice and built by his son-in-law's construction firm. "But," said the ex-Kaypro employee, "that's not the same as automating the whole plant." And Andy's selection of the architect and construction firm was further evidence of the Kays' tight-grip management style.

This lack of flexibility could especially hurt them in responding to the threat from lap-sized machines with flat screens. Sooner or later they would menace the Kaypro-sized "luggables" in the business market.

About 120,000 flat screens sold in 1983, and although they weren't moving off the shelves as rapidly as expected in 1984, sales still might exceed several hundred thousand.

Some showed 16 lines at one time. That wasn't as many as the 24 on the Kaypro II screen, but enough for light-duty word processing. And soon others would do for the heavy-duty kind and a slew of additional uses. Thousands of traveling reporters and executives were already using the Radio Shack Model 100 introduced in 1983—despite its tiny built-in memory (no more than 24K in a typical configuration) and small screen (8 lines only 40 characters wide).

But where had Andy Kay hoped to get his first flat-screen model? From Mitsui & Co. in Japan, which would offer it to other U.S. companies, including perhaps some with marketing clout far greater than his. The Kays had thought they'd be the only people selling the note-book-sized computer. By late summer 1984, half a year after the original hoopla, Kaypro should have been shipping this miracle machine, but a spokesman in September could not even tell me if the Mitsui deal was still alive. Then word came out that the deal had fallen through and a flat screen Kaypro wouldn't appear until 1985.

A rival company, Morrow, Inc.—headed by George Morrow, a witty, balding ex-grad student in math, one of Silicon Valley's better hardware gurus—had meanwhile acted more successfully. In late 1984 it began marketing the Pivot, a ten-pound, $2,495 MS-DOS portable with one disk drive and a well-reviewed clone of WordStar called NewWord. And a revitalized Osborne—on the verge of escaping the Chapter XI bankruptcy proceedings—would soon sell its own version of the machine.

Data General, the mini-maker written up in the best-seller *Soul of a New Machine*, was another threat to Kaypro. In September 1984 it unveiled the Data General/One, which offered IBM compatibility, a built-in 737K floppy disk drive, and a 25-line flat screen. A software developer joked that the letters on the screen were so faint that the machine should be sold with a coal miner's hat to read it. But eventually the flat screen would be just as readable as the Kaypro's cathode ray tube. With the inevitable price drops and refinements,

machines like the Pivot and the Data General/One would wreak havoc on Kaypro sales unless Kay retaliated with the right flat-screen portable of his own. IBM, AT&T, and Compaq, too, were designing their own flat-screen machines. And already Hewlett-Packard had been selling a $2,995 flat-screen computer with the popular Lotus 1-2-3 spreadsheet program in Read Only Memory—permanent memory.

Another firm—Epson, a branch of Seiko, the giant Japanese conglomerate known for watches—was shipping a $995 computer with a compressed version of WordStar in ROM. The screen displayed only 8 lines of information at a time. But within months a 16-liner from NEC (formerly called the Nippon Electric Company) hit the market at the same price, complete with WordStar and built-in gadgetry for talking to other machines on the phone.

WordStar was now the only word-processing program offered free with the “luggable” Kaypros. If Andy Kay’s lap-sized micro couldn’t run it or a clone like New Word, he might be paving the way for some of his customers to buy rivals’ flat screens that did.

Most buyers used Kaypros to write or type. And how many would relish a switch to a new word-processing program?

And what about piping WordStar-composed letters and other documents from the luggables to the lap-size Kaypros? Customers could do so, but then they might have to insert new commands to tell their printers to underline or produce other special effects.

Beyond everything else, Andy Kay had better offer good software to fight rivals selling flat-screen machines similar to his. And WordStar over the years had generally been the most popular word processor for micros.

4 WordStar: The Creators

Arthur Clarke is *the* Arthur Clarke, the science-fiction writer who gave us *2001* and that beastly computer named HAL. Seymour Rubinstein is a California businessman with only fleeting mentions outside the magazines of the computer trade. He is literate but not literary. When I talked to him, he had not read Clarke's latest novel. Yet Seymour Rubinstein and a colleague played more than a small role in the the writing of *2010*; for they created WordStar, the word-processing program that Clarke uses.

WordStar is to micro software what *Citizen Kane* is to movies: it is old—by computer standards, anyway—but it's one of the best of its kind.

If, when writing, Clarke wants to insert a phrase several sentences back, for instance, he can just zip the cursor to the proper place, then type in the addition. He needn't enter a special "Editing" mode. Some WordStar rivals may break up your thoughts by making you change modes.

Moreover, with simple keystrokes, Clarke can insert, drop, and move whole paragraphs.

"I can make corrections without hesitation that I wouldn't have done before," Clarke said enthusiastically about WordStar and his Archives micro. "It's at least doubled my production with a quarter of the effort." His normal output for his books and articles was still around a thousand words a day, but WordStar had made his writing more fun, and now he was churning out letter after letter to "my neglected friends."

"I said I'd retired," he told me over the phone from his home in Sri Lanka, "but now I'm working on three or four things simultaneously. I haven't touched a typewriter since I got this computer a year or so ago."[16] You can easily understand why he hasn't. No longer, for instance, does a noisy bell tell Clarke that he's nearing the right margin—he

just keeps on typing and a feature called **word wrap** automatically takes him on to the next line.

Granted, WordStar is traditional software. It doesn't use **icons**, for instance, those cute little pictures of wastebaskets or file folders that some snazzy new programs will flash across your screen to tell you what you're doing. And as of this writing, anyway, the original WordStar didn't offer **split screens** to show more than one electronic file at once. WordStar 2000, a related but not identical program, does. First marketed in late 1984, it may supplant plain old WordStar eventually, but the original program will always have a special place in the hearts of the cognoscenti. It's an indisputable classic. More than a million people have used WordStar since it appeared in 1979. Rubinstein and Rob Barnaby, the brilliant programmer who did the actual coding for WordStar, are legends.

As computer technology matures, the machines themselves will be mere commodities like televisions or Walkman imitations. It's the programs that run on them which will make the difference.

WordStar is at least adequate, and mostly superb, in all but the last of these areas:

1. Absence of bugs. The software maker should have gotten all the bugs out so that the program will run reliably on your computer. You can't write a complex program that will be absolutely bug-free. But you can make it bug-free 99 percent of the time.
2. General ease of use. A program should be easy enough to learn *and* use. Being logical helps; ideally, you can use combinations of familiar commands to coax the program into doing many things that you haven't done before.
3. Good documentation. The manual should be clear and logically organized. Either the simplest material should come earliest, or else there should be a beginner's version; also, the manual should boast a good, comprehensive index.
4. Usefulness to beginners and old pros alike. You can adjust the best programs to suit your own level of skill with them.
5. Speed. It lets you do your job fast, especially when you use it with a hard disk.

6. Power. Related to speed. The program can quickly accomplish complicated tasks like substituting one word for another in a contract thousands of words long. Imagine the boon to lawyers plugging new names into standard boilerplate.
7. Fewer chances for botch-ups. Good programs limit the chances for careless errors in the first place.
8. The Jewish-uncle effect. Ideally, your software will slow you down or flash a warning when you're about to ruin your work with a few taps on the wrong keys.
9. Damage limitations (if you *do* goof).
10. After-the-goof feedback. After you've botched up—and we all do sooner or later—the program will tell you how you did so.
11. Ability to customize. You or at least a software expert can customize good programs for *your* use on *your* machine.
12. Availability of "accessory" programs to make your original software still more useful.
13. Support. Ideally, the software seller will stand behind his product if you have problems. MicroPro's record here is far from the best; this may change.

Again, WordStar isn't perfect (see Backup III, "The Lucky 13," for a more detailed description of it and criteria for choosing good software), but it comes closer than most other popular programs.

■ ■ ■

Here are a few terms useful to people shopping for a word processor:

1. A **cursor** is just the marker on your screen—a blinking line, maybe—that shows where a letter will appear when you type. *Cursor keys* move the cursor up, down, left, or right.
2. A **file** is an electronic version of a letter, report, or other document or collection of data.
3. A **control key** is what you start holding down to turn a letter or series of letters into commands for your

computer. Used with the control key, the letters normally won't show up in the document you're typing. Some programs, by the way, may use the control key and an **escape** key, which could be a way to get from one part of the program to another. Or the escape key may take on functions similar to the control key. In addition, there's an **alternate** key that you may also use to help boss your machine around.

4. To **scroll** just means to move from place to place in your electronic document. It's like rolling or unrolling a Torah or other scroll, except here there's no ink or paper, just patterns of electrons in your computer memory and dots on your screen. On most computer monitors you see only 24 lines of typing at a time.
5. A **menu** lists commands on your screen. It can tell you how to locate a document on your disk or what to do while you're at work there.
6. A **block move** is the ability to move material from one part of your document to another.
7. A **global search** tracks down specified words in your document.
8. A **search and replace** substitutes one word (or group of words) for another.

■ ■ ■

WordStar's creators, Seymour Rubinstein and Rob Barnaby, are like Orson Welles and Herman Mankiewicz of *Citizen Kane*. The movie would have been hack melodrama without the brilliance of both the producer-director and his writer; and yet critics still argue over *Kane*'s exact origins. So it is with WordStar. When *Time* said Rubinstein had written the program, a friend of Barnaby's whipped off an angry letter to the editor. I won't take sides here. Rubinstein, however, far from playing down Barnaby's WordStar role to me, unhesitatingly passed on his phone number when I asked. Barnaby is equally willing to acknowledge the importance of his collaborator. Even the letter writer emphasizes the usefulness of Rubinstein's salesmanship and his perception of

the software market back in the late 1970s when WordStar was born.

A short, stocky, bespectacled man in his fifties, Rubinstein grew up in New York City, the son of a pinball- and novelty-machine owner who died while Seymour was still in grade school. His mother worked as a clerk. “My first job,” Rubinstein said, “was a helper on a fruit truck when I was twelve years old.” Two years later, however, his neighbors were “letting me ruin their radios,” and by his mid-twenties, he seemed settled into the routine of a TV repairman.

But Rubinstein grew restless after six months’ reserve military duty in the 1950s; he attended night school at Brooklyn College and took up technical writing.

Decades later he recalled a navigational computer he encountered while a civilian, speaking as if it were his “Rosebud,” as if he were Charles Kane thinking about the Colorado snows and the name on his childhood sled. He gave me the machine’s exact measurements, eight by nine by twelve inches. Then, mixing nostalgia with awe, he said, “If you opened it up, it would look like a Swiss watchmaker’s nightmare, all those gears and little electronic things whirring and clicking away. But with it you could take off from an aircraft carrier and circle overhead and press the reset button and fly anywhere you wanted, and wherever you flew, an indicator kept track of how far you were from that spot on the ocean and told how you could return.” Ask Rubinstein about his early career and you may hear more talk of machines than of people. “$2” The hardware, however, helped make the man. Rubinstein spent years working with data-communications networks—the ones that, for instance, handle airline reservations or credit-card information. Without quick, accurate updating, these **real-time** systems are worthless: just ask anyone whom an airline has booked on an already-full flight. You could have the best-designed computers in the cosmos. But the question in the end may be “Did the airline clerk key in reservations for you on the right flight at the right time?” And Rubinstein’s software philosophy later reflected his real-time work. He originally did not intend WordStar for the bumbling and the lazy but for “the production typist” on whom the boss heavily counted for both speed and accuracy.

In my last interview with Rubinstein for this book, he downplayed his statement that he created WordStar for the fleet-fingered typist. “I believe that everyone deserves a product appropriate to his particular classification,” he said, “and while WordStar may have been aimed at a particular niche, that is not to say we shouldn’t enlarge the scope of this product.... We’re going to make the next version easier to learn.” As thousands of professionals and executives can verify, however, WordStar all along has been quite learnable.

Early in his computer career Rubinstein also grasped the importance of clear documentation to guide people through the programs. IBM at the time was one of the world’s largest publishers, at least in sheer volume of paper consumed, ranking right up near Random House and other giants, and Rubinstein recalls the old manuals as abysmal: “You really had to have a lot of drive and patience to get through their stuff.” Programmers rose or fell according to their ability to push through “arbitrary collections of material arranged in an arbitrary order.” Rubinstein, who by now had forsaken technical writing for programming, made a discovery helpful to any software user: you won’t serve yourself best, necessarily, by completely memorizing the manuals. The trick, rather, is to know where to turn in a hurry when you *do* have a problem.

In 1977, wandering through a store for computer hobbyists in San Rafael, California, Rubinstein saw a box with blue-and-red switches and lights, and “it looked really interesting. I went home, built it, and a week later I had a computer.”[17]

It was his first micro, perhaps more of his Rosebud, after all, than the navigational computer.

“I had spent many hours of my life in very brightly lit, cold rooms in the middle of the night, surrounded by millions of dollars’ worth of junk,” he once recalled. And yet his new dwarf seemed “a true computer” to him “in every sense of the word. I could see the potential, and I got very excited.”[18] His elation grew when he saw that a company named IMSAI, run by an old boss, had produced the kit. He once remembered the firm, now defunct, as “one of the tiny companies that really made this industry happen. The industry did not happen by

some big, famous manufacturer deciding this was what he was going to do. It was a grass-roots movement."[19]

Rubinstein joined IMSAI as software-products manager and within two months was marketing director; there he signed the first contract between a computer manufacturer and Digital Research for CP/M, the popular operating system—the only one with which WordStar at first would work.

Leaving IMSAI in 1978, Rubinstein "knew exactly what I wanted to do." He would "build packaged software" for businessmen and others unfamiliar with computer arcana. Registering out a business name in June, he included "International" after "MicroPro" because "I felt that with the right, well-designed products, Europe would be an approachable market."[20]

Rubinstein was barely out of the IMSAI fold when he dropped by Rob Barnaby's flat in Berkeley, California. The two had met at IMSAI, which Barnaby had left a short time earlier, for different reasons, after hot words between the moody young programmer and his boss. Barnaby was a Harvard graduate, a physics major, a tennis pro's son, the descendant of an old New England family. A pattern in his life was seemingly emerging by the time he reached his thirties; he would throw himself into computer jobs, program masterfully for a while, then find his interest waning. Just before joining IMSAI, Barnaby had been fixing up old houses. "I kind of like creating things with computers and forgetting them and getting away from them when I'm not creating something new," Barnaby told me. He was in no hurry, quite likely, to return to work after IMSAI, having salted away a good part of his salary. "I like the flexibility that saving money produces." He isn't materialistic—the very antithesis of it. And yet money and WordStar are together a touchy subject. Barnaby's work for MicroPro seemingly did not make him rich, at least not California rich.

"It was originally royalties," Barnaby said, "and when the royalties played out, I took a salary and a stock option." His total earnings from MicroPro were somewhere in the six figures.

"I want you to understand where his ego is," said the friend who wrote *Time*. "He's often chided by people for allowing

himself to be taken advantage of and he simply does not want to discuss it. He says, 'I made a deal. I kept my promise, Seymour kept his promise and that's it.'" Describing the circumstances in a peculiarly Californian way, the friend said: "If Seymour was really greedy he would have gone to Rob two years ago and said something like, 'Hey, you got to believe me, Rob, I never expected this thing would ever do what it's done. And I'd like to do right by you and so I would like you to graciously accept this check for $150,000 I brought with me here today.' Then Seymour would have owned him. Rob did not get rich writing WordStar. People think that, but it's simply not true. I've seen it. The guy's a friend of mine. He's back to work again because of financial need."

"We were both very poor," Rubinstein told me earlier about himself and Barnaby. "I had less than $8,500 to my name, in fact, but I gave Rob a $2,500 retainer, a third of my cash reserves. I owned a house, but the bank owned most of it."

Rubinstein offered to make Barnaby a partner. Barnaby, characteristically wary of entanglements, turned him down.

An early program Barnaby did for Rubinstein was a programmer's aid, which, among other things, let you move words and numbers around more easily on the screen. It was no more a word processor than a pencil. Nor did Barnaby intend it to be one: "I was writing a program editor, a tool for me." Yet "computer stores would be trying to sell people something they could write letters with, and it would get back to Seymour that our program definitely did not have those features." Rubinstein recalls taking a big hint from dealers' enthusiasm for a program called Electric Pencil. "What they liked," he said, "was you could both enter and print from the same program, and you had a lot of control over the printout. You could specify things like underlining and margin settings, but it was very primitive. You certainly couldn't imagine what it would be like until you printed it. You didn't know where page breaks would occur, where one page would end and another began," and so you might have to print several times before you got it right, since each change might create new breaks in the wrong places. That was micro word processing 1970s style. You either put up with all these nasty details or

prayed for a sweepstakes killing so you could buy a $20,000 "dedicated" machine from IBM or Wang.

■ ■ ■

When You Should Buy a Dedicated Word Processor

Here are some times when you should seriously consider it:

1. When you work for a stuffy old bureaucracy that's rich and afraid of the new.
2. When you're a procurement officer on probation. As they say, no one's lost his job for buying Xerox rather than Brand Non-X. Then again, your boss may bawl you out for not buying a Xerox *micro*.
3. When you want to dump the training problems in the manufacturer's lap. Of course, many independent companies and consultants nowadays are training people to use micros, especially IBMs.
4. When you prefer an extra-large, extra-sharp screen and giant memory and when you can't easily find micros of comparable quality. Here, too, I'm skeptical. The gap between micro hardware and the dedicateds is narrowing.
5. When you're looking for a machine that will run special software that the micros won't. Fondly, a Hollywood writer-director tells of a script-formating program "dreamed up by some lunatic in northern California." Nowadays, however, more programmers are writing for micros than for dedicated word processors.

You should think "Micro" if you're working for (1) yourself, (2) a needy company or organization, or (3) a rich, frugal one.

"But," you ask, "what about repair?"

Well, surprise: many big companies—including Xerox itself—are now in the micro repair business.

Besides, for the price of one dedicated, you might buy both a micro and a backup.

■ ■ ■

Psyching out the market, Rubinstein not only listened to computer-store owners but read up on the features of the dedicateds, determined to match them.

In some ways, in fact, he hoped to surpass these rivals. From the very beginning he was against built-in function keys features, believing that they actually slowed down typists by forcing them to take their hands off their main keyboards.

Pitting himself against IBM and the other giants of the word-processing world, Barnaby worked in a spare bedroom from which he evicted an electric-train set. He wrote the WordStar with a brand-new IMSAI computer, 64K RAM, two 530K disks. His big, fat Teletype Model 40 printer crawled along at a pokey 10 characters per second, but he poured out his code as if he were a muse-inspired novelist.

"Working out whatever it was he was going to code," Rubinstein recalled, "he would sit in front of the machine and his fingers would fly. And he would actually growl at the machine with his chin jutted out—*rrr, rrr*, like that—and he would pound the keys as fast as he could go, because he couldn't get into the machine fast enough." Between fall 1978 and summer 1979 Barnaby typically worked eighteen hours a day on WordStar, and sometimes many more in the frenzy of it all. Rubinstein said, "I stayed up a few nights with him, in fact. He was younger than I was—still is," he said dryly, "so I couldn't do it as much as he could. He was an excellent coder, one of the best I've ever seen in terms of speed and accuracy and putting in features that are real clever."

Barnaby, in turn, praises Rubinstein's contributions to WordStar. "Seymour set the general goals. I wouldn't have known what the world wanted because I'm not in touch with the world. He gave me a lot of specifics. He was probably the person who used WordStar the most and gave me the most comments, because he bridges the range from being able to understand where technical people's heads are at and being able to relate to the outside world and the market. He was a

programmer years ago. He's familiar with the process I go through. He doesn't like to do it anymore, but he sort of understands what I'm doing. I think the menus were his idea"—the instructions that pop up on the screen if the typist takes too much time to execute a WordStar command. Rubinstein also recalls contributing touches like the Q effect, which accelerates the impact of other WordStar commands; and he says he thought up the dotted lines that cross the screen to mark page breaks. No matter who did what for WordStar, however, it's likely that Barnaby, regardless of Rubinstein's helpful studies of the market, was writing mostly for Barnaby. "I don't hear a voice from the world," he generalized to me about his coding habits. "I hear a voice from the back of my head."

Rob Barnaby, you might say, was WordStar's first user. He used WordStar as a programming aid to write WordStar. Then he used WordStar to write the manual for WordStar.

As we talked, I realized how close his working habits came to mine and how, coding WordStar for himself and Rubinstein, he had also programmed it for me. It was not so much a fluke that the program's logic coincided with mine. So, in many ways, did Barnaby's personal writing habits. "I fiddle around a lot with text," he said. "I try to get the points down, and then I try to get good sentences to say them with. If I find I try to word the thing right from the start, I lose it. I must see things on the screen." Amen, Rob. I don't write my best English inside my head, either; I, too, must *see*. Like me, Barnaby might have loathed the programs that didn't let you zip the cursor to an error and correct it without much ado.

The creation of WordStar, by the way, wasn't the only act of genius from MicroPro. The name was a marketer's dream. Why "WordStar"?

MicroPro already had the programmer's aid called WordMaster, and Rubinstein apparently held an informal name-this-product contest for the new word processor.

"Who's this for?" asked an employee named Barbara.

"It's really for the production-minded secretary," he replied.

"Why don't you call it Word—?" she said, using a vulgar synonym for "cat."

"What?"

Barbara mulled it over. “Maybe that’s a little too risqué. But you say the secretary’s the hero?”

“Yes,” said Rubinstein.

“The star?”

“Yes.”

“Then why not call it WordStar?”

And so it was.

Hitting the marketplace in the summer of 1979, the product clicked; no competitor came close; at least none offered WordStar’s get-what-you-see printing features.

Rubinstein had come out with good, timely software, and now he was riding the beginnings of the micro wave. Just as with VisiCalc, buyers soon asked about WordStar by name—before they bought their computers. In fact, often it was *why* they bought micros. And Rubinstein found WordStar wasn’t merely a good first sale for dealers. Frequently, it would be a second. Balking at WordStar’s price, customers would make do with an inferior word processor but remember the sales reps’ original praise of the MicroPro program.

Ironically, as WordStar was taking off, Barnaby, its writer, was headed toward another burnout. The atmosphere around MicroPro was changing. Rubinstein, who eventually would name a yacht the *MicroStar* and move into a hilltop home with a sunken tile tub, was losing touch with some programmers. “They locked us up in this little windowless room with Customer Support,” recalled Jim Fox, Barnaby’s former assistant, who worked on WordStar Version 3.0, the one I’m using. “It was messy. It was very noisy—not very good air circulation. And then they were expecting us to do programming. Rob asked months and months for shelves, and they never gave them until he threw a temper tantrum.” It seemed strange for Rubinstein to let this happen. Everyone agrees that $400,000 home or not, he was the opposite of a golf-course president. And yet Rubinstein had burdened MicroPro with high-tech bureaucrats who were turning it into a mini-Washington, inflicting reorganization after reorganization. The real producers, whether sales reps or programmers, sometimes suffered. Barnaby quit in the summer of 1980 just after working on an important sister program of WordStar, MailMerge, which helps businesses personalize

letters with names plugged in from mail lists. “To my knowledge,” Rubinstein told me in early 1983, “he has not coded anything of significance since.”

Rubinstein was telling the truth as he knew it. Barnaby, indeed, had largely forgotten about computers. He had lost excess weight; he had traveled; he had stopped smoking and shaved off his beard. In superficial ways he seemed a different man from the writer of WordStar. And yet Barnaby had left software before and returned; and in late 1982, unknown to Rubinstein apparently, he had again.

It wasn’t just that he needed the money. He could no longer flee computerdom so easily. A barrier had tumbled, the one between his work and the rest of the world. Once micros had been mostly hobbyists’ toys, demanding hours of soldering and programming. Many of his friends hadn’t fathomed what he did. But now Barnaby was hearing a woman—formerly perplexed—say that WordStar was the rage at the stores where she was shopping for her new business computer. Barnaby’s father got *2010* for Christmas and read that Arthur Clarke had written it with WordStar; Clarke had sent the book to New York on a five-inch floppy and transmitted final corrections from Sri Lanka through his computer over a satellite link. Another science-fiction leader, I discovered, also was hoping to catch up with *2010*—Seymour Rubinstein.

Returned to computers, bearded again, Barnaby in early 1983 was working for a small rival of MicroPro, Chang Laboratories, aiming at the lucrative market for software compatible with IBM’s 16-bit PC. He was like a canny Hollywood scriptwriter. Barnaby was somewhat vague about his software plans, in part because he really did not know what he would create in the end, but perhaps also because he did not want to alert the competition. He would not, in early 1983, say he was working on a new word processor, only that he was at the keyboard of his new IBM. It ran WordStar. Barnaby, like thousands of other people, had bought his IBM version at a local ComputerLand store. You might say it was the neat completion of a circle, for the founder of the ComputerLand chain was none other than Bill Millard, the man behind IMSAI, Barnaby’s former employer.

Barnaby offered his opinion of the WordStar version he had bought at ComputerLand—competent but unimaginative. Well, how could he outdo his WordStar? Barnaby answered, and despite his refusal to be pinned down on a future project ("It could be a spreadsheet"), he gave at least an inkling of what another word processor from him could be like.

Among other things, Barnaby would take advantage of the newer machines' more powerful memories; he'd write more instructions for the RAM. So he wouldn't have to choose as much between making the program either (1) more easily understood or (2) capable of moving around words in the fastest or most efficient way. Smart computers and dumb humans could coexist more gracefully.

Also, he'd reduce the number of commands in WordStar, a good idea if not overdone. "I've thought, Gee, couldn't I have only two or three ways of deleting text rather than twenty. And I look at my habits, and I do use a lot of them. But most of them I could replace with the same number of keystrokes or only one more keystroke using a combination of other commands. I'd never tried to write a program where you didn't have to read the manual before. And I still don't think I've succeeded. I think that's a worthy goal for the future—to write a program that doesn't have to have a manual."

Back at MicroPro, Rubinstein, by early 1983, had fallen behind some previous goals of his own. Fewer than 250 people worked for the company, or less than half the peak number, and the company had saddled itself earlier with hundreds of thousands of dollars a year in office leases it no longer needed. "There were some odd things that happened internally with these visions of increasing numbers of sales," said a former MicroPro man, "and they hired too many people too quickly. They pay very well, and their salesmen were getting incredible commissions. I know one guy—his first month in sales he took home five grand in commissions." Did he sustain that amount? "He didn't," said the ex-MicroPro employee. "Every month after that he fell." And so, it seemed, did the sales rep's colleagues at MicroPro. "They kept trying to break record after record," the former employee recalled, "and the only way to do it was to extend generous credit and get their products out the door.... They had to produce all the programs people

ordered, but they weren't getting their money immediately." With high interest rates, some buyers would stall payments as long as possible. MicroPro's growth problems weren't unique. Another pioneer in micro software, Lifeboat Associates, a distributor, also found itself overexpanded and laid off employees.

MicroPro likewise suffered when programmers, ordered to meet Rubinstein's deadline, cut corners on an early version of WordStar for the IBM PC. The software was too hard to adapt to customers' printers. And then IBM threw MicroPro a loop. It suddenly changed the PC's operating system in a way that made WordStar glitch up. MicroPro wasn't the culprit here. And yet it was the one receiving angry phone calls from frustrated customers. It was, in a sense, a victim of its own reputation for quality. MicroPro products had bugs like other software makers', but fewer of them than most, so that the IBM WordStar problems—since corrected—enraged customers with high expectations.

Old friends of Rubinstein's, meanwhile, complained that the firm had nothing truly original coming out, that MicroPro had evolved from a programming company to a marketing one. I disagreed somewhat. MicroPro had succeeded largely *because* Rubinstein had aggressively sold himself and his programs. And yet it was also true no other MicroPro product had commanded as much attention as WordStar, the first big one. Michael Canyes, a computer consultant, complained that it was "getting a little gray around the temples." It was time for updates, drastic ones. If they didn't come, if competitors kept duplicating various features of WordStar, the program would eventually perish.

So far, however, that hadn't happened.

Nothing had appeared that was both as good as WordStar and marketed as successfully.

"If you'd asked me when I first introduced it," Barnaby said, "I would have said as soon as we stopped moving, somebody would have done something better. I sort of thought WordStar would be gone by now, but it's growing instead. It may sell a million by the time it's done." He wasn't bragging; he was right.

We were talking now in summer 1983. Barnaby had removed himself from the payroll of Chang Laboratories, and I suspected it might be because he worried about living up to his first success. Barnaby didn't discourage that impression. When asked if another WordStar might be on its way, he said, "I hit once; I may not hit again." I understood. He was no different from a writer trying to create another blockbuster book or movie; he would be competing against himself—a contest made more difficult by the fact that MicroPro's marketing expertise would no longer be on his side. I suggested that he and Rubinstein might both benefit by working together again as a team. If Barnaby agreed, though, he certainly didn't make that clear to me, and I hung up thinking that the Barnaby-Rubinstein collaboration was as dead as the Welles-Mankiewicz one.

"Let's just put it this way," said Barnaby of MicroPro. "They could have made me happier there and I'd still be there, and MicroPro would still be growing instead of being flat."

"Rob is beloved around here," said a public relations woman at MicroPro when I suggested that the company might benefit from his return, "but we have many other good programmers."

Not long afterward I was talking to Seymour Rubinstein. He was decidedly more upbeat about MicroPro's fortune than Barnaby had been. He had added some fifty people to his staff since we'd last talked. Rubinstein predicted record sales of about $42 million in 1983, of which WordStar would be 65 percent; he expected that his word processor would thrive inside the ROMs of $1,500 lap-sized computers.

During our conversation I expressed my astonishment over a newspaper article; supposedly, a programmer—unnamed—had dreamed up WordStar in a week or so during vacation.

"I was amazed to see it myself," Rubinstein said. "It was really romanticizing something in a way that wasn't necessary, beyond not being true."

"I talked to Barnaby," I said, "and he has the normal worries of programmers and writer-writers—whether he can ever repeat his success. And I still wonder about the chances of you two coming together again."

"Well," Rubinstein said without the slightest pause, "I got him back working again."

"Now?"

"Yep."

"When?"

"Just started a week and a half ago."

"Christ," I said, "I sort of popped the question to him."

"I'd just as soon you didn't broadcast it," Rubinstein said. "He's not in solid yet, but I expect he will be. You can put in there a blurb that as of this writing Barnaby came back for a test run to see whether he could get involved again."

"As a WordStar user," I said, "I have a selfish interest in his developing it further. Will he be working on WordStar?"

"He'll be working on WordStar," said Rubinstein. Like a movie man, he excitedly described his coming attraction. ("It'll just knock their socks off.") The new WordStar would contain a spreadsheet. Also, used with the right printers, it would offer proportional spacing, meaning that an "I" would take up less room than a "W," making the print look more booklike. What's more, the new WordStar would be simpler to learn. Listening to Rubinstein raving over his forthcoming word processor, I could tell that if Barnaby didn't work out on the new project, MicroPro might use someone else. Ideally, however, it wouldn't. "Just incredible," Rubinstein had said of Barnaby's coding of WordStar. "The man is a consummate artist."

Surely, I thought, Arthur Clarke would agree.

Barnaby stayed some months with MicroPro. In fact, he had helped fit WordStar into the little memory of the Epson lap-sized portable marketed that year. A micro magazine, meanwhile, came out with a report that a version of WordStar for big machines, Version 4.0, might contain split screens. In October 1984, however, I was still waiting. And Rob Barnaby had left MicroPro in July.

"Things didn't click," he said without going into the specifics. "We talked about a lot of things, but they didn't jell." He was now consulting.

MicroPro suffered in other ways. Yearly income was up 53 percent, and the company was still shipping thirty thousand copies of WordStar each month, but quarterly revenues

reported in September 1984 were $12.4 million versus $15.6 million for the same period in 1983. The company sustained a loss in earnings of six cents a share, $756,000. Hoping to cope with threats such as NewWord, which sold for $250 and used the same commands as the older word processor, it laid off 10 percent of its workers and reduced WordStar's list price from $495 to $350. NewWord even offered twists of its own. You could tell it to go to a certain page number, for instance, without having to specify a word on the page you were looking for. The natural question arose: Why should people pay $100 more for the real WordStar?

■ ■ ■

Six Reasons Why Customers (or Noncustomers) Feel Free to Cheat Software Companies

WordStar clones like NewWord aren't illegal. Getting a "free" WordStar from a friend, however, is.

"It's like illegally getting a second typewriter—copied from a friend's, down to the serial number," a software columnist observes. "You're stealing a valuable tool." H. Glen Haney, the president of MicroPro, told me that most copies of WordStar in use are *bootlegged* ones.

While opposing the practice, I'll list six reasons why customers cheat:

1. It takes all of two or three minutes—maybe less—to copy a disk worth hundreds or even thousands of dollars. Yes, anti-bootlegging gimmicks exist. But often they *reduce* software sales; would you be as keen to buy a $500 disk if you couldn't easily make backups?
2. Everyone does it.
3. Computer users want to befriend others with similar machines so they can draw on them for technical hints or back up equipment.

   And what better way to cement a new friendship than at a copying session where the users swap programs? That's the thinking.

4. Many software companies overprice their wares. Yes, it's expensive to develop good programs; but some companies, rather than creating innovative products, gouge you to pay for development of copycat offerings. They themselves rip off people—their more imaginative rivals. (No criticism of NewWord here. It is much cheaper than the original WordStar and offers some improvements.)
5. Some people in large companies think software houses don't give big-enough discounts to corporations buying the same program for a number of machines.
6. Many software companies don't offer enough guidance or other help. Customers think, Why should I buy this program when they're just going to ignore my problems once they have my money? The columnist counters: "That's like saying, 'I'll just throw out the old Judeo-Christian ethic that it's wrong to steal.' The other guy being wrong doesn't make you right."

■ ■ ■

MicroPro's responded to such competition by keeping WordStar but developing another word processor, WordStar 2000, aimed at offices that had shunned micros as too hard to use.

WordStar 2000, named because MicroPro said it would stay modern into the next century, discarded most of the older program's commands. There wasn't one line of code from plain old WordStar. And WordStar 2000 couldn't easily read its files—imperiling an industry standard that MicroPro itself had created. Moreover, it couldn't run on less advanced micros like the Kaypro II. Machines in that vein were still good for word processing, and critics claimed that MicroPro had kissed off the 8-bit market. MicroPro replied that it had wanted to take full advantage of the hard disks and other capabilities that were showing up in powerful new computers such as the IBM AT.[21] WordStar 2000 did not run well on the slower floppy-disk machines. Its early version was pokey, moreover, even on

an IBM XT hard disk computer. However, it indeed simplified WordStar's commands and offered split screens, a form-letter program, a spelling checker that you could use as you typed a letter rather than having to leave the file to call up the speller, proportional spacing, underlining displayed on the screen, and the ability to go to specified pages—in other words, what one writer called "a catalog of wishes" for people using the older program. WordStar 2000 lacked a spreadsheet and sold for an outrageously steep $595; for $100 more you could buy WordStar 2000 Plus, which included a simple list-keeping program and software to help hook you up to other computers via phone. A slogan captured the MicroPro sales pitch: "Easy Word Processing You'll Never Outgrow." WordStar 2000 wasn't "easy" word processing—all powerful products took some time to learn—but it was *easier* than plain old WordStar.

I went to a MicroPro dealers' meeting just outside Washington in early November 1984 and saw a slick, professional sales campaign that would have done a shaving-cream maker proud. Company officials, including president H. Glen Haney, said WordStar 2000 wasn't a fluke: "We're going to repeat this process again and again." Educators, even science-fiction writers, were said to have helped forty programmers make The Product easy to use. MicroPro billed 2000 as having been "beyond the capabilities of one or two genius programmers." This philosophy, as much as anything, perhaps explained why Rob Barnaby was no longer with the company. Like many talented people, especially writers, he was the very antithesis of a team man. There was a difference between being one of forty programmers and *rrr*ing away in front of the keyboard at midnight while the head of the company watched. And yet as a user of WordStar I still hoped that Barnaby might return to the MicroPro fold. No matter how many creativity experts MicroPro brought in—and the company in fact had experimented with one—you could no more replicate a Rob Barnaby than you could a Welles or Mankiewicz. It was entirely inevitable that the MicroPro officials at the Twin Bridges Marriott felt compelled to say that 2000 was beyond one or two genius programmers. WordStar 2000 indeed had *some* merits. Still, it was far from the earthshaker that the original WordStar had been. Barnaby and

Rubinstein had so brilliantly conceived their program that it could hold back the competition for years and years.

Well into the 2000 presentation at the motel, the room darkened. It was movie time. The dealers chuckled at "word processing throughout the ages." A cartoon caveman wrote on stone, a Greek shuffled around stones bearing inscriptions for a temple, and a cartoon George Patton barked orders to the troops as part of a pun based on the phrase "command-driven word processor." (See Chapter 5 for a definition.) MicroPro officials trotted out advertisements that would appear in the *Wall Street Journal*, *Fortune*, *Time*, and other major publications. The company was as proud of the ads as of WordStar 2000. A lie-detectorlike device, measuring electricity in the body, had even gauged test subjects' responses to the copywriters' creations.

After lunch—salad, roast beef, potatoes, and a redemptive low-calorie dessert—MicroPro let the dealers try out WordStar 2000 themselves on IBM XTs and ATs. It was a combination sales talk and seminar. MicroPro quizzed the dealers with questions in the vein of "What do you like most about the product?" The session greatly increased the dealers'—and my own—understanding of 2000. At the same time, using a teacher-student relationship, MicroPro people fortified their depiction of themselves as the world's top experts on word processing.

Similar dog-and-pony shows would take place in cities across the country and overseas. MicroPro by now had four hundred employees worldwide and thirty-five hundred retail dealer outlets—a far cry from the days when Rob Barnaby had been writing WordStar in the room from which he'd displaced the electric-train set. If WordStar 2000 didn't sell well, however, MicroPro would shrink into just another software company. It was a crucial time. MicroPro was deemphasizing products like data bases and spreadsheets, flaunting its reliance on word processing, and inspiring headlines like "MicroPro Back to Its Roots."

■ ■ ■

How to Work on Two Files at Once While Using Plain Old WordStar

Windows, among other things, let you view several files at once and move material back and forth (see Backup IX, “Window Shopping”).

Even though plain old WordStar lacks windows, you *might* be able to upgrade your software to include them. Ask your dealer about IBM’s Topview software and Microsoft’s Windows.

■ ■ ■

For Rubinstein personally, 1984 had also been eventful. He and his wife had separated—different interests, he said—and he had a heart attack. He had lost thirty pounds but had come back “stronger than ever.” Meanwhile, an initial public stock offering in March had made him richer than ever. It brought MicroPro $13 million.

“After all is said and done,” Rubinstein told me about the offering, “I’ll end up with a little more than $5 million.” He already owned a gold-colored Corvette and a house worth hundreds of thousands. “And okay,” Rubinstein said, “so I’ll decorate the house. I’ll buy some furniture. So maybe I’ll spend another couple hundred thousand, but most of the money will be used for investment, not to go on some wild spending spree.” He said that “unless you’re a dissipated type, your life really doesn’t change.”[22]

His corporate life, however, would be different. Perhaps chastened by Adam Osborne’s failure, some investors had insisted that Rubinstein give up control of MicroPro. He would still serve on the board. And he would help plot long-range strategy and develop new products, but the old entrepreneurial environment was vanishing at MicroPro and in much of the industry at large.

The Osborne failure haunted Rubinstein in ways besides making money raising somewhat harder. Some investors in Osborne filed a suit saying that Rubinstein—owner of Osborne stock—had bailed out ahead of time, using insider knowledge. “It’s such hoked-up bullshit; it’s just ridiculous,” Rubinstein

said in May 1984. He had “needed the money ... principally to pay my taxes.”[23]

By now, the sales of personal-computer software exceeded $1.5 billion a year.[24] Throughout the industry, accountants and others in three-piece suits were increasingly calling the shots. Marketing considerations—advertising, even the designs of the boxes housing the software—often overwhelmed technical ones. A word-processing program called Select typified some so-called user-friendly software aimed at the burgeoning market.

Backup:

■ III, The Lucky 13: What to Look for in Choosing Software, page 302.

5 The Select Word Processor: Martin Dean versus the Command-Driven Restaurants

"Gentleman Farmers" don't appear just in whiskey ads. One showed up in *InfoWorld*—ballyhooing Select, a craftily marketed rival of WordStar.

Embracing Madison Avenue-style tactics, software companies like Select Information Systems were luring some customers away from programs that would have been far better for heavy-duty business use.

Select's word processor retailed for about $500 in 1982, a year after its introduction, including speller and mailing list programs and a tutorial disk. Just WordStar—without accessory programs—listed for about the same.

More than twenty-five thousand copies of Select sold in less than two years, and major manufacturers started offering it with their computers. I myself loathed Select. And yet I could see how the program could wow the throngs jamming their local computer stores. The tutorial disk was a salesman's dream: he could walk away while the program baby-sat the customer tinkering with the computer.

Select Information Systems, moreover, a forty-employee company in Kentfield, California, was running an advertising campaign as slick as any distiller's.

"No contest," proclaimed a *San Francisco Examiner* columnist in one ad in 1982, looking up from his Xerox 820, dangling a pair of glasses from his hand, like some refugee from a Famous Writers School. "Select was easier to learn." The ads didn't say what he was comparing it to, but a popular computer magazine named his equivalent of Brand X, WordStar.

The columnist, Dick Nolan, never returned my calls, and Select wouldn't put me in touch with the secretary featured in

another ad, but I did track down "Richard Russell, Gentleman Farmer."

"Nebraska soybeans," said the ad, "are Richard Russell's business. But he rarely gets there. Richard manages his farms from a Victorian flat in San Francisco. And he does it with little more than a telephone and the SELECT Word Processor." What was this, an ad for a word processor or a communications program? And yet the copywriter had done her job. I read on eagerly, curious about gentlemanly word processors—human or disk. "Select supports his interests as efficiently and often more quickly than could a well-run office back home. The briefest bank instructions or thickest annual report can be recorded in minutes and retrieved in seconds." Was software so powerful? Maybe. The ad quoted Russell: "Select manages the business. I just reap the harvest."

The gentleman farmer, however, wasn't mainly a gentleman farmer—rather, an interior decorator.

"I spend more time doing that," Russell told me when I called up out of the blue, "than on my farm operation, which is managed in the Midwest."

Then why be a gentleman farmer in the ad?

"I think they just thought the idea of a gentleman farmer was more interesting than an interior designer," Russell said. It must have been. He was deluged with calls, including one from NBC, which was in the thick of a computer series.

Well, I asked, did he actually use the word processor?

Yes, Russell said, but mainly in his designing business. It was a successful one, 20 percent commercial, 80 percent residential, including work on some mansions in the million-dollar range. "I design architectural interiors, furniture, fabrics," he said, "the whole thing."

What did he most like about Select?

"The self-teaching program was the main thing that appealed to me," he said—the tutorial disk.

I asked Russell about the cumbersome series of keystrokes that the Kaypro version of Select inflicted on people making insertions a few sentences back in their writing.

He knew about the problem. And he knew about WordStar, too.

"I'm a lot more aware of that since the ad ran," he said of WordStar's reputation as a powerful word-processing system, "but I don't think I'm in a position to say much about it since I gave Select my endorsement. But you've brought up some valid points. The whole business of personal computers is new to me in the last six months, and so I'm learning about it, as well." Russell said he used Select several hours a week, that he could legitimately endorse it even if he wasn't actually using it mainly as a gentleman farmer. He was right. I didn't question his basic sincerity. But for me, anyway, Select had proved tediously cumbersome.

In early 1983 I called up Martin Dean, the head of Select Information Systems, and did the proper thing.

"Martin," I said in effect, "I hate your software."

Why gladhand information out of him, then stab him in the back?

Dean was smart and a good sport. Not only didn't he hang up on me; he spent an hour on the phone giving his point of view. Like the developer of WordStar, Dean had a philosophy, one born of his own business experiences—in this case, a WordStar debacle. He was a real estate lawyer eager for one of his staffers to work with a sophisticated word processor. "I handed her WordStar," he told me, "and said, 'It's the standard in the industry.' And she came back two days later and said she was not going to do that."

"She was vehement," Dean said. She wasn't going to spend the seventy hours she felt it would take to master WordStar.

And she wasn't "just" a secretary. She had a year of law school, had done ten years of legal secretarial work, and was supervising Dean's legal research staff. "She's one of the brightest women I've worked with in the legal business," he said. "But she didn't have the time to learn WordStar." A major manufacturer had done a study comparing the two word processors' learning time. "And my understanding," said Dean, "is they determined it takes about fifty hours of working with WordStar to become as accomplished as you could become in ninety minutes of using Select." I disagreed. WordStar took much less time for me to learn; Select, much more. With other people, it might be the reverse, but a good

company normally wouldn't have so much turnover that the employees would lack time to master a *decent* word processor.

Defending Select, Dean praised the tutorial disk and the program's built-in memory aids. Want to erase? If you hit the "Escape" control and pressed the "E," you'd eventually do that. Eventually. Dean and I went through a keystroke count. He claimed that actually his system—improved since the one I'd tried—was as fast or faster than rivals if run on the right machines. He said the Kaypro just wasn't right for his program.

"If you felt this way," I asked, "how come you let it be bundled with the Kaypro?" Why did he and the Kaypro's maker sign a contract that allowed Select to be the "free" word processor provided with the computer?

"Well," Dean said, "we had that version on the market only three months"—in 1982. Then, according to him, Perfect Writer underpriced Select. "Kaypro *then* thought that was a bargain. They do not now."

"Why?"

"Try to get a call through to their service department." He was right. Kaypro owners were swapping war stories. Theoretically, Kaypro—not Perfect—would guide the owners through the software maze. Actually, it didn't. Not always, anyway. I heard people at user groups deciding which machine to lie about owning so the Perfect Writer staffers would listen to their problems. Kaypro, in fact, dropped Perfect software in 1984 after dealers said they preferred WordStar.

Okay, but what about my printer not underlining with the Kaypro using Select?

Here again, Dean blamed Kaypro, and the printer maker, too, but I wasn't about to zero in on who was at fault here. All I knew was that my daisy wheel wasn't that exotic a machine. And yet, involuntarily, I'd been sold cumbersome software that, unmodified, did not even work right with the other parts of my $2,500 investment.

You may love Select, maybe even after you've been running it a while. "Cumbersome," remember, is my opinion. A *Washington Post* staffer named Eugene Meyer, a Kaypro owner, liked Select and said the slowness "gives me more time to think." He was working on a book around the same time I

was and turned out one as long. “But,” I half joked, “if you’d been using WordStar, then you might have written one *three* times longer than mine.”

I called up Ben Shneiderman, an expert on matches between humans and software systems. Just what did an academic feel about Select-style systems and WordStar? Shneiderman, an associate professor of computer science at the University of Maryland and author of *Software Psychology: Human Factors in Computer and Information Systems*, said:

“Select has very few commands. There are very different people in the world. You’re very attracted to choice and options, and you seek the power that WordStar offers. But very simply, people are different. Some like to drive Maseratis, and some like to go twenty miles per hour.”

He was right. There might even be a version of Select better than today’s WordStar; software is constantly changing, and when you shop, you must do your homework to make sure you’re buying the best program available for your needs at the time. But while I was writing this book, I loathed Select—even a version more advanced than the one for my Kaypro.

Who, anyway, wanted to hire a typist content to do the keyboard equivalent of twenty miles per hour?

And yet I tried to be tolerant. I hit the control key to fire up WordStar’s commands; Select users tapped “Escape.” “There are twenty-five thousand people happy with using ‘Escape’ instead of the control key,” Dean had told me, as patiently as a liberal Baptist explaining to a Klansman that Jews didn’t have horns.

Certainly it was true: one man’s joy, another man’s plastic-disked kludge—that was software for you. And what you learned first was often your first love. A computer magazine even called one article “Getting Married to WordStar.” “Can you erase your memory modules?” Mark Robinson, a marketing man with Lexisoft, asked before he mailed me a copy of his company’s Spellbinder word processor. He had a point. I liked Spellbinder more than Select, much more, because it ran faster on the Kaypro, but I still could not abide by the need to enter a new mode to make insertions or corrections. It seemed inhibiting, this requirement, though perhaps more in writing than in secretarial work. Michael

Canyes, a computer consultant, at the time loved Palantir. It offered many of the better features of both WordStar and Spellbinder and let a nonprogrammer set up the numbers pads of many computers to serve as function keys. Canyes also appreciated The Final Word, an excellent word processor for footnoting and other academic requirements. It was clear. There were serious alternatives to WordStar—some, anyway—even if, like the writer of the "Married" article, I was already well matched.

In some ways, however, I felt uncomfortable about the general direction in which the software business seemed to be moving. Would less powerful but well-marketed products like Select drive out the future WordStars?

The WordStar had benefited from Seymour Rubinstein's salesmanship. But Rubinstein also had boasted a solid computer background; and unlike some of the new people in software, he wasn't just a businessman cashing in on an exploding market.

Again and again a pattern was beginning to repeat itself. Programmer-entrepreneurs would tough it out in the proverbial garages—for some reason programmers work in garages, authors in garrets—and score with the right software hit. Propelled by little more than their drive and technical expertise, their companies would grow. Then, however, other businessmen, real businessmen, would want the same niche, and the marketing people would muscle in and set the tone. Or, as with some new companies, they might have been setting the tone from the very start.

This had been the classic pattern in many industries—Orville and Wilbur Wright hadn't exactly gone on to become major aviation magnates—but computers were improving faster than had airplanes. And so the process was accelerated; well-financed managers were rapidly replacing garage-style entrepreneurs.

The stakes were higher, and striking back, software authors were even hiring agents. The question arose, however, of the extent to which the market would remain open to more imaginative garage people, anyway, what with increased use of teams to develop complex programs.

"The frontier," said Jeffrey Tarter, publisher of *Soft.letter*, an industry publication, "is already closing.

"A couple of years ago you got to be successful primarily by competently executing an innovative idea and by picking the right machine to produce that execution for. VisiCalc for the Apple is the classic example here, but lots of other programs achieved success on a smaller scale by doing something useful for a microcomputer that came to dominate a market niche"—or, I would add with WordStar in mind, by producing a program valuable for its very ability to run on a number of machines.

"Now, however," Tarter said, "the rules are changing.... Marketing factors are becoming more important. You have to package and distribute the product with far greater sophistication than before and be able to spend the kind of money that sophistication requires."

"It's like the record business," said Nick Vergis, then a marketing man with Perfect Software, telling me about the new programs his company was developing. "You get a lot more bullets ready than you actually fire. Some will be hits, and some won't. You hope you'll get enough hits to pay for the new bullets." Research and development (R & D) was a major part of the costs of new programs. The original WordStar had come cheaply; Rob Barnaby had toiled night and day for a fraction of the money that his counterparts now often demanded.

Then again, advertising and other non-R & D expenditures in the industry had increased, too. By spring 1984 Select had sold 50,000 copies. That should have been enough to sustain a small or medium-sized software company, but even after a public stock offering in November 1983, Dean still felt capital-short. "We just couldn't spend enough on ads and still have money to pay the sales force," said Dean, who "saw it coming" by February 1984. That summer he licensed Select to Intelligent Systems to publish and promote at the retail level. Intelligent, privately held and based in Georgia, enjoyed yearly sales of $90 million; its Quadram subsidiary made well-advertised computer accessories. In late 1984 Select merged with Summa Software Corp., an Oregon firm that offered a stock-market program called Winning on Wall Street, and

Dean laid off six marketing people from Select, so that his original firm had only twenty-one workers left. The Intelligent deal went on despite the merger.

"There are many more products available today than the market can support, and it's very confusing to consumers," said an Intelligent vice-president named Frank Marks. "The user needs to know that he's buying from a company that will be around in the future." He was right. In that sense, the large companies' growing ascendancy in software may have been to the benefit of the consumer. Still, old micro hands may have gnashed their teeth when they heard that Intelligence would turn Select into the "Quadsoft" line of software and when Marks said that the name "leverages Quadram's brand awareness." Quadsoft might as well have been a new shampoo.[25]

To Select Information Systems' credit, the company had garnered some favorable reviews of new products in the months before the Quadsoft deal. (They included Select Write, a $99 stripped-down Select.) Even so, some of the old-time micro people correctly questioned Dean's style of "user friendliness."

In a *Byte* article, "Simplify, Simplify, Simplify," Dean had pushed **menu-driven** software like Select.[26] The idea seemed logical. You'd see the choices on the computer screen rather than having to recall combinations of keystrokes, as you would with **command-driven** systems. Dean likened a computer menu to a restaurant menu. He lampooned the idea of "a command-driven restaurant" in which, supposedly, you'd try "to remember what sort of sauce the veal came with last time and whether it was pepper or peppercorns that you liked in your green beans."

Wasn't that stretching it, however? If you ate at the same restaurant day after day, couldn't you order many kinds of meals without bothering to glance at a menu? How would you feel about a waitress who *insisted* you see a menu even if the fare never changed? She would be pushy, wouldn't she? All of a sudden "user friendliness" would be antiuser pushiness to those using a program regularly. Strictly menu-driven software should normally be just for occasional users, children, and adults wanting to be treated like children; and many if not

most adults in the business world worked too often with words and numbers to let Select-style programs keep them in the infant stage. Granted, exceptions existed justifying this kind of software. A micro user who occasionally retrieved information from a mainframe, for instance, could take advantage of menus to guide him through complicated routines. What's more, even WordStar employed a menu to handle installation procedures to match the program up with various computers and printers. But that was different from menus that slowed you during your regular work with the program.

Some of the so-called command-driven programs, moreover —at least WordStar—actually did have the option of letting you keep a list of common commands on the screen if you wanted.

Jerry Pournelle, a prominent computer columnist, growled back at the "user friendliness" crowd, saying that their software didn't let ordinary people enjoy the full power of their machines. "It takes a little work to join the micro revolution," he said, "but the rewards can be high."[27] I agreed. You didn't have to learn programming, but you owed it to yourself and your company to make good use of the best software for your job. A user named Alan Scharf had done exactly that—saving his firm $200,000 a year.

Backup:

■ IV, On the Evolution of Software (And a "Perfecter and Perfecter" Program), page 310.

6 Three Software Stories: Motorcycles, Homes, and The $200,000-a-Year Disk

Zzzzzz. I doze off reading lists of the right software for, say, beekeepers or chiropractors. So sorry; I won't cover everyone's programs. Besides, software is evolving. I hate Select now; I may love its future editions. And what about WordStar? Although 2000 offers many improvements over my beloved WordStar 3.3—and I may eventually convert to it—I don't like all the changes.

So don't think specific programs here. Think concepts.

In fact, if possible, don't even think computer concepts. Instead, think business. *Just how could the lessons of the three people in this chapter apply to* yours?

Ed Boland: Accounting

Ed Boland helps run a motorcycle shop, but you'll never find him roaring off on a bike, dodging myopic drivers. "I've got a wife and three kids," he joked. "Scares the hell out of me." It doesn't matter. Boland, a graying, middle-aged accountant, is just as useful to Clinton Cycles as a top mechanic or a crack Suzuki salesman.

Above all, a good controller obviously knows where the money is. He helps his employer avoid unneeded trips to the bank to borrow more. Clinton Cycles, in fact, borrows rarely.

That's one reason why, when U.S. motorcycle sales suffered the economic equivalent of a head-on crash, Clinton survived. The firm even expanded during the early 1980s. Also, years before, owner Don Smolinski had wisely diversified. Clinton Cycles was actually Clinton Cycle and Salvage, Inc., a miniconglomerate with three motorcycle stores and dealings in scrap metal. Sales exceeded several million a year.

But size and complexity weren't pure joy. Boland's accounting software just couldn't handle a holding company and five subsidiaries, not without costly customizing, and nearly a year after computerization, his feelings were still mixed.

"I don't regret the decision," Boland said. But at the time he had spent thousands of dollars more than planned, and he told me, "There's been a few times I would have thrown this computer out the door in a second."

His horror story—even if it eventually turns into a success tale, as it probably will—is instructive. He's good. And he bought his software from a good store. Clinton Computers, in the same Maryland suburb, won top ratings in a consumer guide in the Washington, D.C., area. A software executive, moreover, an outspoken one critical of some other D.C. dealers, praised Clinton.

So a bothersome issue arises. If a $3,800 accounting program doesn't work out easily with good people selling and using it, what happens among mediocre people?

And there is a second point here. Don't expect even the best computer store to serve as your private consultant, intimately familiar with your business; not, at least, unless you're buying a big mini or mainframe from the likes of IBM.

A third point, too, comes through. Don't computerize a multi-million-dollar business without a consultant—at least not if you're running an extra-hairy program like an accounting one—unless you're willing to talk and think computerese or at least take a training course. Accounting software, anyway, just isn't simple and reliable enough yet. Any idiot can flick on a computer and stuff a floppy disk into a drive or crank up a hard disk; most of the time his hardware will work fine, but even the brightest of businessmen may need a consultant to unravel the mysteries of many programs —even "canned," off-the-shelf accounting packages like the one that bedeviled Ed Boland.

A blunt, tough-talking man, Boland himself is no moron. He holds a bachelors degree in accounting, and he's worked for employers ranging from hospitals to restaurant chains, including one where he caught a chef on the take from a supplier.

"Accounting is accounting," he said. "I don't care if it's food or motorcycles. Life exists the same way." Moreover, life is a series of ratios, of intertwining figures. That's how Boland caught the chef. He knew that food costs were normally 20 percent of the company's expenses; two months after the chef's hiring, they were 23 percent, creeping up toward 27 percent, finally. The incident perhaps colored his attitude toward computerization. He would computerize, but not overdo it, not lose himself in tangential statistics, not hire extra clerks to key in data.

"We carry more than seventy thousand new parts *numbers* alone," he said. "Seventy thousand different kinds of screws, bolts, nuts, fenders, rims." But if he couldn't track every single bolt, he at least could work with major numbers like sales figures for various categories.

Normally, for instance, new bike sales and accessories sales went up and down together, and if one of the two had fallen off alone, you could bet that Boland would demand a reason. If

nothing else, computers, by making past information available more quickly, could help him sniff out trouble.

Computerizing, he saw a micro as one way to avoid greedy consultants and their expensive recommendations.

"I've seen too many instances," said Boland, "where businesses paid out $50,000, $60,000 to a consultant who spent six or seven months analyzing computer requirements. Then he'd recommend $50,000 or $150,000 worth of computer equipment." Boland wanted the benefits of the bigger machines without the costs. His goal was to reach the point that a somewhat larger competitor in the D.C. area already had; the rival owned an IBM 34 system with a six-digit price.

"He used to work for IBM fifteen or twenty years ago, before he went into the motorcycle business," Boland said. "He now has just about every one of his salespeople on commission, and he knows exactly what they sell every day. He can tell you where each motorcycle, each piece of inventory, is.

"He can tell you whether it's in a truck, what color it is, where it is, what stage of preparation it's in for delivery. He puts his purchases in the computer with an inventory program. The moment a salesman sells a cycle, the register itself deducts it from inventory. It's a **point-of-sales** system. So theoretically, at the end of the day he knows exactly what he started the day with, what he sold, what he added to it, and what the bottom-line figure is. We'd love to get to that point.

"The likelihood of this happening with us, though, is very low. I don't know if all this detail is necessary. And our business is seasonal, and I don't want too much cash tied up in the system. And what's the sense of keeping instant track of every nut and bolt sold? But we'd love to get the major items in on computer. The motorcycles, for instance. They can easily sell for up to $6,000 apiece, so it's worth it.

"It's a question of software. This competitor has spent more than $100,000 to develop specific software to get what he wants. Now if you've got $100,000 to throw away and want to hire a programmer full time at, say, 0,000 a year, that's fine. Most companies like us can't afford that."

So Boland bought several programs off the shelf from Clinton Computers, including Accounting Plus, which he began trying to use as an electronic general ledger. He ran it on a North Star computer with a 5-megabyte hard disk—a memory device capable of stashing away the equivalent of maybe 2,500 typed pages of information. The North Star system was just a way for him to get his feet wet in computing with a general-ledger program. Boland, though, would switch computers even sooner than expected. The system's memory space wouldn't suffice for the records of his miniconglomerate, and it wasn't easily expandable. And he would have trouble getting the machine repaired as quickly as he needed. Clinton Computers, however good its service department, just could not respond fast enough to suit *his* requirements.

And the software seemed just as major a disappointment, what with the need for complicated customization.

"The biggest problem I ran into at the store," he said of the hardware and software, "was 'We're going to sell you a system that we think will do the job, but not necessarily so.'"

Both the buyer and the seller, in this case, apparently lost the software gamble; they apparently came out on the wrong side of "necessarily." Clinton Computers did not win, because it *isn't* a fly-by-night operation. Boland's name had come to me from none other than Sue Grothoff, who'd sold him the software. She had enough confidence in herself and her store to offer Boland as the source of a "candid" story, and my respect remains, especially after having talked to another business customer, raving happy about her ability to understand his company's software needs.

Boland emphasized that Clinton wasn't out to cheat him. "Sue is a very nice person." And he liked the software expert there, too. "He knows how to change software, but you have one person trying to meet the needs of too many customers. He's spread too thin. Clinton never gave him enough time to get the program running at my business. And we never could seem to get together to get the twelve hours of training they've promised me. To be frank, I think we spent the twelve hours trying to correct the problem I had rather than on training."

Giving Clinton Computer's side, Grothoff said, "Because of changes that Ed wanted in the software, it took longer to adapt the program to meet his needs. And that used up the twelve hours." Evidently, Boland and Grothoff stayed on good terms, because she later sold him a new Kaypro portable for home use.

But with his big computer system at work, Boland—for one reason or another—seems to have suffered more than his share of woes.

"Accounting Plus," said Boland of the software he bought there, "is a very good program, but it was designed for one single company to be subdivided into departments. You could have six departments, everything from sales to used parts, and it will work beautifully. But it wouldn't for what I wanted. It would not treat a motorcycle store, for instance, as a subdivision of a holding company. I could not pull off separate profit and loss statements or separate balance sheets."

Clinton Computers, to its credit, referred Boland to a consultant familiar with the **source code** of Accounting Plus—a part of the program that would enable it to be customized. The consultant took in Boland's North Star computer system as a trade-in. He sold him a Delta microcomputer and TeleVideo terminal in return, along with a hard-disk system upgradable to 70 megabytes. With the software customization included, the cost came to $20,000, minus the $12,000 trade-in. The consultant, like Clinton Computers, didn't know as much about accounting as Boland had hoped. But through sheer tenacity Boland at least got himself a halfway usable program.

"I had the software changed," he said, "so that instead of one company with departments in it, it now reads a holding company with subsidiary companies. The software was changed to print out separate balance sheets and separate income statements for me.

"On the income-statement side this machine will ask me if I want a consolidated or individual by-page income statement. It will print out a holding company and then, in successive order, on each page, the income statement for each company. When I go to the balance sheet, it will ask me that same question.

"If I tell it I want individuals and a consolidated by page, it won't do it. I must ask it individually each time for company one, then company two, right down the line. I have to give the computer individual instructions to do that.

"And that was the best my consultant could do to change the software. It got the job done, but not all the way.

"I've since found out that for $400, not ,800, I could have bought an accounting package that would do exactly the same thing I wanted."

So why didn't he buy it?

"Why spend another $400 to delve into it further and then find out *it* isn't what you wanted?" Boland asked. "I think it's stupid to spend money at this point. I have a system I know I can make work within certain limits. I'm still in the learning phase, and I'll probably still be there for another year, for all I know." I thought he was too patient. If his software system was a dog—perhaps not for everyone but for him—he should change it. Four hundred dollars was a pittance compared to Boland's total investment of $20,000.

Ideally, too, as he said himself, he would have gone to a consultant in the first place, not just any consultant but one familiar with accounting. And yet it's understandable why he acted as he did. Why repeat the mistakes he'd seen at other companies? Why not frugality? Better to be out $20,000 than $50,000 or $100,000 after paying for a mini, a consultant, and the other trimmings. His computer wasn't making or saving buckets of money for Clinton Cycle and Salvage as of early 1983; but it might in the future as he got his software under control and could, for instance, easily put salesmen on commission.

He told me, moreover, that he would soon stop farming out the company payroll—up to seventy people—to a computer firm. He also was mastering an electronic spreadsheet. He did not plan an accounts receivable program, because Clinton Cycle collected quickly through checks and credit cards, but an accounts payable one was in the offing.

"It's going to give me the companies' names, the payment terms, the volume I deal with them each month," Boland said. "It will flag when the bills are due, and it will also generate checks."

He was also going to crank up a mailing-list program, using a list of all buyers of new bikes within the last three years—a sensible project, considering the market for accessories and repeat sales. Obviously, here, as in other applications, the more information built up on his hard disk, the more his machines would justify the $20,000 investment. The benefits of computerization for Edward Boland might not be immediately dramatic, but with his stick-to-itiveness, sooner or later they'd almost surely come. Boland's battles with computers were to continue. When I caught up with him in spring 1984, he said he'd bought yet another computer system.

Charlie Bowie: Data Base and Spreadsheet

Remember the customer who was raving happy about his software—also bought from Sue Grothoff at Clinton Computers?

That's Charlie Bowie, who, when we first talked, was a vice-president of Washington Homes and manager of its Southern Division. He told me he expected two Zenith micros to save his company perhaps as much as $50,000 a year, maybe more.

In just one month, in fact, his $5,000 computer had already saved the equivalent of thousands of dollars in executive man-hours.

Even before he and I met, his assistant, behind his back, was singing praises of her boss and their new machine. "I wanted to learn word processing," said Julie Grimes, a young, blond woman who could have been the secretary in the IBM commercials saying the advertised product was "a piece of cake" to master.

Gazing at the Zenith—which she and Bowie use for data-base work, spreadsheets, and some word processing—she said: "It really comes in handy.... We were both worried. Charlie told me, 'Don't worry. We'll teach each other.'"

Bowie by now was in the room, and it was immediately clear he'd won her respect through his brains and dedication, not through the normal trappings of executivedom. He was bearded. He wore a sweater and heavy boots and wire-rimmed glasses. He plainly was the construction industry's version of the proverbial shirt-sleeves manager. He must loathe paperwork, prefer the field to the executive suite, even if he was a vice-president of a publicly owned real estate company with twelve hundred stockholders. He was in his mid-thirties. That wasn't so much younger than Ed Boland, who himself, interviewed on a Saturday, had worn casual clothes. And yet the two somehow came across as being on opposite sides of the generation gap that all the pundits were babbling about during Vietnam. I could imagine Boland watching *M*A*S*H*; I could imagine Bowie, in the right setting, being a mild

version of Hawkeye. He wouldn't necessarily do things the traditional way, but in the end no one would care, because whatever it was, he'd succeed. Ed Boland was a man with a fondness for constants—a characteristic that in his profession had served him well. Charlie Bowie, I sensed, enjoyed surprises and change.

Bowie's company, like Boland's, had to be good to have survived so long in a boom-and-bust industry. Everyone needs transportation, everyone needs housing; everyone does *not* need recreational motorcycles or *new* homes. Across the country, home sales had plummeted at the start of the 1980s. Washington Homes' sales had been almost $30 million in 1980 but just half that two years later.

Yet Bowie's company had survived the ups and downs since 1965. The management philosophy struck me as the same as Clinton Cycles—the lean, mean school. It was early 1983 when we first talked. Another housing boom seemed ready to explode, and Bowie was working a sixty-five-hour week, "because we've gotten very busy, very quickly, and we haven't built up our staff rapidly. It's hard to find qualified people, and we don't know whether the recovery's here to stay." Small wonder that he welcomed his computer as a sort of financial radar—an early warning system that would buzz before the bombs fell.

Washington Homes was a general contractor. In other words, it was just as much in the management and budget business as the building business.

Bowie and his company didn't hire laborers, didn't buy every nail and brick. Rather, they farmed out the construction to subcontractors, some of whom, if not policed, could wreak havoc on Washington Homes by, say, finishing work late.

You can't do plumbing and the electrical wiring, normally, if the walls aren't up yet. You've got to keep your invisible assembly line moving. The sixty phases on Bowie's "House budget summary" started with items like "Engineering" and "Water Sewer Charge," continued through "Brick Veneer" and "Siding" and went on to such details as "Fences" and "Trash Removal." If Bowie was late in submitting bids or getting what he paid for, it wasn't a bureaucratic abstraction. It meant a late house, an unhappy customer, perhaps, and above all,

more interest to pay the bank on Washington Homes' construction loans.

Bowie, moreover, had to keep track of his customer's own financing arrangements. The company's houses sold for anywhere from $55,000 to $135,000, but most customers were first timers who had never before wended their ways through the mortgage maze. Bowie could reduce his company's carrying charges if he didn't rush homes to completion before the customers were ready for them.

"We don't make any money until we deliver the house," he said, "so we need to keep track of the time between when people contract and make application with a lender and how long it takes for them to win loan approval.

"When our company had ninety or a hundred houses and was backlogged, it was fairly easy to do manually. But now we have almost five hundred houses in our backlog."

Shopping around for a system to handle all those grubby details, Bowie found that computer stores didn't treat their first-time buyers as well as he wanted to treat his. "I looked at computers for a year," he said, "and the biggest thing I found was the condescending attitude of the people in the sales centers to someone who knows nothing about it.

"I'd walk into a store and give them a written list of my requirements, and the first thing they'd tell me was 'Your requirements are wrong.' And that was the case until I got to Clinton Computers."

Bowie showed Sue Grothoff, the sales rep, his sixty-phase budget sheet—a basic common-sense rule of software and hardware shopping. If you're working with documents, at least nonconfidential ones, then *show* them! Do so to a store. Do so to a consultant if you have one. Explain as clearly as you can just what kind of paperwork you're computerizing. Here, incidentally, you can't compare Bowie and Boland in an apple-to-apple way. Accounting programs can be much trickier than data bases and spreadsheets, especially for companies with unusual circumstances like Boland's—that is, all those subsidiaries in a small-to-medium business. It's clear, though, that whatever happened, Grothoff and Bowie communicated much better than she and Boland.

"At this point," said Bowie, "I was only interested in loan processing and budgets, and the main thing I was interested in was budgets."

He thought he needed above all an electronic spreadsheet. Here, however, for once, a computer sales rep knew his needs better than he did. Grothoff persuaded him that most of all he needed a **data-base** program—one that would help him track loans on hundreds of houses. It would store information and rearrange it in patterns he needed. He might not want full copies of all loan-processing reports, for example. Instead, he might want just the names of the home buyers, say, or just the foundation costs of each house. Or he might want the program to tote up all the foundation costs or perform other arithmetic, including complicated multiplication and division or calculation of ratios and percentages. And with a program like dBASE II that's possible. Like many of its rivals, it will do some complex calculations, not just shuffle facts around. There are many books on dBASE II—yet another advantage and indication of its popularity. (Two good choices are *dBASE II User's Guide* by Adam B. Green and *Everyman's Database Primer featuring dBASE II* by Robert Byers.)

Here are some ways in which dBASE II might organize your records if you're an executive like Bowie:

1. The CREATE command lets you begin a **file**.
2. A file in a data base is the electronic version of a file drawer or cabinet. It's just the space on the disks holding **records**—say, the house-budget summaries for your homes.
3. A **field** is a category of fact like the amount of money spent on each air-conditioning system for each house.
4. **Structure** is simply the way a record is set up. There are three big considerations—the **field names**, the **field width**, and the **field type**. The field name is simply a field's title. The field width is the number of spaces required for the information in each field. The field type can be one of these categories:
   a. A **numeric field**—just numbers
   b. A **character field** or **alphanumeric field**—numbers, letters, question marks, miscellaneous symbols like "@," or spaces between letters or numbers

c. A **logical field**—one with just two choices, like "Y" for "Yes" and "N" for "No"

5. The EDIT command changes the contents of a data field. You can type in modifications after putting your cursor in the right place.
6. A command to APPEND can add new records to your electronic filing cabinet.
7. **Sorting** lets you reshuffle records alphabetically, by date or other ways, just as you would index cards.
8. The LIST command tells dBASE II to flash across the screen the records that you specify.
9. .AND. helps you narrow down the information you're looking for or changing. Consider this hypothetical example: LIST FOR SALE:PERSN = 'BABBITT' .AND. LOAN:AMT = '$70,000' would guide you to all houses that a sales rep named Babbitt sold to a customer borrowing exactly $70,000.
10. .OR. is another way to describe the desired facts. LIST FOR SALE:PERSN = 'BABBITT' .OR. LOAN:AMT = '$70,000' would indicate you wanted to see records involving either Babbitt or a loan of $70,000.
11. LIST FOR .NOT. SALE:PERSN = 'BABBITT' could help weed from view, or the files, all records involving Babbitt.
12. **Command files** are programs that tell the machine how to manipulate the data so you needn't repeat complicated procedures one by one. You might work out these files to simplify your secretary's work—or he or she might do the same for you.

Bowie and Grimes mastered dBASE II basics in eight hours of classes at Clinton Computer. "dBASE II was real easy," he said. "The manual is in plain English. Even without all our records in the computer now, it saves me and Julie probably five or six hours a week. We were doing it manually before, and we're on the verge of saving other people in the company lots of time with the loan processing by using dBASE II. I think we'd have to say with five hundred houses in our backlog there is the potential for this to save us $50,000 a year in carrying charges that may have accrued under the old system of keeping loan-processing records.

"We are going to buy another machine," Bowie said, "for the Northern Division."

The potential $50,000 annual savings from the two machines, by the way, would include just reductions in carrying charges—not in executive time or tasks besides loan processing. Consider the economies that would result simply from less paperwork.

"When we first set up the computer," Bowie said, "we set it up exactly like we were doing things manually. As a division manager, I'm in charge of marketing and production. And earlier we had (1) marketing reports, (2) production reports, and (3) reports combining highlights of each for me to determine whether to start houses and things like that. But now all three categories appear on one loan-processing form."

dBASE II (or the new dBASE III) may not work for you. But for Bowie it was a dream program through which he could store and retrieve records quickly and conveniently for any one of many purposes. He might set up his records mainly for loan processing. But the "SALE:PERSN" field, combined with the "SALE:PRICE" one, could tell him which outside sales reps were selling the most expensive homes. In other words, the loan-processing data base was one good way to keep track of the salesmen catering most successfully to the $135,000 buyers. For who cared what Bowie called his data base —"Loan Processing" or "Sales"? The point is, he could follow the salesmen's performance, too, through cross-references between fields. dBASE II was a treasure trove of information about trends, sales, or otherwise.

"The problem," said Bowie, "is that dBASE II would work fine with my budget summaries for my houses, except they require sixty fields and dBASE II is limited to thirty-two. So Sue suggested the Multiplan spreadsheet program. Multiplan is easy to use, even easier than dBASE II. Julie got started with Multiplan with just fifteen minutes of instruction."

Multiplan works on the same idea as the better-known VisiCalc program, which, like WordStar, has sold hundreds and hundreds of thousands of copies.

The true origins of these spreadsheets go back to 1978. A Harvard MBA student disliked the tedium of using a calculator to tote up columns and rows of interrelated numbers; it was

boring even with a pocket calculator. A change in just one number could throw off dozens of other entries, so imagine the brain-numbing effect of making an error and then having to recalculate an entire spreadsheet. Why not write a computer program to alter all the other variables if one changed?

And so was born the electronic spreadsheet; it and word processing are the single most popular uses of microcomputers —the real justifications for their existence. A VisiCalc-type spreadsheet can add, subtract, multiply, average, do partial sums, find minimums, maximums, simplify your life in a number of ways.

A description of VisiCalc in *CPA Micro Report* ticks off an awesome number of applications: "sales forecasts, profit and loss statements, rate-of-return calculations, project scheduling, tax calculation, pricing strategies, financial planning, loan amortization, league standings and report generation." An electronic spreadsheet can help do your checkbook; or it can assist in the preparation of a small country's budget—which, in fact, has happened.

Some even say that spreadsheets are contributing to the paperwork deluging American business. VisiCalc coauthor Dan Bricklin disagrees. "A lot of calculations," he said of the pre-VisiCalc days, "were being done on the backs of envelopes or corners of envelopes or the corners of newspapers. VisiCalc isn't causing people to produce more numbers and reports. Those numbers were always there, but they weren't always being identified."[28]

"Multiplan is incredible," Bowie said of his VisiCalc-style software. "I have generated budgets to see if they'll do all I want them to, to consider all the what ifs.

"And it's a big help in scheduling production. We have a factory producing cabinets for our homes, and our scheduling system is critical, since at most it can produce cabinets for only fifteen units a week." The cabinet plant manager, caught between the demands of Washington Homes' northern and southern divisions, had scheduled production according to his own whims.

"It was costing us a lot of money in missed settlements," said Bowie, "and cabinets were not delivered, or they were the wrong color and size." He was talking in late February, telling

how, the other day, he had loaded in thirty-five more cabinet orders and instantly learned "we were out to April 15 on cabinet deliveries. That's the soonest we could get them based on the plant's production capabilities. I'm meeting with the manager this morning to see if in the future he can up his output. I've found that everybody's got to live with lead times. Everybody's got to give us the right lead time on orders, which means we are now ordering cabinets for delivery at the end of April and May, where we generally in the past would not have ordered May delivery until April. If I miss five house deliveries in a month because of cabinets not being there on time, then that's ,000 to $5,000 in carrying charges over the next three to five months."

Similarly, Multiplan was probably saving Bowie several thousand dollars more over the same period by "identifying houses not started because building permits have not been issued. And it will help identify the reasons why they haven't been.

"To get a building permit, all sorts of things must fall into place. And now we can look at any particular job at any particular time, and if we see it isn't started, find out why the permit hasn't been issued.

"We can determine if we're waiting for site plans or a plumbing permit or electrical permit or whatever it happened to be and instantly target and solve that problem.

"Before, the record keeping was 'Go get a permit. Have you got it yet?' There were no details, no backup. We relied on our field people to get the permits, and they would get the permits in a way that was timely for them and their production schemes but not in a way that was timely for us in bottom-line deliveries. So we are now able to target all the permit process and make it happen at our rate." Not only was Bowie using Multiplan as a spreadsheet to plug in all the what ifs; he was also using it as a data base, even if it wasn't as nimble in manipulating nonnumeric data as dBASE II could be.

Whatever chore Bowie was using Multiplan for, he loved the "Help" screens. He could turn them on to guide himself through the commands he wasn't familiar with; besides, all of Multiplan's basic commands were normally at the bottom of the screen, anyway.

Multiplan, by the time you're reading this, may not be the best spreadsheet on the market, at least not for you. But at one point *CPA Micro Report* was pronouncing it the "new Empress of Spreadsheets" for accountants using a wide range of computers. Multiplan even worked with VisiCalc files so that users of the older program could easily convert.

"Multiplan," said *Micro Report*, "... can sort a line-by-line record of events by account number or name—a frequent requirement in CPA applications." Keepers of expense accounts, presumably, could cherish such a capability. Also, Multiplan, as the newsletter pointed out, lets you name your variables; you could refer more easily to the **cells** or the exact locations in the columns and rows. Instead of saying cells "A26" or "R38P," you could refer to "Sales" and "Total Costs."

With programs like Multiplan, software designers are more successfully catering to the needs of businesspeople who want computers to adjust to them rather than the other way around. That's how it should be. Bowie is a construction executive, not a computer expert, and Boland's an accountant rather than a hacker.

Bowie, however, plainly seemed more willing to live with the complexities of existing software. Many in his place would have used a consultant—and wisely, I think, for Washington Homes was a multimillion-dollar operation—yet Bowie had the background and patience to computerize just with guidance from a store. He might not have been a computer expert. But he loved the new. He loved complexity if he could logically unravel it. He didn't mind mistakes. He felt in control because he had backups on disk and on paper. The manuals didn't scare him. Instead of soaking up every word there, Bowie, like Seymour Rubinstein, had a gift for knowing which page to flip to if he had trouble. Bowie was a born micro user. However serious about his job, he might as well have been a child relaxing after school with a few rounds of Pac-Man. He loved seeing instant cause-and-effect relationships. He took as much delight in learning where his division could be six months hence as a child might take in winning an arcade game. He considered his computer "the greatest therapy in the world," an

opportunity to “sit down and feel really good” in “a fairly high tension business.”

Edward Boland, too, however, in a different, more structured way, was curious about numbers and life, and in the end, I suspect, the two men’s learning styles didn’t entirely explain their opinions of their programs. Bolands’ general-ledger software just wasn’t right for his needs. It straitjacketed him. Bowie’s programs, on the other hand, helped him do just about anything he wanted.

“Anything,” incidentally, included advancing his career. When I next caught up with him, in May 1984, he was president of another construction firm and owned one-third of that company and was taking home a paycheck thirty-five percent bigger. Bowie said his computer skills “had a great deal to do with it. I had management tools that not very many other people had.”

Alan Scharf: Integrated Program, Including Graphics

Alan Scharf, a forty-three-year-old New York executive, also has a nice touch with software—a good-enough one, in fact, to have helped win him a job at a blue-chip firm at triple his old salary.

"It's done wonders for my earning power," he said from his offices at Merrill Lynch Leasing, Inc., where he was a $75,000-a-year assistant vice-president. "I got this job because I walked in and told them I could do a better job on an Apple.

"I didn't own one at home at the time. But you can be sure that I bought one promptly and boned up on it for the next three weeks, and of course I'd done a lot of research on the Apple before then to make sure I could deliver on my promise.

"My previous company had refused to let me get one to improve operations there and do estate taxes. I had to do them by hand on a calculator. It took hours per client. And I got mad. Most people my age are afraid of computers, but I'd worked with word processors. And what are word processors but another kind of computer?"

So Scharf left his job as an estate tax planner with a staid old brokerage firm and set up shop at Merrill Lynch's division dealing with real estate and equipment leasing.

It was a VisiCalc devotee's dream job, one calling for quick, repetitive, accurate math in deals as big as $150 million. Merrill Lynch Leasing made bids to companies hungry for better cash flow. The leasing company (and rivals) offered to buy their headquarters buildings or other real estate, freeing the money for bigger factories or research and development. It was a series of leaseback arrangements. Merrill Lynch organized syndicates for the ultimate buyers—people or companies eager for tax shelters. And that meant more than a little numbers crunching.

Imagine the variables. The deals had to be sexy enough to the selling companies for Merrill Lynch to win the bids. At the same time, the tax shelters couldn't leak. The deals must provide the buyers with the write-offs that the prospectuses

from the leasing company promised. Ideally, too, they would yield maximum tax advantages on minimum investments. And for investments of different sizes and at different tax rates, just what would the various benefits be?

When Scharf reported for work, he found that the real estate department of the leasing company was on the verge of spending $200,000 a year tapping into an outside firm's computer to come up with the right numbers. The big machine would have been able to do simple debt-amortization calculations. Scharf could have told a company, for instance, how long it would take to pay off a mortgage on a building for which Merrill Lynch proposed a leaseback. But that was only a small part of what the job needed. And what about the costs?

So Scharf instead used an Apple system costing less than $7,000, a one-time investment. The Apple couldn't do all the calculations needed, but it could actually outperform the time-sharing system in some ways.

Consider simultaneous equations. The software on big machines—at least by way of the terminals at Merrill Lynch Leasing—just didn't include them. But the Apple could simulate this capability. With the VisiCalc spreadsheet it could juggle around dozens of interrelated statistics, using nightmarishly elaborate algebra with Catch-22-like mathematical spirals. In other words, you wanted to know the value of *x*, and it depended on the value of *y* and *z*, and you couldn't solve for *y* until you solved *z*, and you couldn't solve for *z* until you knew *x*. That's how it worked, except, quite possibly, Scharf and his staff would be wrestling with, say, *a* through *k* instead of just *x* through *z*.

Struggling with these Catch-22s, the Apple was a slowpoke by computer standards. It still took half an hour. That might seem like the Indy 500 to someone accustomed to hand calculations. But Scharf must have felt the same way I did about inferior word-processing software. However faster than without a computer, it still limited your possibilities. You didn't have as much time to experiment with all your choices. And the more time Scharf had, the more closely he could consider all the variables and the more attractive could be Merrill Lynch's leaseback bids. The Apple did its job. "We used it to compete successfully for work with a number of

well-known clients," Scharf said. "Anheuser Busch—we did their office building in St. Louis. We worked with Beneficial Corporation. We've done a number of K mart stores."

Scharf, never smug, still tinkered with the Apple and its software. An observant computer dealer noticed he would keep asking for larger RAM boards to allow him to do bigger, fancier spreadsheets.

And so it was that the dealer nominated Scharf a tester for Lotus 1-2-3 in late summer 1982. 1-2-3 was the new **integrated software** from Lotus Development Corporation, a Massachusetts firm started by a former rock disk jockey rich with $500,000 in royalties from programs sold to the makers of VisiCalc.

1-2-3 combined a spreadsheet, graphics, and data base. You could, for instance, pump figures from the spreadsheet program directly into the data base with a few simple keystrokes. You didn't have to go through unwieldy computer rigamarole to transfer facts from one kind of electronic file to another. More important, however, Lotus, at least for Scharf's use, was a more powerful numbers cruncher than the VisiCalc he ran on his Apple. Lotus was for the 16-bit IBM PC. Sixteen-bit machines were speed demons for numbers crunchers, especially with powerful programs like 1-2-3. An Apple-VisiCalc duo handled worksheets with 254 rows and about 65 columns. But an IBM and 1-2-3 duo could take on 2,048 rows and 256 columns.

Scharf's first test version of 1-2-3 cracked simultaneous equations in four minutes, one-tenth the time that the Apple-VisiCalc combination took. Income and cash-flow statements came out calculated to the nearest penny.

■ ■ ■

Alan Scharf's Tips on Choosing the Right Spreadsheet

Not every spreadsheet user has needs as complex as those of Alan Scharf, a whiz with Lotus 1-2-3 and Symphony, but here are traits he says you might look for:

1. A large number of rows and columns. A spreadsheet of 254 rows and 65 columns doesn't mean you can work with 254 rows *and* 65 columns containing a total of 16,510 cells. The actual number of cells—the number of columns multiplied by rows—will be only about a thousand. A 640K-RAM machine and an elaborate spreadsheet would be much more appropriate for budget planners in a large corporation with many products and divisions.
2. Speed. "Even with a simple spreadsheet," says Scharf, "someone might get annoyed if it seemed to drag." In late 1984 his complex calculations on an IBM PC were taking as much as four and one-half minutes. And he said: "There are times when I just need the answers faster." The powerful IBM AT could run the present version of Lotus 1-2-3 twice as fast. However, he was still looking forward to the day when a version of Lotus 1-2-3 for the AT would require even less time and address the full 3 megabytes of memory (aided by a new operating system). Consult micro magazines for the latest speed comparisons.
3. General simplicity and ease of use. In tricky places, does the program offer "help" messages in plain English to guide you through various procedures if you want? Ease of use will increase as computer memories grow larger and leave more room for "help" features.
4. Range of commands. Most spreadsheets nowadays let you easily move or copy numbers. But there are less common but very useful commands. Symphony, for instance, lets you flush out formulas behind calculated cells so you can regain available memory space.
5. The ability to do what-if tables. The best spreadsheets won't just tell you what your profits would be if your costs increased by *x* amount. They'll also let you calculate for a whole range of numbers around *x*, automatically creating a table.
6. Easy consolidation of figures from different spreadsheets. That's no small matter if you're trying to come up with a profit and loss statement for a twenty-

division company. Lotus 1-2-3, unlike some rivals, lets you consolidate an unlimited number of divisions.

7. **Natural order of recalculation.** Cells must influence the numbers in other cells in a precise sequence if some calculations are to be accurate. Natural order of recalculation helps you automatically control that sequence.
8. A useful **macro language**. Macros are combinations of commands that you can program into your computer to reduce the number of keystrokes and save time. A macro language systematizes these shortcuts.

■ ■ ■

He could use 1-2-3 in the future, moreover, as a data base with up to 32 fields and up to two thousand records, and it did allthe basic search and sorting that you'd have in other data-base systems. At the time I talked to him, the names and addresses of investors—receiving quarterly income reports—were still stored on an Apple. Scharf was waiting for the right word processor-mailer to come along to work with the 1-2-3. Then the massive retyping job for the address lists would be worthwhile. With space for two thousand names, 1-2-3 would be much more useful than just a small filer. It wouldn't be just a primitive record-keeping system with limited capacity.

Meanwhile, for Scharf, graphics was a snap. "If I send out a thirty-page bid, I do three or four graphs with it," Scharf said. "We have a selling job to do with both the potential corporate leasees and the potential inventors. The presentations are complex, and the graphics come in very handy. We use line graphs and bar graphs showing the expense of lease payments versus mortgage payments if they went out and mortgaged the properties conventionally. The minimum terms of the leases are usually twenty-five years; it's a huge numbers-crunching job, and we try to simplify everything as much as we can. I come up with the figures on the spreadsheet part of 1-2-3. Then I tell what I want on the graph. Maybe I want to make a line for the rental income, interest expense, depreciation, or taxable income. So I select the appropriate columns on the spreadsheet. Then I push 'V' for 'View,' and I can see my

work instantly as a graph. If I don't like it, I can quickly redo my calculations and look at the graph again.

"And 1-2-3 offers a tremendous range of printing options. You can specify how many rows you want per page. You can tell if you want border lines separating some numbers and titles of columns. You can tell if you want a header—can indicate the subject on each page.

"The printout can be in any one of several type styles on dot-matrix machines. Or you can use a daisy wheel with its own typewriter-style print.

"And you can do color. A colleague uses plotters." Controlled by the IBMs and Lotus 1-2-3, ballpoint pens, with different colors, wriggle up and down. They can make bars as well as line graphs, and pies, too, among others.

Not that Lotus was the answer for everyone. *Soft.letter*, Jeffrey Tarter's trade publication, noted that all integrated programs compromised in some way and were the software version of a Swiss army knife. "Swiss army knives are nifty gadgets; we've got several ourselves," said *Soft.letter*, "but we don't use them much. Instead, we use specialized tools for specialized tasks—screw-drivers for poking around inside the Apple, a stand-alone cork-screw for uncorking the Chablis, and a nice big carbon steel blade for carving roast beef. Each of these tools does its specific job better than the multipurpose tool."

At least in the version available as of this writing—listing for $495—Lotus 1-2-3 didn't have a real word processor. You could write paragraphs. But it lacked the speed of true word processors and was awkward. Nor did it offer communications software to use with a modem. Context MBA, a rival integrated program, did. But then MBA's spreadsheet module wasn't nearly as fierce a numbers cruncher as 1-2-3's was.

Lotus planned to improve 1-2-3's text-processing ability—which it did, ultimately, along with the data base, graphics, and spreadsheet capabilities of a super-1-2-3 called Symphony. The new program, unlike 1-2-3, also let you talk to other computers.

At Merrill Lynch Leasing, however, Scharf hadn't any need to reach a mainframe for his calculations. His four IBMs with 1-2-3 were doing the work. They had cost $40,000, including

extras like printers; except for service, that was it. What's more, with four people, Scharf said, he was tackling the same work load that eight people were handling in a similar office on the equipment-leasing side of the operation.

Months later I reached Scharf to find out if his career was still in ascent. "I'm now a vice-president," he said. His salary had broken the six-figure barrier, and he was hoping for a still more lucrative job there or with another firm.

It was a good fit, Scharf and his software. He had the best program for *him*. "Most people would rather talk about hardware," he said. "I know hardware, but I'd rather discuss software." He had a point. Especially now, when there are so many clones of various IBM micros, you'll find that good software will give you an edge on your competition.

You can also gain an advantage by experimenting with new *types* of programs. The next chapter discusses graphics, which, after many years, is at last becoming practical for owners of inexpensive micros.

Backups:

■ V, "3-D" Versus Mail-Order Software—and How to Shop, page 319.

■ VI, "Easy" Data Bases: Another View (Mensa Member Versus InfoStar), page 323.

7 Graphics (or How a Mouse Helped Joe Shelton's Friends Stop Feeling Like Rats)

When a California executive invited people to his apartment, they often ended up feeling like rats in a laboratory maze.

"I had people driving around for half an hour and find a phone and say, 'Come on over and get me,'" says Joe Shelton.

In recent years, however, the "hit rate" for finding Joe's place has jumped from 50 percent to over 95, and computer graphics is the reason.

Joe's neat little map shows a mile-square area with up to five turns *before* you even start wending your way through the complex of 150 units. He isn't an artist. But he uses a Macintosh computer.

With the Mac's famous "mouse"—the pointer device that Joe rolls along his desk to move the cursor—he can effortlessly make sketches.

Granted, Joe isn't detached about Mac's virtues, not as a $50,000-a-year software products manager with Apple Computer! And this particular example is trivial. It's also, however, irresistible. And the story indeed shows how graphics can ease the life of a corporate manager. People also use computer-drawn maps for, say, directing colleagues to meetings in new places.

The easier-to-use graphics programs—like MacPaint—are to art what word processing is to writing. They won't turn you into Picasso. But they'll make your sketches and designs look less like your kindergartner's.

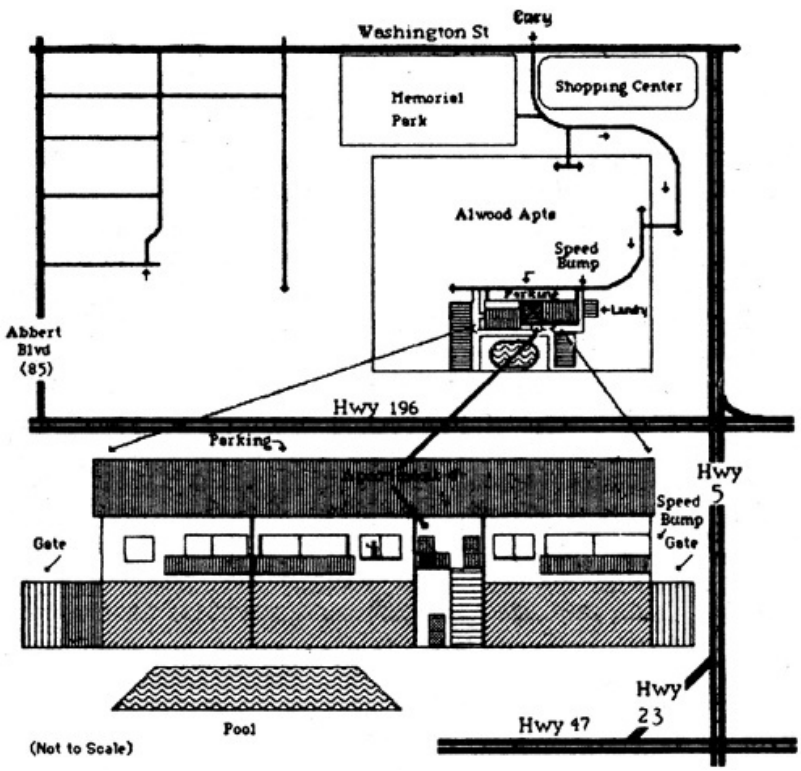
"But I can't even draw a straight line," you protest.

Well, Mac-style graphics programs will help you electronically pick a line out. Or a circle. Or a rectangle. You also, of course, can control the sizes and locations of the shapes you select. And you can choose shading. And vary its

intensity. And you can also use exotic type styles and even design your own type.

By letting you zap mistakes, without messy erasures, computer graphics may eventually halve the time it takes for you to do a complicated drawing.

Directions: Turn onto Cary Avenue. Follow Cary around left and then right bends for at least .3 mile from Washington St and turn into apartment entrance on right. Make immediate left turn and continue until you cross speed bump. Park in any uncovered space on left. Apartment 4 is upstairs in the middle on the other side of the building.



Would you feel like rat in a maze if you had a map like this to guide you to Apple executive Joe Shelton's house? Indeed you would. Lest anyone mistake Joe for Customer Support, the map doesn't contain his actual address.

Of course there'll always be resistance to graphics from some hard-core bureaucrats in and out of government.

"The Macintosh," gripes one, "takes us back to the time people were drawing pictures on cave walls."

He'll tolerate *some* graphics but loves to read and write twenty-page memos.

And if I were an executive, I myself would growl if my people insisted on Macs just so they could use Old English characters for routine paperwork. In fact, for that, I'd rather work with a Kaypro or a mouseless IBM PC.

"For the world of letters and numbers a computer without a mouse would be better," says James Fallows, the *Atlantic Monthly*'s Washington editor, who tried a Mac for several weeks but happily returned to a machine with WordStar. He and I are baffled. We can't understand the Mac's lack of cursor keys. Why couldn't Apple have kindly let Mac users move the cursor conventionally on the screen if they wanted? Omitting the cursor keys was IBM-style arrogance, no ifs or buts. Even if cursor keys become available on a numbers pad, it won't be the same as having them in a convenient location on the main keyboard.

But graphics? That's where the Mac and similar machines may pay off for people with overscheduled art departments or an honest willingness to experiment:

- A California designer can draw a hot-water system for an outdoor car wash in just four hours, thanks to his Mac; once it took him days.
- A Washington state man uses his Macintosh to design optimal orchard layouts.
- Another user lays out the Yellow Pages with his Macintosh, while still another employs one to plan paintings.[29]

Advertising agencies, especially, may benefit from computer graphics even if the Mac-priced technology still has some flaws. Take one example. Just after a Colorado agency bought a Mac, a bank wanted an ad saying that it gave personal service—that its customers were more than computer numbers. But how to get the idea on paper?

"I suggested that the bank use a computer for the ad," said Rebecca Glesener, assistant art director of Heisley Design and

Advertising, a twenty-five-person agency in Colorado Springs. The bank agreed.

Using a Macintosh, a Heisley artist drew a man and woman with masses of numbers on their faces.

"If your bank sees you this way," the ad said, "come see us."

Western National Banks loved the results. And when I talked to Glesener, her agency was about to unleash another Mac-drawn ad—the machine's "self-portrait"—for an Apple dealer.

"We have several clients in the computer business," Glesener said, "and we thought we should be aware of computers."

Of course you don't start instantly doing first-class graphics work on Mac-like machines. Take the man drawing the Western ad. He had "no computer skills" in his background, and he toyed around with the Mac for some six hours or so before he did the numbers heads for the bank.

With the art stashed away on computer disks, though, the Heisley agency could more easily crank out different versions of the same drawing.

It's like word processing. Once you've stored your material on your computer disk, you needn't start over from step one.

Mac-like machines may also streamline ad agencies' mock-up work. Through the marvels of graphics an art director can more easily figure out the best location for Brooke Shields's derriere in a jeans layout.

In fact, the Heisley people said they had used Mac successfully on drafts of a sales brochure and an ad for the U.S. Amateur Hockey Association.

Even so, Don Pierce, the artist behind the bank ad, warns: "Inexpensive machines like the Mac can't come up with drawings good enough for final ads without a deliberate computer effect. A line other than a forty-five-degree line can be pretty ragged because the machine makes them in steps." And they lack a good-enough resolution to downplay the roughness.

Eventually, of course—through high-quality graphics made on laser printers—cheap machines may turn out slick ads that don't scream, "A computer made me!"

Meanwhile, Mac-like computers will do fine for drafts and nonpublished work. Already, when hooked up right to some Compugraphic typesetting machinery, Mac's sister computer Lisa II can turn out seamless charts for publication.

Who else might use computer graphics? Some examples:

A SALES REP (OR BROCHURE DESIGNER)

Computer graphics would help you simplify a complicated brochure in which twenty statistics proved the superiority of your company's industrial dishwasher to Brand X's.

There's no question—graphics can liven up otherwise dull data, and remember: if people don't read, there's less chance they'll *buy*. In that sense, sales literature isn't so different from a newspaper. Again, though, bear in mind that the inexpensive computers may not produce graphics of professional smoothness.

A CORPORATE TRAINING OFFICIAL OR TEACHER

You can Xerox your Mac-drawn pictures of a widget maker or Mayan artifacts—perhaps even include them in test papers. And you or your audiovisual specialist can even prepare overhead slides by photocopying the drawings onto clear plastic sheets.

A BUREAUCRAT

The same slide technique could be a relief to bureaucrats preparing low- or mid-level briefing.

A PERSONNEL OR DIVISION MANAGER

What a boon to the addicted drafters of personnel charts!

Now, there's a dark side to this. I have a good friend at the Department of Housing and Urban Development named Al Ripskis.[30] "They're *reorganizing* again," he groans from time to time. It's a waste of good tax money in Al's opinion. The faces and desks change; the bungling remains.

Shelton, though, says the better companies thrive on fluidity, and in Silicon Valley he may be right. It depends on your outfit's style of management. Don't play computer games with your people, however, just because the machines make it easier to play musical chairs.

AN ARCHITECT

Microcomputer graphics might be just the ticket for rough sketches. In fact, on a sophisticated machine, the computer graphics would do for the final version.

Who knows? An architect someday might carry around a little computer the size of a sketch pad and do designs to be fed into a larger machine for the detail work.

A PRODUCT DESIGNER

If I were one, I'd leap at the chance to try computer-aided graphics. Sooner or later, American industry will make widespread use of machines that automatically turn drawings into real frying pans, soap bars, or refrigerator cabinets. Well, it won't be *that* simple. But computer graphics and related technologies will increasingly blur the line between creative types and production people.

Just look at the newspaper industry. Reporters, after all, on most daily papers are basically setting the type for their stories as they tap them out.

But back to the factory. The jargon is **computer-aided design/computer-aided manufacturing** or **CAD/CAM**.

A FACILITIES MANAGER

Working on the floor layout for offices that your company will rent? Computer graphics could be just right in this era of instant partitions.

A CONVENTION PLANNER

What better way to juggle around the positions of various booths on your charts?

A CORPORATE PLANNER

(AND MANY OTHER EXECUTIVES)

Building nuclear submarines, you might worry about your keel before your propeller shaft. An overgeneralization, maybe. But that's how a defense contractor hit on the need for **Project Evaluation Review Techniques** (**PERT**) software.

Charlie Bowie—the home construction executive in the last chapter who worried about his basements before his floors—might have used a PERT-style program with graphics to keep up with his priorities.

"With PERT programs," says Shelton, "you can graphically draw important relationships: 'This has to be done before this starts.' Or, 'Both of these have to be done before the other thing starts.' Or, 'This can wait while the others are done.'"

A more complex PERT can help you juggle priorities of two hundred or so projects. "It's a capability magnifier," admits even my friend the hard-core bureaucrat. "PERT charting by hand takes ten times as long as a computer. You can wear holes in the paper—erasing mistakes—if you do it by hand."

Hearing of PERT, I recalled the Case of The Missing Cafeteria. The taxpayers were supposed to get a cafeteria—worth maybe $500,000 or more—at the headquarters of the Environmental Protection Agency in Washington, D.C. The landlord's company, however, laid not one brick for the cafeteria. Some say it was politics—he was once a friend of Spiro Agnew's. The landlord denies anything wrong. Whatever happened, the case boggles the mind. How could an entire cafeteria slip through the cracks; how could the General Services Administration, the government's real estate agent, have shoved aside such an important detail even in a $60-million-plus lease? You never know. Perhaps with PERT graphics in the right federal offices in the 1970s, some budget-minded lunchers today wouldn't feel forced to brown bag it.

"When you have so many little pieces," says my friend the Hard-Core Bureaucrat, working at another agency, "it's so easy to let one drop off the table. We could sure use a good word processor-cum-PERT machine."

Although computers can help you tidy up your work, they themselves can be messy enough unless you know what you're doing. There's no substitute for a good computer expert in many cases. And training, too. In the following chapter, you'll have one answer to "people" problems—the "Who-How Solution."

Backup:

■ VII, Graphics Tips, page 331.

8 People: the Who-How Solution

Stewart Research, Inc.—a fictitious name, along with the others in this tale, which is true in the main elements—once seemed on the verge of big money.

Frank Stewart, a slim, intense young chain-smoker, was receiving hundreds of thousands of dollars from a large company to monitor congressmen and bureaucrats influencing certain business activities. He planned to sum up gigantic piles of newspaper stories inside a computer. Then his early-warning service would ferret out patterns for his benefactor and other businessmen trying to keep up with the vagaries of government. Stewart's plan may come to pass, but last I knew, he was fighting off unfounded rumors of bankruptcy.

"We've wasted upwards of $40,000 on computer consultants and the consequences of their 'advice,'" Stewart told me in the modest white-frame home where he and his wife lived and worked and took in boarders.

"And that doesn't include the thousands of dollars in business we lost because our computer was down at the wrong times.

"I had to lay off five people largely because of the consultants' lack of interest in anything but turning a buck off us."

Stewart's story illustrates the need for the Who-How Solution in hiring consultants. Who-How may also help micro users train employees and get the most out of their data-processing departments.

Who-How is nothing more than the five Ws and the H of newspaperdom. Like a reporter, you simply ask, "Who?" "What?" "Why?" "When?" "Where?" and "How?" and especially "How much?" Ask those questions often. Ask them when:

1. Deciding whether to hire a computer consultant. How much in your time and your people's will it cost *not* to have one?
2. Hiring and using a consultant. It isn't just a matter of asking, "Who?" Ask, too, "Who cares?" Who cares about a consultant's two decades with IBM? What counts is how much he can do for *you*. Is the IBM experience relevant?
3. Training employees. Don't clutter your people's minds with computerese not related to their jobs. Use the five Ws and the H to strip the training to the basics—which, by the way, almost surely won't include BASIC.
4. Working with your company's data-processing people. Know which questions to ask to find out the computer crew's true attitudes about micros. And come up with the right answers of your own if the mainframers feel threatened by your interest in do-it-yourself computing. Good data-processing people, however, won't be frightened—quite the reverse.

The scary aspect of Frank Stewart's consultant fiascoes is that he and his people were hardly lost amid high tech.

"Some of us were inventors," Stewart said, and his vice-president, Bob Hillard, even had a smattering of the FORTRAN programming language. Stewart's firm didn't rush blindly into computerization. Originally, it had been hand culling articles from 140 periodicals and 16 major daily newspapers. "We sat down," Hillard recalled, "and worked out a mathematical formula to give weight to a particular article by mention of certain words, certain individuals, certain companies." Existing data bases like The Source and Dialog just wouldn't do. You couldn't easily use them to search out the political patterns affecting the fortunes of Stewart's clients.

Stewart spent $31,000 on a computer and soon was suffering defective circuits and junky software. He paid a secretary to cram almost a million words of newspaper articles into the machine's hard-disk memory, but it still couldn't fetch facts as easily as he'd hoped. Then the data-base program, the one he was using to store facts and juggle them around, crashed—apparently overwhelmed by the volume of data. Micro data bases at the time, the early 1980s, couldn't easily handle big hunks of text. Stewart couldn't retrieve whole articles.

It was time for a consultant. A good consultant (the "Who") theoretically could write or install a new program (the "What") in an effective way (the "How"), justify his actions (the "Why"), and ideally do everything at a reasonable price (the "How much") before the data base grew too unwieldy (the "When"). Stewart wanted him working on his own premises (the "Where") as much as possible so he could supervise him.

"Our first consultant lasted all of four days," Stewart said. "He was abrasive, nasty, and didn't know what he was doing. One of our staffers was so frustrated trying to work with him that she wept. We'd hired him because he was a friend of a friend and said, 'I'm a computer programmer. I can fix it for you.' We never quite could pin him down about his background. We were so burned that for five or six months we put off hiring another consultant.

"And when we did get one," said Stewart, "we wanted a solid, established firm."

So he went to a government contractor headquartered in an imposing building, the size of a small public library. The consultants even owned the same-model computer that Stewart's company did.

Unfortunately, however, they were using different software for much different purposes. Stewart's needs were new to them.

"Look at MDBS," Hillard recalls telling the contractor. "It really looks like a good package."

But he says the consultants told him they hadn't even heard of it.

That in itself might have been a tipoff that Stewart had hired the wrong people for the job. MDBS stood for Micro Data Base Systems. Ads and reviews about it had appeared in *Byte* and other prominent publications of the micro world.

With the clock ticking away at up to $35 an hour, the consultants searched for data-base software meeting Stewart's detailed specifications. "Three weeks later," Hillard said, "they handed me a bill for $2,500 and said, 'The package you need to use is MDBS.' I said, 'Where is the work, where are the hours in relationship to the $2,500 bill?' It went around in circles." Stewart and Hillard must have remembered the old

saying that a consultant borrows your watch to tell you the time of day and then charges you for it.

According to Stewart, in fact, the consultants based most of the report on material his company had given them.

By think-tank standards in his area, Stewart may have gotten a bargain. Dealing with consultants new to micro data bases, however, he was in effect paying their tuition.

"The federal government must like them immensely," Stewart said, "because they do good, documented work in the fields they have expertise in. But a small businessman had no business using them. After two and one-half months we had nothing but recommendations on the data base—and a stack of bills"—$2,500 high.

But there was hope. Stewart's corporate benefactors were sticking with him. If he could get his data base running, he could easily recoup his losses, offering clients a treasure trove of information about government policy-making affecting them. Although Stewart thought of himself as a truth seeker, his vice-president was bluntly a money man. "We would have sold our service for a million a year," Hillard said, "and we would have netted $600,000. We were using four people to feed the articles into the computer, but that would have changed, because optical readers eventually could scan magazine articles and newsprint."

So now Hillard shopped around for a new savior to unravel the complexities of the MDBS software that he had settled on.

He found three possibilities. One consultant, a micro expert, was snowed under with work, and another man had only mainframe experience. So Hillard and Stewart chose Fred Brown, a retired military officer who had worked not only on big computers but also little Radio Shacks and TeleVideos. In fact, Brown came recommended by the manager of a local computer store. The manager leveled with Stewart. He said he and Brown were together in a partnership developing software for lawyers' offices. Hillard asked only two people about Brown. And both references came from the computer-store manager with the business relationship with the consultant. Inquiring about Brown, however, Hillard asked some good questions. Did Brown document the software properly? Did he, in other words, tell how to use or change it? Did his

software work? Did he meet deadlines? Did he live up to all the specifications in his contracts? "I got affirmative answers to most of these questions," Hillard said. One reference said a software project of Brown's hadn't come in on time but brushed off the problem as a hardware one.

Unfortunately, Hillard didn't ask *all* the right questions. Brown had never before worked with the brand of computer that Stewart Research was using; nor was he fully comfortable at the time with the exact kind of software used at the company.

Brown, however, struck Hillard as "a very nice professional." He wore three-piece suits, lived in a $140,000 home with several computers in the basement, and held a masters degree from an Ivy League school.

"No problem," Brown told Hillard. "Listen, I charge——" He gave an hourly figure to the nearest cent; $30.02, we'll say.

"What?" asked Hillard. "Why 0.*02* an hour?"

"I like to be fair about my salary, and that gives me $30,000 a year."

"Okay," said Hillard, "that's cute."

Brown wasn't about to apply for welfare. On top of the $30,000 for consulting part of the time, he was enjoying income from sales of computer hardware. In short, he came across as successful and honest. And he may have been. Just the same, client and consultant were clearly mismatched.

Their downfall was a familiar kind—software problems.

You could customize the MDBS program in FORTRAN or BASIC. The earlier consultants, the ones with the large government contractor, had suggested FORTRAN. Brown himself was more familiar with that than with BASIC. And Stewart was convinced that FORTRAN would make the best use of software already purchased. So Brown went ahead with it despite three strikes against him:

1. The computer company's FORTRAN, according to Stewart, was as badly botched as its hardware.
2. FORTRAN wasn't as good as BASIC for micro data bases that stashed away English prose rather than mainly numbers. Another consultant was amazed when I told him that Brown had used FORTRAN in a data base storing newspaper

stories. “You can use it if you like,” he said, “but you’ll lose something. It’s like trying to translate Hemingway into pidgin English.”

3. Brown was still basically a mainframer. And micro FORTRAN was different from the kind used at large military installations. Writing software for micros is like writing short stories instead of novels. You’ve got to be more elegant and get to the point faster. A micro’s memory simply lacks the capacity of a mainframe and brooks less sloppiness than would a larger machine. Many great novelists could never write decent short stories, and many first-class mainframers just couldn’t code cleverly or deviously enough for micros—couldn’t electronically trick them into thinking they were larger machines.

“What happened,” said Hillard, “is that we were paying for Brown’s training on how to use FORTRAN on a micro. He spent forty or fifty hours developing specifications for the data base and writing the code. This went on and on. Brown kept running into all these problems, and he could have cleared up some with just a quick call to the manufacturer.” Meanwhile, the money clock was ticking.

Several months later, thousands of dollars richer from those $30.02-hours, Brown threw up his hands. “This isn’t going to work in FORTRAN at all,” he said. “Maybe we should do this in BASIC.”

“So,” Hillard told me, “all the work he’d done up to that point was out the window.”

“And on top of that,” Stewart said, “we were anticipating our new software package and didn’t care to feed the information twice into the computer. So we built up a backlog of well over 10,000 articles waiting for the software that never came.”

Brown’s clock ticked away for several thousand dollars more in time, bringing the total billing to $8,630.81. Then it stopped. Stewart Research had simply run out of money.

Stewart’s corporate sponsor could send no more. “Their pockets,” he said, “just weren’t deep enough to subsidize both our own computer literacy and that of our consultants.” When I talked to Stewart in mid-1983, his computer was doing word

processing and other minor chores. “But,” he said, “it does hardly enough cross-referencing to be a major data bank.” His research firm faced some $30,000 in debts, including much of the $2,500 bill from the consultants with the library-sized building; and he and his wife were the only two employees left in Stewart R & D. He still hoped to get the data base going, however. “We’re going to become computer consultants in self-defense,” said Stewart. “I’ve done nothing but work on this computer for a year.” It would be nice to be able to do the same, but most of us lack the time or talent; the challenge is to find the right computer consultant so you won’t end up feeling you must do the work on your own.

Not so coincidentally, Hillard himself actually did go on to become a computer consultant part time. He wasn’t the smartest or the best credentialed, but he had what many of the more established consultants lacked—empathy and humility. Don’t shrug off those traits. The real question, as one consultant pointed out to me, isn’t just whether someone is competent; it’s whether he’s competent enough at the job he’s doing for you. Never forget that when pondering the “Who?” and “What?”

Stewart and Hillard obviously aren’t the only people who didn’t ask the right questions in time. A sail maker wasted $18,000 on a computer system recommended by a consultant. The machine didn’t work right with the hard-disk memory, and it lacked proper shielding against the 60-cycle hum given off by power lines. By the time Hillard was on the scene, the consultant had left town. He says the computer was such a disaster that “I suggested to the client that he get a length of rope and use it as an anchor because it was unfixable.” In another case, a truck-rental firm spent $30,000 for $15,000 of computer equipment. And then the consultant didn’t even supply instructions to operate and modify the software. “As far as I know,” said a more ethical expert, “he’s still a consultant. Computers are mystical, and most people don’t know when they’ve got a good system or when they’ve got a bad one.”

“The real problem,” Hillard correctly said of consultants, “is that the microcomputer field has only been around since the mid-seventies and things are moving so rapidly. It’s hard for anyone to keep up, consultant or layman.”

There is, too, a nasty economic fact. A micro consultant can't reach full prosperity, in many instances, without having ties with stores or manufacturers. Indeed, most micro consulting nowadays is done in effect by sales reps recommending systems to their customers. How objective can they be? Even conscientious consultants—independent or those with ties—may still favor the computers and software with which they're most familiar. The man and the machine in effect become one package.

Another anticonsultant argument is that small computers may soon be inexpensive and simple enough to make consultants much less necessary. You don't use a consultant to buy a $1,000 typewriter. And by the time you read this, or a few years afterward, we'll have good, complete word processors selling for no more—with printers.

Yet another anticonsultant argument is that you may have computer-wise friends in your own business or profession, smart people you trust. They may actually anticipate some of your needs better than would a consultant. Moreover, it's been said that if you know enough to pick the right consultant, then you really don't need one.

I'm not sure. As one consultant pointed out, it's like choosing doctors. You can be good at choosing one without necessarily knowing brain surgery.

I was a borderline case. I still might have bought a Kaypro without Michael Canyes's approval, since I knew another writer familiar with the glories of the Osborne who appreciated the greater glories of the Kaypro. On the other hand, with my consultant friend's guidance, I could shop for the lowest price rather than the most technical help from the dealer. And Michael steered me away from the dot-matrix printer, which, with their inferior print quality at the time, would have been bad news for me. I was lucky. I had befriended Michael through an Osborne user group at a time when he himself was looking for advice on writing, so he didn't even charge me. You may be similarly lucky if you have a skill a computer consultant needs. But don't count on it. So often, free consultants are worth their charges.

Had I not been as fortunate and had I experienced difficulties, I would have been willing to pay for advice. And

mind you, my whole system costs less than $3,000. “You don’t want to spend $10,000 on a computer system,” Michael warns, “and find it doesn’t do what you want. You’d be better off spending several hundred dollars or more to learn exactly what you want and get some help installing it. Think of the business you’ll lose if you install your computer and it doesn’t work as planned. It depends. You could also spend a lot of time shopping and talking to people and not pay a consultant. It depends what your time is worth. The average guy has one or two uses for his computer in mind, and he doesn’t want to piddle around with the complexities of the thing. He just wants to cut right down to the core of it and get this job moving. If a consultant spends two or three hours with someone discussing a micro, it may cost perhaps $75 or $100. But the client might master in a day what might normally take a week or even several.” The wrong consultant, however, may actually cost you more—in money and time.

When shopping around for the right one, you’ll first want to consider a *what*—what work you need him for. Forget about computers. Does the task make sense commercially? Are you realistic about its costs? A former New England consultant tells of a baseball enthusiast who wanted to recreate some board games on the computer screen. It might have worked. But the man didn’t just want a computerized arcade game here—rather, a replication of ball parks, with their actual proportions. “He had a statistical background,” recalled the ex-consultant, “and had done some statistical consulting for a professional sports organization.” But there was a problem. The man believed that the consultant could perform this miracle on an Apple for less than $5,000. Actually, the program would have cost $50,000 to write—probably more than the man could quickly recoup through sales of the program. The consultant turned down this mission impossible. But the client let his enthusiasm for the project blot out his business sense and in fact squandered $55,000 on another consultant, who, incidentally, botched the job.

Now move on to the details of the work you want done. Do as with software; get as clear an idea as you can of the paperwork you’re computerizing. You may want your electronic files organized entirely differently from your paper

ones. Whatever the case, plan ahead. You don't want to—as somebody once put it—automate your confusion. And there's another reason for knowing your precise needs before calling a consultant. Trying to jack up the bill, some experts can be brilliant at inventing new problems to fit their prepackaged solutions. Or they may downplay your real needs because the answers are not in their tool kits.

You'll also want to decide if the consultant is just to give advice or more. Don't pay simply for advice, then expect him to haggle with equipment suppliers and install the software.

And what about other services besides advice? Take the task of keying paper records into your computer system; some consulting firms will line up temporaries for the job. That way your normal people must worry only about their regular work and learning the new computerized routine. Of course, this **data-entry** work may itself be part of the training, and at least if your people enter the material, they'll more easily find it later on.

As you define the *what*, you also get into a *when*—your deadline for computerization and how long the consultant or the firm is to remain on the job. There is a happy medium. You want him around long enough, full time or part time, to get the system up and running. But don't count on making him in effect an employee. Hire permanent people if that's going to happen. Joseph Auer, a $1,500-a-day computer-negotiations expert with blue-chip clients like New York Life, tells what can happen when consultants stay too long. A bank used a consulting firm for years. The outsiders became the main people familiar with the electronic links between the automatic teller machines and the big computer. Then the bank woke up. It realized that the outsiders could cripple its operation. The consultants didn't blackmail the bank, but it was worried enough not to risk incurring their displeasure. Rather than farming out the work to a facilities management firm as planned, it extended the existing consultants' contract, with the understanding that the outsiders would make the bank's own people self-sufficient.

Next go on to the *who* question. A generalist who's a good, quick learner might be a better deal for you than an overpriced guru who limits himself to one area. It's like medicine. I'd

much rather be cut up by a smart general surgeon with a steady hand than by a mediocre cancer specialist. Of course, for a complex job, you want the equivalent of a top cancer surgeon. At Stewart, anyway, the right specialist might have "programmed" the company to succeed.

Intertwined with the *who* are two *how muches*—the size of your company and the task for which you need the consultant. Are you a small businessman or a Fortune 500 executive? The consulting needs of the two categories may overlap. The general rule, however, is that a large company will feel more comfortable with a large consulting firm (GM, say, with Arthur D. Little) and a small company will be better off with a small one. A small businessman may enjoy more personal attention from a small consultant. He knows the people he's dealing with, and it's harder for the firm to pass the work on to a green employee—while charging the full price. The smallness of the firm, of course, makes it that much more important to check out references. Of course, sometimes the small guy may fit the large company's bill; Michael Canyes, for instance, has tutored WordStar classes for the Federal Trade Commission—a good buy for the taxpayers, considering his skill and low overhead. "The smaller consulting firms," he wisely says, "are likely to save a large business money when the consultants are working within their limitations."

Canyes, however, at the time I wrote this chapter, wasn't the consultant to install a $5 million micro network. He might be one day, but back then he just didn't have the resources to do the job justice. A Big Eight accounting firm would have been better than Michael; in fact, an executive with a large company mightn't need an outside consultant of any kind—large or small. His or her employer may boast a large microcomputer center and a helpful data-processing department. But you never know. Sometimes, Data Processing is either ignorant of micros or discourages their use. Ask some test questions. Has anyone in Data Processing ever installed a micro for business purposes? Do many in the department have micros at home? Are they reading the micro magazines and newspapers—*InfoWorld*, say, rather than just magazines about the big machines? If Data Processing isn't comfortable with micros, you'd do well turning to the outside.

One of the qualifications for the outsider, of course, might be his ability to work harmoniously with Data Processing if you're hoping to hook into the mainframe. Then again, your micro might be a stand-alone, not exchanging information with other computers, so that you needn't worry what Data Processing thinks. Even if you're using a Data-Processing staffer or other internal person, you still may want to find out his track record. Don't be a corporate chauvinist. Every company has its share of gobblers.

Turning to an outside consultant? Then, through computer stores, you might try to track down a local users group for a brand of hardware or software. Go to a meeting. Find out whom the members regard as an ace consultant. In fact, try to go to several user groups—remember the preference that Apple owners, say, may have in favor of an Apple solution or that Kaypro owners may have in favor of a Kaypro one. Mere word of mouth, though, is still no substitute for a thorough interview with the consultant and reference checks. Certainly, too, you can't use a consultant just because he or she shows up in the directory of a consultants group. Charles E. Harris, a lawyer who, with Joseph Auer, wrote *Computer Contract Negotiations*, says, "I know of no organizational membership that proves anything other than membership and the fact that the man's paid his dues."

"The person to watch out for in particular is the guy who's doing this part time and he works on a mainframe or something like that," warns Mark Robinson, a California consultant. He's been in the micro business for years and handles dealer relations for Lexisoft, a software company—a micro one, mind you. "Anybody who hasn't made this his business full time for a significant period of time," he said of micro consulting, "is a great risk." Consultants can relax. Robinson said eighteen months could be "significant." I myself wouldn't shrug off the part timers from Data-Processing departments if they have a long list of pleased micro clients. But as a generality Robinson's observations seem valid. Not only is micro software written differently from the mainframe kind; there's also a different mentality. Cloistered away in the computer rooms, some mainframers may strive for technical perfection at the expense of economy.

“They may be right about things,” Robinson says, “but that’s not the point. The point may be more like what Mr. Osborne prates about all the time—mere adequacy. I’m thinking of posting an aphorism on the wall from *The Soul of a New Machine*: not everything worth doing is worth doing well.”

The same wisdom might apply to consultants. You don’t need a $1,500-a-day man to help you choose a good micro for word processing—not unless you’re about to buy a few hundred. Opinions vary about pay. Some observers of consultants say you get what you pay for. “There’s very little relationship between pay and value except for one thing,” Robinson says. “People who don’t charge enough eventually go out of business, or that business. If they don’t charge enough, they’re not likely to have been around long enough to have gotten experience for you.”

Then again, as Robinson points out, experience in the microcomputer business rapidly decays in value, weakening the relationship between pay and competence. Back in the late 1970s Bernard McGowan, a Massachusetts ophthalmologist, bought an Apple and hired an expert at all of $5 an hour. His consultant was a scruffy young man in an old jacket. And this guru had himself owned an Apple only a day. But it didn’t matter. His name was Mitch Kapor, and he was good, apparently, for he went on to found Lotus Development Corporation, the company that developed the best-selling 1-2-3 integrated program. Today McGowan is still using $5-an-hour men at times. He told me, in fact, that one consultant, a teenager digesting software manuals for him, doubled as a baby-sitter. No, this isn’t an argument for merciless exploitation of child labor à la nineteenth-century England. For a small businessman with a simple task, however, and no pressing deadlines, a teenager might do well. Why must every sixteen-year-old be flipping hamburgers around after school at McDonald’s?

But teenage computer geniuses are special cases. Don’t count on a $5-an-hour consultant to write up a complex accounting program that you need done within three months to avoid bankruptcy.

Moreover, if you’re a business of any size, you might end up spending hundreds or even thousands of dollars just to

audition consultants. That's right; you may pay them. Canyes will talk to people by phone if he thinks they're good prospects, but the moment he gets in the car, the meter starts running. That's basically in line with what Adam Green, a software training expert, told me. Green has conducted seminars for big-name clients like Price Waterhouse and Xerox, and earlier he worked as a programmer and salesman, so he's been around. "A good consultant in my view would come out [in many cases] and spend a day or two looking at the operation and then give back a written proposal saying how they could help the client," Green said. "And then they should charge the client about $250 for that."

"If someone comes out and spends a day or two with you and writes something up for free, obviously they don't have anything better to do. They're not working. They're amateurs. They don't consider their time worth anything." Paying a consultant to write a proposal, you'll learn (1) if he can communicate in comprehensible English, (2) if he can think logically, and (3) if he understands your business and its needs.

But maybe that's a step or so ahead of where you now are in the game. Having found a promising candidate, make certain you feel comfortable with him or her. Trust your instincts. Beware of snake-oil artists who, through greed or incompetence, may actually increase your time and expense. People like Bob Hillard and Michael Canyes come across as teacherlike in their eagerness to pass on their wisdom to the appreciative. But not all consultants, in and out of computers, seem that way. A few might not even give you a written report of their findings. Many intimidate you through jargon, even through dress. Quite correctly, some young business school hotshots have been depicted as punks in pin-striped suits. "You have to know what your client wears and dress one level above him," said an ex-Bain and Company man. "If he wears a sport coat, you wear a suit. If you're meeting him in a midwestern cornfield and he's wearing a T-shirt, you wear a button-down. You might actually drive to his office in beige pants, a jacket, and a tie. But you can look in through the window when you get out of your car and then take off as much as you have to."[31] The consultant wasn't in the computer trade, but he might as well have been. One industry magazine began a "So

You Want to be a Consultant" article with a warning against polyester.

"Well," I asked Mark Robinson, "what about dress? Can you trust a consultant in a three-piece suit more than one who looks like a refugee from a university computer center?"

"It's really irrelevant," he said, "I'd look more at things like Can the guy focus on the relevant features of my business? Does he seem to understand what my business is about? This is one of the things that probably isn't even related to the number of years in micros or computers or what not." Robinson suggests asking yourself, "Does he quickly grasp the nature of my relationships with my suppliers, my clients, my promotion methods? Is he focusing on the technical solutions rather than my needs first? Does he even consider a question like whether I need a computer at all? Does he try to look at the highest-priority needs that I have in terms of the effect on my bottom line? Does he really have a grasp on why I might have a computer—to move into new things and serve my customers better, to replace existing functions, and so on? Does he know general things like that? If he doesn't have that sort of perspective, if he isn't even able to back off as to whether I should have a computer, I may be getting a slightly different type of salesman, someone who is committed to a computer solution, for instance, and isn't really looking at it from my viewpoint. He is not totally professional." You might still use such a person, but you'd better consider his limitations and biases.

I asked about "pure" consultants versus those selling software or hardware.

"Most consultants," said Robinson, "have found that small businessmen's budgets for pure consulting and their appreciation of it aren't high enough so they make enough money. So they've got to sell software and hardware. And also purity means that a consultant is spread too thin. He's not able to specialize and know enough about a particular package to be competent in it. So either he has a superficial view of these packages, or else he's a partisan." While working as a full-time consultant, Robinson hoped to maintain his purity. "I found myself dealing with a lot of invoices of fairly small amounts,"

he said, “and most of my support came from contract programming.”

What with the line so thin between salesman and consultant, you should politely but persistently ask about business connections that could sway their judgment.

Obviously, too, you’ll want a consultant’s résumé if he or she has one. He should. One way or another you’re after the normal personnel-office answers—his schooling (anything that could help him understand your business?), his previous jobs (one computer consultant ran a nightclub once—perhaps not such a bad background for an expert dealing with small businesses), maybe even if he has an arrest record (a perfectly suitable question if he’s setting up an accounting system or doing security consulting). Be polite but aggressive. By not shying away from the basics, you’ll be reminding him who’s in charge—the client. Don’t forget the *why*. Why is he in “consulting”? It isn’t a euphemism for unemployment, presumably. Also, why is he working with micros rather than mainframes? Attitude matters as much as brains and skill. Ideally, your consultant will be comfortable with the flora and fauna outside the antiseptic computer rooms. While he’s auditioning, see if that’s true of him.

How do you tell? Introduce him to your people, not just your executives. Encourage them to ask questions. If the consultant condescends toward a secretary or clerk now, he may very well do so toward you later. And if he rubs your people the wrong way, they may resent him in the future and take it out on the computerization project.

Well, there’s a caveat here. Maybe the specs for the job are so clear-cut that your consultant can work in a little corner away from the rest of the world. With *personal* computing, that’s not going to happen as much as with mainframes.

In winding up the interview, ask about the future. Will the consultant be around in the future to do work or answer questions? He won’t be? You still might use him. But police him very carefully to make certain he’s following standardized procedures that another consultant can pick up on. You don’t want your business to go down the tubes when your software man goes off to find his karma atop Mt. Fuji.

Satisfied? Then move on to references—which, if you're a small, budget-minded business, you might want checked before a full-fledged audition.

Remember Stewart's ordeal. Ask for the names of people whom the consultant served in tasks similar to the proposed one. Request ten names. The consultant needn't have done—in each case—jobs like the proposed one. Moreover, you often don't have to call more than five or six references. But with ten names, at least you'll know you're far from the first client. Don't, incidentally, phone just the references at the top of the list; outfox the consultant in your most constructive way.

You'll want the references to tell you the usual—what the consultant achieved within the time agreed. Would they use him or her again? What kind of hardware, what software, did the consultant recommend? The same kind for clients with different needs? Be on guard if he seems to have a one-shoe-fits-all philosophy. Also, ask about the references themselves. See if they have any connections with the consultant, social or business.

How many consultants should you try out before signing the contract? That's up to your needs and your budget. There's no law saying you have to go through all the screening steps here in every case. Why pay $250 to a consultant to audition when that very likely will be the cost of the whole job (assuming you're lucky enough to find one willing to take on a project with such a low budget)?

For all tasks, though, even small ones, you'd do well to bother with at least one formality—a contract with your micro consultant.

■ ■ ■

A Sample Consultant's Contract (Featuring Some Plain English From a Washington Lawyer)

No, you're not going to pay a lawyer $50 to draw up a contract for a consultant doing a $60 modification of WordStar.

But you can help protect yourself with your own version of the sample contract below. It's nothing more than a letter in simple English. William Wewer, however, the Washington lawyer who drafted it, says it probably would be just as binding legally as a document filled with "whereases."

Dear ——:

This will confirm our agreement that you will perform the following [software?] *services*:

[Precisely list the services in numbered paragraphs.]

You have represented to me that you can complete this project by [date]. *You will charge me $—— per hour for your consulting time. Do not exceed $—— without my written consent.*

You agree that you are performing these services as an independent consultant and are not my employee.

If you are willing to work under the terms of this letter agreement, please sign the enclosed copy and return it by [date].

Under your signature, use this language:

I agree to and accept the terms of this agreement to [quick description of service provided].

———- [consultant's name], ———- [date of signing]

Remember, this sample is just a starter. See Backup VIII, "Consultant Contracts: Some Who-How Questions", for a list of some of the points a contract might address. One of the more important ones is ownership and control of software. If you want to own the newly developed programs and keep them away from your competitors, here's what Wewer might insert after the paragraph saying the consultant isn't your employee:

I am paying you to do this work for me alone and require that you not retain any copies of it or give any copies to anyone else or tell anyone else how to recreate what you have done for me. We agree that the software you create for me will be my trade secret.

"'Trade secret' is a key phrase to get in there," Wewer says. "Then it's within common law."

Again, your informal contract won't give you iron-clad protection—that could depend on the mood of a judge—but it's better than nothing. "It's the handshake deals," Wewer says, "that always fall apart."

■ ■ ■

"The real problem," Adam Green says, "is that no one ever has to sign a contract. People get concerned. They say, 'Boy, lawyers cost a lot,' and I know the feeling." Then Green brings up an exception to that opinion, lawyers. "I know a lot of consultants who will never work for lawyers because as far as lawyers are concerned the job is never complete. They understand what it means to be complete." Their contracts reflect this; yours should, too. Have the consultant do the first draft of the contract, perhaps; but don't shy away from extensive changes if need be. "Hell," tell him, "that's what your word processor's for." Back out of the deal if he isn't reasonable now. He might not be later on.

When hammering out a consulting contract, you should fret over three variables emphasized by Joe Auer:

1. "How long is it going to take?
2. "How much money does it cost?
3. "What's the quality of the work?

"If you tie down the money and the quality and not the time," he warns, "you give them a license to loaf. If you tie down the quality and time and not the money, you give them a license to steal. If you tie down the money and time but not the quality, you give them a license to cheat."

Training:
How to Enjoy
the Mahony Advantage

Who-How counts just as much in training your people as in the selection of consultants:

1. Who's teaching? Can he or she communicate well with the students, and how adaptable to computers are the people getting the instruction?
2. What task is being taught? A very teachable one?
3. Why is the material taught? To make your people computer literate in a broad way? Just to help them do their present jobs better?
4. When do the students learn? On their time or yours? Will you reward them in any way for their extra effort?
5. Where is the learning happening? Ideally, your students can take the machines home if they want—one advantage of transportables like the IBM portable and its work-alikes.
6. How do the students learn? Through instruction manuals, mainly, or through early experience at the keyboard? Do they suffer through irrelevant exercises, or do they start right away on assignments similar to their jobs? In fact, do they start immediately on their normal work, as some training experts recommend? Do the students work with teaching disks? And are the disks interactive, as Adam Green, the training expert, correctly recommends? Do the disks, in other words, require you to type in a thoughtful response?

"How much?" also figures here. Consider the cost of a good training program versus your losses from misused or underused people. In the future you may want an office filled with people conversant with WordStar or dBASE, but don't shrug off valued employees who can't even play an Atari game. Tutor them if need be. Bend. You needn't be sentimental, just practical. Don't waste the Mahony Advantage, as I'll call it; don't throw away a mixture of background and experience that silicon won't ever fully replicate.

Unfortunately, Jim Mahony's employer didn't take full advantage of the Mahony Advantage.

Mahony, a white-haired man with a ruddy face like Tip O'Neill's, was a popular local columnist at my old paper, the *Journal*, in Lorain, Ohio. He barely survived computerization. In fact, he barely survived. He suffered a heart attack that may or may not have been brought on by the added stress. His ordeal is a preview of what some companies may expect as small computers—or terminals like Mahony's—become requirements instead of options in many businesses. It is a fitting argument for tutoring or other adjustments for key employees. Within the newspaper industry—more computerized than most fields by now—you'll find few Jim Mahonys today. But many other businesses are now wasting the Mahony Advantage.

At the *Journal*, readership surveys showed Mahony's column was one of the main draws. He was a native of his steel town, a perfect counterpoint in a newsroom dominated by young outsiders. He'd worked for the *Journal*—whether as a newsboy or an editor—since he was ten. The only break was time off for World War II service. Indisputably, on local matters, he was a human data bank. "There's nobody who knows this town and the people and the relationships, the marriages, like Jim," said Bill Scrivo, an ex-managing editor. "You just can't store this kind of material. He knew who was a phony and who was likely to mislead you." Jim doubled as the news editor (on the *Journal* the news editor's job was more of a copy-desk function than an executive one in the fullest sense), and over the years he may have saved the *Journal* thousands of dollars in lawyer's bills from the libel suits that never were filed. He knew, say, that the Phil Smith caught in a gambling raid was not the prominent black minister with the same name. If nothing else, his vast knowledge of Lorain, Ohio, and its people made the paper more credible. And Mahony loved the traditional newsroom as much as he did his city—the big, black wire-service tickers, the bulky Remingtons and Underwoods.

"A ticker gives a newsroom that certain flavor," he told me. "You hear a bell, and that means an important story is about to be released and it puts you on the alert, makes you news

conscious." And typewriters? "I figured they were the backbone of newspapering all the way through." Mahony obliterated, however, at least two of them. He would strike the keys so hard that the letters would fly off the arms. Appreciating the man more than the machines, his colleagues cheerfully wheeled in replacements.

Dapper Dan, however—Mahony's name for a young computer expert with some flashy sports coats and a fondness for jargon—wasn't so accommodating.

"His word was God's," Mahony said, "and he pressured us. He felt that the pupil should be stepped into a more advanced bracket. And evidently he misjudged the person who was possibly of an older era and not familiar with the computer field. He never appeared news interested. It appeared his whole life was wrapped around computers."

"The training consisted of sitting down two hours every other day in this little room," recalled Dick DiLuciano, the former editor handling state news, "and then we'd be told that when you hit this button, this activates this diode or that diode or whatever the term. And finally I decided they were wasting their time telling what happens when we hit a button. We didn't have to know that. All we had to know was what buttons to hit to get our story into the computer and get it typeset." Mahony himself complains that the paper didn't start him out with real news stories on the terminal. Instead, he did boring exercises similar to those in typing manuals. "It was much like a batter in major league baseball taking batting practice," he said. "You just stayed there while they threw curve-balls at you more or less."

"The only thing Jim really put into the computer on the job itself was headlines and his column," DiLuciano said, "but he really was getting frustrated and distraught. And I bumped into him in the washroom one day, and he was about to cry. He said, 'Dick, I know I'm going to lose my job, because I can't learn how to work that damn computer.'" He almost did lose it. Jim was out sick several months, and he had to leave his news editor's post. The *Journal* let him continue the "Mahony's Memos" column but assigned him to the "morgue," the library, to file away old clips. The library was in a room apart from the city desk. No longer was Mahony so handy to editors wanting

to know, say, if a home on East Twenty-eighth Street is on the "East Side" of Lorain. (It isn't—contrary to what a story said.) Were it not for the mishandling of Jim Mahony's training, he might still be vigilantly editing.

What could have been done to keep Jim Mahony there? Jack LaVriha, a cigar-chomping newspaperman of Mahony's generation, had an idea. Why couldn't the paper have hired a tutor for Mahony—maybe a journalism graduate familiar with computers who was waiting for a reporter's job to open up? The young grad could have entered Mahony's stories on the terminal, learning city-room ways while Jim gradually mastered computer ones. Computers and older people can get along fine. Even without a tutor LaVriha himself was one of Dapper Dan's star pupils, and today, though retired, he still drops by the newsroom to write press releases for community groups on the computer.

Distilled, here are some lessons from the *Journal*'s experience with computer training:

1. Even the best-intentioned companies may fail miserably in easing some employees' computerization traumas. The paper's editor at the time was Irving Leibowitz, a Lou Grant-like figure beloved by many in the newsroom; I can recall Leibo once jumping up on the copy desk to lead a "Happy Birthday" tribute to Jim Mahony and barely missing the cake; that was Leibo. He died in 1979. Were he alive today, however, he would probably be the first to admit that the paper mishandled Mahony during the transition. Like many others, Leibo was in awe of Dapper Dan. And so he'd suspended the skepticism that usually served him well on the job.
2. The traits which make somebody valuable to his company *may* be the very ones complicating his transition to computerization. Jim Mahony was the folksy, family-oriented man that his column suggested. Mahony knew steelworkers as well as politicians and businessmen, and to maintain that network of friends, even in a small town, takes time. Jim didn't like working late at the office, boning up on computers; he would rather be with his family or some of the average people he wrote about.

3. At the same time you can't stereotype anyone—by age, folksiness, or otherwise—as absolutely doomed to fail at the computer keyboard. Just look at old Jack LaVriha, himself a Lorain native and strong family man. Jack took well to computerization and would give the editors cards with numbers on them, saying, for instance, "Call up story number so-and-so if you want to know about a hot veterans parade coming up." Before computerization he'd lobbied for his stories by shoving them in front of the editors' faces or leaving notes; the cards were his new way. Why did Jack succeed where Jim didn't? Hey, he thought of computerization, if that's what it is, I'm going to accept it. I do whatever stories they give me, so why not this? His being a reporter, not a desk-bound editor with a strict routine, may have helped.
4. An important part of training is simple salesmanship—persuading the worker to adopt the right attitude. Mahony rightly or wrongly felt bullied. He wanted to be wooed, not pressured.
5. Don't make computerization seem more threatening than it has to be. *Journal* managers bragged how they'd throw the typewriters out of the newsroom—Mahony's security blankets. Instead, the paper might have kept a few there for tasks like note taking. As a matter of fact, that's what actually happened. Also, Mahony recalls that the paper computerized without at first having a printer in the newsroom, meaning that staffers had to trust everything to the computer memory. He would have felt more comfortable in the beginning with paper backups. That's a close one. Learning the Kaypro, I myself progressed faster because I couldn't use my printer at night without disturbing the neighbors. I, however, was learning voluntarily. Mahony was forced. Try to computerize with the old system intact in the beginning—with paper records, in other words. Not only will your Mahonys feel more comfortable; you'll be better protected when the computer glitches up. Sooner or later, they all do.
6. As early as possible start people on real projects. The first day at the keyboard Jim Mahony might have been writing a column or part of one. Adam Green, the software training

expert, says to start off teaching your new employees some computer basics. But then they should buckle down to the practical from day one. Integrate WordStar, for instance, into your employees' work. Don't say, "Okay, now you're going to take a class in WordStar." Instead, have a sales rep use WordStar to write some letters to customers or encourage an accountant to start using 1-2-3 as soon as possible on a limited basis. This isn't to say that a real project is the only hook you can use. Green has been quite successful with Adventure-style computer games that require people to learn to format their disks and other basic micro skills. It's a good introduction to micros for the Pac-Man generation. That might not be right, however, for Mahony-vintage people.

Above all, beware of the babble about "computer literacy" for everyone. Follow John H. Bennett's example. With a Harvard Ph.D. in mathematics and a Phi Beta Kappa key, he's hardly antilearning. And yet he skillfully mapped out a micro program for executives who weren't interested in all the subtleties of bits and bytes.

Bennett is the top data-processing man at United Technologies Corporation. United, a $14 billion conglomerate, produces everything from helicopters to air conditioners and silicon chips. "We're a high-tech company," Bennett said. "More and more of our products have microprocessors in them." Most of the senior executives, however, had never used a personal computer before Bennett started a training program for those baffled by tech talk. "It's not a productivity program," Bennett said. "It's an educational program." With the $5 million program's stress on hands-on experience, however, those goals meshed nicely.

United homed in on the computer skills that seasoned executives could use in their jobs and searched hard for the right people to teach them. "You can get people to teach you to use an automated spreadsheet," Bennett said, "and of course there are at least a dozen vendors offering to teach people to use a word processor, but there is no program that takes the standard tool kit and offers to at least introduce you to every tool." National Training Systems, Inc., however, a California company, designed the course he wanted. In 1983 and 1984, more than a thousand United executives were to learn to use

the IBM PC and the Context MBA program. Bennett had settled on the IBM one Christmas vacation when he himself tested several different brands. It was his own initiation to personal computing. He surmised that plenty of software would be coming for the IBM, and in fact Context MBA did appear in time with tools he wanted for United's executives; the integrated program included a spreadsheet, data base, graphics, communications, and simple word processing.

United held the three-day course in a windowless conference room on the second floor of the research center in East Hartford, Connecticut, just across the river from corporate headquarters. Blowups of IBM computer equipment lined a wall. It was as though United were doing all it could to engender concentration. If an executive turned to gaze at a nonexistent window, the sight of the photographs might gently nudge him back to work. Up front was a projection screen and an easel bearing such "EXTRA ACTIVITY" suggestions as "EXPERIMENT WITH VARIOUS COMMANDS ON YOUR SPREADSHEET." In a photo from United's public relations office, the carpeted room looked like a cross between a college classroom and a ComputerLand store. Executives came from United divisions across the country. With sixteen IBM computers and matching printers, the training project couldn't travel very far.

One of the students was himself a local of sorts, Robert J. Bertini, Jr., controller of the East Hartford research center. He was an MBA in his mid-forties, and in some ways he typified many of the executives in the program. "To a certain extent," he said of his thoughts before he took the course, "you're afraid you're going to screw up." He had toyed with the idea of buying an Apple or Commodore but "didn't want to sit there and read a book and hunt and peck at the keyboard." Still, he was constructively egotistical: if others could master computers, why not he? So he signed up. On paper the program was completely voluntary. In practice, perhaps, what with peer pressure, it was army voluntary. "We just didn't feel the management of a high-technology company could be competitive without knowing what the computer can do for them," Bennett had said in announcing the program, and who wants to be known as noncompetitive? Still, the company was

bending over backward to make the training as palatable as it could. Within minutes of the computer instructor's first "Good morning," Bertini was learning how to load disks into the little IBM machine and type out the commands of Context MBA. Mercifully, he wasn't wrestling with unneeded computerese. "Most manuals," Bennett correctly says, "are not written with executives in mind. Most are written for people who know how to use computers. On page thirty-something of the manual it eventually gets around to telling people how to start their computers up."

Just a week after Bertini finished the course, his own IBM PC arrived at his office. Man and machine were still new to each other, and data-processing people were ready to help overcome the normal start-up glitches, but Bertini faced other problems. Would he have time during the normal work day to perfect his computer skills? Nearly thirty people reported to him, and now the machine, too, would be vying for his attention. He also worried some about his image as he groped around on the computer. "Hell," he candidly said, "we all have our degrees of vanity."

Once again, however, United had a solution, a routine one in the training program. It allowed Bertini to take the IBM home. "Let's face it," he said, "the course taught you the basics, how to get on the machine, how to do some relatively simple, basic things with it. To learn other stuff that makes it the tool it really is took eighty or ninety hours or whatever I spent with the thing at home." Even after Bertini mastered the IBM, he still used it at home for chores like checkbook balancing—and for work, too; especially work. "My wife," he joked, "decided that the reason this thing was going to be a big productivity improvement for the corporation was that I'd put in that extra eight hours at home and give them a sixteen-hour day." He also found himself working later some days at the office.

But Bertini emerged a believer in both the training program and the machine. As chief fiscal officer at the 1,200-employee research center, he helped preside over much of United's research and development budget—then $800 million a year. His life was a series of what ifs. What about that $4-million mainframe computer; should United buy or lease it? What about taxes, depreciation, interest rates? What about a number

of what abouts? Traditionally, Bertini had waited around for answers from his staffers, which could take hours or days; but now he had his own computer and electronic spreadsheet and could consider more options faster. The IBM was also handy for confidential tasks like salary analyses. “As far as merit increases for my people were concerned,” said Bertini, “I had access to it, and they didn’t. And that’s the way I wanted it to be.” He also wrote letters and memos on the computer. “Would you believe, twenty years ago in college I took a typing course?” he said. When Bertini wrote to Harry Gray—United’s chairman—the center controller’s secretary redid the letters on a typewriter. But the little dot-matrix printer worked well for memos zipped out to Bertini’s staffers. The communications part of Context MBA was also a joy, for Bertini could send electronic mail and tap United’s mainframe for facts that previously had been filtered through subordinates. Some staffers resented his new ability to bypass them. It was a reversal of normal roles. The boss had a personal computer before they did and was now better plugged in to United’s information network. “As far as I’m concerned,” Bertini said, defending his new system, “the boss’s job is to second-guess you.” But the worried might find some solace: Bertini was planning to bring in a second IBM for the people below.

Training (Continued): The Dahlonega Answer

For a bucket of fried chicken, Hugh Hunt, a son of H. L. Hunt, the late oilman, gave me some lessons on how to run my Kaypro.

An Anderson Jacobson salesman had offered my name to Hunt after he couldn't get his Kaypros working quite right with his AJ printers and the Select word-processing program. I passed on the number of someone who might actually solve the problem.

Hunt, having tinkered with computers for several years, gave me some quick tutoring on my Kaypro.

"Well," I said, "I'm still not really familiar with the basics of CP/M."

"Come on over," he told this stranger, who was wise enough to own the same brands of computer and printer as he did.

"No consultant's fee?" I joked.

"Bring along some fried chicken," he said.

Hunt's home sat on a hill in horse country just outside Washington. He called it Dahlonega, after a town in the Georgia mountains where he had once lived and where miners had extracted gold before the Civil War. In his basement, in plain, fluorescent-lit rooms, were the offices of his land-development company. Hunt showed me how he had rigged up a roll of Teletype paper with a clothes hanger so he wouldn't have to buy a tractor feed for one of his daisy-wheel printers. A tall, heavy-set man nearing fifty, he wore casual clothes and looked like old pictures of his father in middle age. In the beginning, however, I could only guess who he might be. Even if he had been Hugh Doe, I still would have been interested in his style of training the people who operated his Apple, his several Kaypros, and a pair of Osbornes. His techniques were wrong for many corporate situations. They would have been a disaster for Jim Mahony, the old newspaperman, who was so heavy-handed that he ruined at least two typewriters. But they were just right for Hunt and his people—and perhaps for many

other small businessmen who like to be surrounded by employees comfortable with high tech.

Hunt didn't give his staffers extra-long, step-by-step guidance. Instead, he:

1. Hired people who were fast learners at the keyboard.
2. Helped them with some learning aids like color-coded keys showing kinds of WordStar commands.
3. Motivated them by explaining how their new computer skills would make them happier—and richer, since he paid them more, once their productivity increased.

Esther King, his middle-aged office manager, a bright, down-to-earth high school graduate, actually may have been as responsible for his training methods as he was. She tried to hire only people who'd benefit from some quick lessons followed by intensive self-instruction. "Sometimes I'll have them sit down at the computer," she said of her employment interviews, "and I just turn it on and tell them to type. A lot of people, they're afraid they're going to hurt it. And you're not going to hurt it. You can't hurt it. So you mess up, and you get the wrong thing, and it says you made a 'fatal error.' So you just start over, and that's the only way you're going to learn—is sit down and not be afraid of it."

Jeanette Counsellor, at the time an employee of Hunt's, didn't just type on computers. She also knew how to juggle around thousands of dollars on electronic spreadsheets. And King herself boasted the ability to use computers to help project building costs, a useful skill since Hunt at the time was finishing construction of a water-theme park in North Carolina. What's more, on the Apple, King helped Hunt do company tax work.

By telephone—I talked to Hunt and his people several times—I asked point-blank why he'd been so successful in getting staffers running on computers.

"I told them," he said, "how it would be useful for the rest of their careers to be able to say, 'I've worked with a computer and I've word processed.'" His people didn't mess with BASIC, just skills directly useful in their work. "I showed them," said Hunt, "how computers could save them a lot of

time and trouble in the amount of rewrites I do. I put it to them as a challenge."

"I was ready to learn," said Counsellor, who had taken a data-processing course at a community college but had never before used a computer. "I was looking for a job that would train me to do this sort of thing."

Although your people may need more guidance than Hunt's staffers in learning computer skills, you can take heart in the results of a poll reported in *InfoWorld*. Of 500 personnel managers and over 500 clerical employees, 87 percent said "on-the-job training to learn new technologies" is important.

Micros and the Data-Processing Department

Bertini and the employees in Hunt's office were lucky—the powers-that-be were encouraging the introduction and use of micros.

Within American corporations, however, many data-processing departments have looked askance at small computers.

They've seen them as a threat to their power. So American executives have bought millions of dollars of "typewriters" and "adding machines" from computer stores, hoping to fool Data Processing (DP) and bookkeepers. One man lost his job after Data Processing wouldn't let executives buy micros and he falsified an expense voucher to smuggle in an Apple. Dishonest? Yes. But a micro martyr, too.

This atmosphere may be changing, of course. As early as 1983 *Computerworld* reported that of 220 data-processing managers replying to a poll, 62 percent said they would encourage the use of personal computers.

Beware of the De Mille Syndrome, however. It's the fondness of many data-processing managers for what one consultant calls a "Cecil B. De Mille production" with "a cast of thousands, millions of dollars and years in the making."[32]

The poor, ignorant people outside Data Processing, meanwhile, can't enjoy all the micros or advice they need. "Last year," went a plaintive letter to a computer columnist, "we purchased a microcomputer and VisiCorp's VisiCalc software for the company accounting office. The micro was idle for about six months until someone decided to figure out how to use it. Since then, half a dozen people in our office and at least as many in other offices keep the system tied up." But the firm's computer people wouldn't budget more machines even though the $5,000 micro in the accounting office had "paid for itself many times over." The excuse from the computer pooh-bahs was this: several accounting systems were on the way that would do the job, and why allow micros to proliferate? "Money," said the letter to the columnist, "has

never been a question."[33] Power, apparently, was. In that sense also, many data-processing biggies are like De Mille.

"Programmers in general are pretty control oriented, pretty methodical in nature," said Adam Green, "and usually the most methodical, the most control-oriented person becomes the head of DP."

"If they like you, they'll help you; if they don't, they won't," said my friend Michael Canyes, who himself served time in data processing in government and private industry.

And it isn't just the De Mille desire for control that has dashed many an executive's hopes for an office micro. It's also their sheer ignorance at times.

"Some data-processing managers started out ten or fifteen years ago when the field was growing," Canyes said, "and stayed with their companies while more able people moved to others. They just were in the right revolving door at the right time. Many don't know enough to get a job elsewhere. And they don't understand the capabilities of micros and are afraid of them."

At United, Bennett's executive micro course was geared toward the nontechnical, and yet he commendably wanted his top data-processing people included, too.

"Many of them," he said, "hadn't touched a computer console or terminal for ten years and were quite surprised as to what a modern microcomputer can do." They didn't learn faster as a group, in fact, than did the other United executives. "If they've never used a word processor," Bennett said, "why would they learn it faster than the guy next door?"

■ ■ ■

'How

What do you do if you need Data Processing's favor to buy a micro or set up an office network of them? Bennett has the good sense not to "tell somebody how they could do something in a political environment that I'm not familiar with." Here, however, is my own reckless scenario for you. Do not sue if this advice makes you a micro martyr:

1. Before approaching Data Processing, ask who-how questions about the people there—questions similar to some you'd raise about outside consultants. Find out who, formally and informally, can help you the most.
2. Ask your informal Data-Processing contact about possible technical problems. Tell him what you hope to do. If it won't fly, how can you modify it?
3. When you're ready to deal with the Data-Processing manager, tell him your exact computer goals. Easier word processing on just one machine? A micro network tied into the mainframe? Many executives correctly see big computers as massive repositories for information to be analyzed on micros.
4. Make it clear you're aware of your project's complications. Anticipate the manager's own who-how-style questions, especially the "How" and "How much?" Take on the issues closest to the Data-Processing manager's heart. Traditionally, DP seeks to centralize facts so Sales won't have one set of numbers and Administration another set. Does your micro plan tackle that problem? Also, what about the security issue? How are you going to safeguard facts stored inside the micros? What about maintenance? Who's going to look after the computers—your department or DP? How about training? Your baby or Data Processing's? Also, what will you do for ongoing technical support?

■ ■ ■

Despite some DPers' *possible* ignorance of micros, you'll still come out ahead with the computer room's cooperation, especially if you want your micros talking to the mainframe.

"The situation," one expert told *Computerworld* in describing micro-mainframe hookups, "is like connecting two telephones with a wire and trying to get a Russian to communicate with an American. The microcomputer users think they have finished the job, but they haven't even begun."

So if you want your micro to get along with other computers, try to coexist with the people who might help out.

Well, so much for relations with humans. Now, how do you survive the computers themselves? How do you choose the best keyboards, screens, etc., for you to live comfortably with your machine? How can people feel in charge of their computers—guarding health, comfort, and productivity against the HAL syndrome?

Backup:

■ VIII, Consultant Contracts: Some Who-How Questions, page 339.

9 The Hal Syndrome

Raquel Welch, the movie star who pranced around in a fur bikini in a caveman epic, reportedly planned to use a $10,000 computer to write a fitness book. Her ballyhoo in late 1982 stressed that "the mind and body are connected." But for *Time* readers she may not have set the best example. A color photo showed a tightly gowned Welch lazing on the floor near the newly famous computer—it lacked a detachable keyboard.

And if you can't separate your keyboard from the main part of your machine? That might be bad news for both your mind *and* body. The best distance between your eyes and the TV-like screen may clash with the right separation between your torso and the keyboard. Your posture may suffer. In fairness to Raquel—who declined an interview on the topic—she might have felt perfectly comfortable using her computer. Perhaps she had the proper eye-sight, the perfect body, for it. If she didn't, however, Raquel may have subjected herself to the Hal Syndrome—letting the computer bully her.

Hal, you'll recall, killed all but one of his human masters. Raquel's computer didn't murder her, but if she indeed toiled hard on it for her book, it may have done a very nice job of killing her back.

The Hal Syndrome can manifest itself in other ways. Even the wrong furniture, indeed especially the wrong furniture, can poison relations between humans and machines.

What's more, bad **ergonomics**—the jargon for the human-machine link—actually can make you sick.

Raquel may like her work; but millions of clerical people don't, and aches from computers can add to their stress. They can help bring about heart attacks, strokes, high blood pressure, perhaps even raise yours by raising your company's health-insurance costs over the long run.

And they can lower your profits in other ways.

Working with bad furniture and lighting, computer operators in one study made more errors and tapped out 25 percent fewer keystrokes than they did under better conditions. Michael Smith, former chief of the Motivation and Stress Research Section at the National Institute of Occupational Safety and Health (NIOSH), says the NIOSH experiment lasted a week and was closely controlled. A private ergonomics consultant found a 10-15 percent difference in a study of good and bad furniture. Whatever the percentage, however, ergonomics isn't just a gimmick to sell new tables and chairs; Smith says it especially can help narrow the gap between mediocre and prize workers.

Not only does good ergonomics pay for itself in the long run; it may also improve your labor relations.

It's a perfect meeting ground for you and your employees. They want good working conditions. You want good work. And everyone can win; for with decent ergonomics, you'll enjoy lower turnover. You may very well lure good people away from competitors who run electronic sweatshops. Sharp screens and silky keyboards won't single-handedly stave off unionization or endear you to ensconced unions, but they won't hurt. A smart, secure executive, in fact, may even turn union complaints to his advantage. He'll *listen*. He (or she) won't spend $20,000 on new computers or terminals that inflame people's eyes and tempers.

In short, he'll learn eleven steps to good ergonomics:

1. **The canary-in-the-mine** theory of labor relations. Ergonomics is people, too, not just machines, and you'll read here of better ways to work with both.
2. **Good job design.**
3. **"Terminal" happiness.** Detachable keyboards are just a start, whether you're using a micro or a terminal hooked into a large computer. Micros normally include keyboards, screens, and other major parts of terminals. So "terminal" is what I'll say most often in this chapter.
4. **The right furniture.**
5. **The proper light**, or as it's been said, "Let there be less."
6. **Noise reduction.**

7. **Air conditioning, heating, and ventilation**—basics neglected by a surprising number of computer users.
8. Honest assurances to your people that you're exposing them to the least risk. Not all the extra stress in some computer work comes from the equipment itself. Some is from *fear* of the machines.
9. A willingness to consider alternatives to the TV-like CRTs that computers use to flash out words and numbers. Flat-screen computers—with thin panels rather than bulky tubes—may eventually be easier on the eyes.
10. Sensible use of wrinkles like the mouse—the hand-sized gizmo you use instead of the arrowlike keys to move the cursor on the screen. (See Backup X, "Of Mice and Men—and Touch Pads, Touch Screens, Etc." Also see Backup IX, "Window Shopping.")
11. A related ingredient, good software—the topic of earlier chapters.

The Canary in the Mine

"How," I asked a consultant, "do you know if someone is trying to offer a constructive suggestion about computerization or to get in the way?"

"Consider the source," he said. "Is it coming from a researcher or a union?"

To some extent the man was right. Some people, unionized or not, may be no more than twentieth-century version of the Luddites, the English workers who, during the 1800s, smashed the mechanical looms that were taking away their livelihoods. Indeed, Dr. Michael Colligan, a NIOSH psychologist, says, "Opposition to computers is usually kind of veiled or disguised under more general complaints about eyestrain, headaches, and physical discomforts often associated with video display terminals (VDTs).[34]

"But," Colligan warns, "if you talk with workers awhile, major concerns begin to surface." Legitimate concerns. Whether it's individual workers or unions, don't tune out gripers. Listen to people like Joan.

Joan started out around 1980 as a model employee in a northeastern office of a major insurance company, whose officials declined to be interviewed. "I averaged ten hours a week overtime," she said, "and I came in when I had pneumonia and a fever of 102." In a modest way, helping to unravel the mysteries of the machines, she aided computerization. Later, however, in a not-so-modest way, she aided something else: unionization.

By the time I reached her, she had quit her $10,000-a-year job to go into business with her husband. For more than an hour she poured out her anger against the terminals and the company that now used them.

"They affected my stomach quite a bit," Joan said. "Most days I worked, I would throw up in the ladies room. I didn't throw up before I started working on the computer, and I haven't thrown up since I quit.

"The screens weren't at all soft on the eyes, even with the glare screens that snapped over the top. And they were

nontiltable."

She also complained that the screens were too low even for a five footer like her.

"Could I have some books and put my system on top of them so the screen will be in the middle of my eyes?" she recalls asking a supervisor. "You get this constant tension in your back because you're always hunched over."

"No," she says the supervisor told her in effect, "that's unacceptable, totally."

Why?

"Because," came the reply, allegedly, "the office won't look the same. It won't be level."

Joan says management wouldn't even let her work with the terminal in the middle of her desk. "They wanted them all on the same side," she recalls. "I said, 'Hey, I don't work on that side of the desk, sport.' It was ludicrous, absolutely ludicrous. Even a simple request like that was too much."

At least the chair was adjustable "I lowered it so I could get my eyes as close to the middle of the screen as possible," she says. "I was so low that if I opened the middle drawer on my desk I'd bang myself."

But it was the lights that most irked Joan. They were bright fluorescents, fine for traditional paperwork but not for the computer era. Management, pressed by employees, took out many of the tubes; and yet Joan says some glare-ridden workers still wore sunglasses.

She also complains that the company wouldn't even offer the operators eye examinations, an irony, considering that she was processing health claims.

Again, Joan was a union activist—as a result of her experiences—and some managers may recoil from the very notion of clerks organizing, and yet in her litany of complaints about working conditions, there was not one with which most ergonomics professionals would quarrel. Had management listened to her on those issues, in fact, it would have been doing itself a favor. Forcing the workers to strain their necks, backs, and eyes is hardly the road to higher productivity and profit. It would have cost several thousand dollars at the very most to change the lighting. Corporate bureaucracy may or may not have allowed the workers to be consulted in selection

of the terminals, but there is no reason—other than a misdirected passion for discipline and order—why the company couldn't have let Joan change the level of her screen.

Joan's experiences are a good argument for the Canary-in-the-Mine Theory of Labor Relations. In the days before electronic gas detectors, coal miners carried canaries into the pits. The birds' lungs were more sensitive than theirs to poisonous fumes. And watching the canaries, many a miner saved himself and others.

Novelist Kurt Vonnegut, Jr., used the canary-in-the-mine parallel to describe artists and writers serving as an early-warning system to call attention to social ills. And workers like Joan, "troublemakers," are your canaries. You may not agree with them, and you may aggressively fight them, but before making up your mind, at least listen to them. They can anticipate the concerns of less vocal workers scared of losing their jobs.

"Well," you ask,"what about my authority as a manager? You knuckle under to the troublemakers once, they'll come at you again and again." Confident executives, however, will avoid this misplaced machismo. They will assert their authority more productively, letting workers have a voice in working conditions but, in return, demanding good, steady production, which, after all, is the bottom line. When your stockholders receive dividends, how many will think, What slobs—their VDTs don't even line up at the same level!

Ideally, of course, your people won't have to prop up their machines at all, because they'll have helped you choose easily adjustable screens and other equipment.

"When I help design new computer systems," says Robert Waters, an ergonomics specialist with a background in psychology, "I try to find out who'll be using them. Then, if possible, I'll seek out their opinions.

"If you do that, people won't feel so threatened. It will be their equipment, too, not just the company's. They won't think, I don't like it, it's bad for me."

Richard Koffler, editor-publisher of the *Ergonomics Newsletter*, also recommends giving the worker a voice in equipment selection: "If you can do it, try it. They'll tell

themselves, 'I wouldn't want to look like a fool because I chose something that wasn't good.'"

In Washington, D.C., Richard G. Barry, now senior advisor for management systems at the World Bank, has successfully let employees help pick some of the computer gear the bank was using. Barry didn't set out to experiment. He just decided that giving the workers a strong voice would be the most logical way.

It happened, among other places, in the offices of the Eastern African region at the bank's D.C. headquarters. "We had a few word-processing machines," Barry said, "and there were a few word-processing centers around the bank where we could go if we wanted something done, but essentially we were starting out from zero."

The office included two hundred professionals and one hundred secretaries and other clerical workers, and Barry's task force represented them in several ways. One was by job function; lending officers were there as well as those overseeing the existing projects. People also came from different parts of the office's bureaucracy, from different countries, and, obviously, from different job levels—everyone from secretaries to division chiefs. Barry didn't go out of his way to pamper clerical workers in particular. He simply felt that like any other bank employees, they should decide what tools they needed to get the job done.

Secretaries, far from being anticomputer, asked for equipment to reduce repetitive typing. Managers sought fast word processing, in different languages, which complicated keyboard requirements. The secretaries themselves wanted terminals with whose keyboards and screens they'd be happy. In a microcomputer installation without separate terminals, of course, there may be less choice.

It took a year for the task force to line up the equipment, and wisely the actual equipment shopping came last. Instead, the task force focused on what characteristics it wanted the gear to have. Then it learned what was available—how products compared to the ideal system within budget. As a result, the Eastern African region ended up with good, sharp computer screens, ergonomic furniture from the very start, and a lighting

system fit for computer work. And Barry says the teamwork helped promote ...

... Good Job Design

A friend of mine, a mid-level manager, was almost salivating over the economies of computerized word processing.

"You know what I'd do?" he said of an office where he'd worked. "I'd take out just about all the secretaries and dump them into a central office. I'd reduce their salaries. They'd be doing less demanding work and should be paid less." He wasn't an ogre. He was reflecting the thinking of a good many modern managers. It makes sense, doesn't it, turning offices into factories, which, indeed, might run twenty-four hours a day, to make the best use of equipment?

Well, not quite. In fact, not at all. Nor should you try obnoxious gimmicks like **computerized pacing**.

They're all threats to good **job design**, which is nothing more than sensibly deciding what each job includes and how the employee does it.

Consider typing pools—er, centralized word-processing operations. If not passé, they at least deserve to be; most, anyway. Employees' salaries keep rising, even with slowed-down inflation, while the price of computers is falling. By the end of this decade an average worker's salary may exceed $20,000 annually. And yet micros and dedicated word processors will easily cost less than several thousand dollars. Even now, for a typical business, Barry says, centralized word processing simply doesn't pay; it tears the employee away from his or her boss and harms the managers' own work. Executives must vie with other offices of a company for the word processors' time. They can't effortlessly set their own priorities. And quality is more of a problem, too, because, as Barry notes, "someone in centralized word processing won't normally get hell for not catching an error. I expect my secretary to challenge anything she's not certain about. For instance, my secretary will come in and say, 'You left such-and-such person off the list of people receiving the memo.' Which matters. Often who a memo goes to matters as much as what's in the memo."

And what about the question of knowing which calls to put through to the boss? Around the time Barry and I talked, he was obsessed with a paper projecting the World Bank's office needs for the next twenty-five years. He didn't have to tell his secretary of the importance of any call about the paper. She knew. For she'd been helping him put it together.

"It isn't a question anymore of the efficient use of the machines," Barry says in recommending the traditional secretary over the pool arrangement. "It's effective use of the people. It's like the phone. Even if people use the phone just twice a day for business, we still give them their own. We don't put all the phones in one room, do we?"

You may disagree with Barry and still insist that central word processing is the most efficient use of both equipment and people; and maybe your company's size, economics, or policy will allow nothing else. But if so, be prepared for more job complaints. Shut off from the outside world, perhaps in a windowless, poorly ventilated room, the pool members may feel like Dickensian factory hands. And the claustrophobia may not just be physical. With no one around but others in drudge jobs and their immediate supervisors, the workers feel cut off from chances for advancement. They become obsessed with their immediate surroundings and may be more apt to notice shortcomings of their equipment. "You look at studies of typing pools," says Waters, "and you'll find they may actually get in the way of productivity. More workers hate their jobs, and they're more likely to dislike their equipment, feel backaches, other pains." He says that sick leave, deservedly or not, may increase.

A gray-haired word processor in Manhattan said she disliked even "clusters," which were smaller and presumably more pleasant than a giant typing pool in a back room. She missed the "pretty cozy relationship" she enjoyed as secretary to one executive.[35]

"He might send me uptown to return a blouse that didn't fit his wife. So he couldn't very well tell me not to make personal calls. Not that I stayed on the phone all day. My job was to get his work out, which included staying late if I had to. He appreciated me. And I expected to stay with him till he retired."

Responding to consultants' recommendations, however, her company one day offered her three choices. She could work as a mere administrative assistant, join a word-processing operation, or quit. So she forsook the familiar typewriter for a Wang. "Ah," she reflected, "when I think of those years of correction tape, white-out, retyping!"

Then, continuing her remarks to writer Barbara Garson, she added: "I want you to take this down: I love my Wang. It's not the machine that gave me the shaft."

What, then, did?

"Straight typing, seven hours a day," said the word processor. "That's the shaft."

Like Barry, she criticized the quality of work from word-processing pools—or the lack of it.

"The worst thing," she said, "is when things come by me with wrong spelling, wrong information. Sometimes I think I should correct it. I did at first. But that's not how they judge me." It's by the number of keystrokes. "So why should I take time to correct their work? And why should I stay two minutes past lunch if they're timing me that way?"

Michael Smith, however, makes a good case for careful, sensitive monitoring.

"Management would be foolish," he said, "if they didn't monitor performance. It's what you do with the monitoring that counts. If you use it in a negative way, that hurts performance. It might improve it for a minute or a half hour while you were watching them, but it might hurt in the long run." He recommends, instead, systems that give the workers themselves "direct, immediate feedback. The faster the better."

Joan's old insurance company, shortly after she left in 1982, started a monitoring system in offices across the country. Some of her ex-colleagues found it more palatable than a simple keystroke count.

Every six months it adjusted their job levels and salaries. And production—the number of health claims processed—was just 30 percent in the formula. Accuracy was another 30. The remainder of the formula plugged in attendance and supervisors' observations on job knowledge and the quality of correspondence. The employees weren't just at the mercy of a machine.

“It’s a more equitable system,” said a claims processor whose salary leaped from $220 to more than $280 a week.

Still, the union claimed that most members weren’t so well disposed to the new system. That may or may not have been true. Just the same, the claims processor qualified her own enthusiasm. She wanted faster feedback from the monitoring. “It would be constructive,” she said, “if we got it at the end of the day or even weekly.”

The woman, too, hoped to know the exact math behind the salary system: “I’ve asked my manager a number of times. She said, ‘You wouldn’t understand it.’ I said, ‘Tell it to me, and I will understand it.‘”

Big questions persisted. Was the insurance company, for instance, really crediting her extra for writing letters to doctors who haven’t submitted diagnoses with claims? The company told her that it was—that it still paid to handle such cases. But she wasn’t so sure. Management, she claimed, had lied on other matters.

Another worker said the company did not audit enough forms to discourage slipshod work from high producers.

Even in its first few weeks, with the normal start-up wrinkles, the system did show some promise. Production was dramatically up. “If I was a manager and my job was to get the maximum amount of work out of an employee,” said a claims processor, a union member, “yeah—in that position I’d use it.” But she worried, justifiably, about her own future. “Maybe a person has been producing ninety claims a day. How much more can they push them? They can’t push them past a hundred, so what else is there for them to do?

“There aren’t many [promotion] opportunities here because supervisors have been here for years and years,” she said. And she wondered: What about turnover?

It was winter 1982. A depression or near depression was in full swing. Would the system have worked well in normal times?

Moreover, how much of a trade-off existed between the claims processors’ productivity and health? NIOSH studied 130 occupations in the 1970s and found that clerical workers were second highest in illnesses like coronary heart disease. Also, many of the women in Joan’s former insurance office

had children and blue-collar husbands, and a Massachusetts study showed that women in such families suffered nearly double the heart-disease rate of their husbands. And in Joan's office, did health insurance claims—for her coworkers' own ills—cancel out some of the productivity increases? Moreover, how about the moral issue? Suppose the monitoring system taxes the employees' health for short-term gains; isn't it almost the same as if the company were belching carcinogens into the air?

If you're working in a low-level clerical job without control over your fate, you're a good heart-attack candidate, according to R. A. Karasek, a professor at the Department of Industrial Engineering and Operations Research at Columbia University. [36] He cites studies showing that people in "strain occupations" may show twice as much "definite and suspected myocardial infarction and angina pectoris."

Computerized pacing can increase the stress and health risks. Smith says it's rarely if ever the answer in white-collar work, not even mail sorting—nothing "involving letters, letters, and so on. It doesn't improve efficiency because there are a lot of errors." Pacing isn't just monitoring, after all. The work is electronically moving past the worker as if it's on a factory conveyer belt. Think of all the lemons Detroit put on the road in its eagerness for new production records. "With older workers the error rate isn't as high," Smith says of white-collar jobs paced by machines. "Maybe it has to do with the nervousness of young people. Older workers always report more job satisfaction. They become used to the drudgery. It's a hell of a way to put it, but that's what happens." Not that many older workers love machine pacing, either.

So, in a large, factorylike office, what's a happy compromise between lax discipline and mechanized martinets?

You might try **participatory monitoring**.

Hear employees' suggestions for a fair monitoring system. You needn't agree. Just listen. Your people may know of complications you wouldn't consider in arriving at your production goals; and you may also get a better inkling of how long it will take for people and machines to adjust to each other.

Also, setting goals, keep remembering that tasks vary. Don't let your monitoring system penalize people, for instance, who fill out forms more complicated than other workers'.

Keep your commitment to quality. Be willing to give employees some time away from arduous work at the tube. It's a good way to reduce expensive errors. And tube breaks might not cost you that much in the end. Can you, for instance, design your people's jobs to use them fully while limiting their time in front of the screens? Maybe you can't. Perhaps, with thorough computerization, there aren't many off-line jobs left. But try. Maybe, for instance, some data-entry clerks, showing high motivation, can work part time in low-level telephone sales. The clerks won't feel so trapped; and you may discover some top-flight talent.

Ask your employees for their ideas. Who says every tube break absolutely has to be a *work* break?

Plan, however, for breaks of one kind or another. NIOSH favors breaks "of at least fifteen minutes every two hours" for moderately heavy terminal work and the same breaks every hour for workers in the most demanding, repetitive tasks. A British labor group even suggests structuring the workday so that people spend no more than half of it at the terminal. You might chafe under those restrictions—many American companies would—but don't scoff at your own people's ideas on breaks as long as they do the work.

Here again, think about the Canary-in-the-Mine Theory of Labor Relations; do not tune out the complainers: do not misplace machismo.

Terminal Happiness

In the Dark Ages, the pre-VDT days of newspapering, I worked on a rickety manual typewriter. How I envied Darlene at the desk behind me! I was a reporter-feature writer, while she was stuck with grinding out TV listings and obits; but Irving Leibowitz, the editor, had favored her with a Selectric, and I demanded to know why.

"Well," Leibo said, "she's a neater typist." It mattered. Darlene would feed her Selectric copy to an **optical character reader**, which helped convert the typing to newspaper print. "There's another reason, too," he said.

"What?"

"Darlene has a lousier job than you do," said Leibo, himself a manual typewriter user, "and just as much typing to do. In fact, more."

Budgeting for VDTs, you might keep Leibo's wisdom in mind. He gave out the best equipment not to his higher-ranking people but to those who needed it the most.

I thought of Leibo and Darlene when I read of the Grid Compass executive computer and its original $10,000 price. It might be a splendid machine, but what a waste of money in many cases. The money instead might go to buy the right screens and keyboards for subordinates. So often the difference is just a few hundred dollars, if it exists at all. Don't give your employees a say in the selection of equipment and then restrict their choices through unreasonable penny-pinching. If you can't do it the right way immediately, maybe you should wait before you computerize.

Mind you, no terminal or micro is going to be ergonomically perfect. "I'd flunk them all," said Waters, and he started with the DEC VT100 terminal he was using on his job at the time. The display was plain, old white on black, not the best ergonomically, and it was too dim for many offices. Fortunately, the lighting in his room was subdued. The terminal, however, had other shortcomings—for instance, the lack of simple knobs to adjust the screen's brightness and contrast. Waters instead had to control them with a series of

keystrokes that he was always forgetting. His loudest groans, though, were over the numbers pad to the right of the keyboard. “I count 1-2-3-4-5-6-7-8-9,” Waters said. “I don’t want anything where I count 7-8-9-4-5-6-1-2-3.” That’s how his numbers pad was; that’s how my machine’s is; that’s in fact how most computer pads are.

“Well,” I asked, “isn’t that just like a calculator’s?”

“But,” said Waters, “isn’t it a little confusing to switch back and forth between that arrangement and the numbers of a telephone? Which are in the normal numerical order.”[37]

You may disagree with Waters, but his message comes through. Even ergonomics experts can’t always end up in front of the terminal of their dreams. What you and your people want, however, is a sensible compromise.

Ideally, rather than simply seeking the biggest discount through the most massive purchase, you’ll remember that different people need different terminals. You may in fact save money that way.

An executive who hates to type, for instance, and who doesn’t have to, won’t need the same keyboard as a data-entry clerk. It still should be a good board in case he changes his mind, but it needn’t be the most expensive. With a World Bank-style selection committee, you’ll be more sensitive to the needs of different offices, different levels of employee.

Encourage some committee members to spend at least two or three hours with the equipment you’re planning to buy; they may change their minds later—but that’s better than no tryout at all.

Testing my Kaypro at dealers, I wrote test letters, composed sample articles, and tried as closely as I could to duplicate my routine.

Impressed by the low price of the Osborne 1, I gave the little keyboard every benefit of the doubt. And yet, even after several hours, I simply could not adjust. “Just a matter of operator retraining” was how one saleswoman put it after I complained that I kept hitting the return when I wanted a quote mark. And yet I wasn’t about to gamble $1,800 on a machine with a keyboard I might forever hate. Ergonomically, I had an advantage: I was buying just for myself. But a selection committee, made up of different kinds of prospective users—

clerks and executives alike—is the next best thing to a lone customer shopping with only himself in mind.

Avoiding the HAL syndrome, your committee should consider, among other things, the following:

THE SCREEN

For heavy-duty viewing, a terminal or computer should have at least a nine-inch screen and ideally a twelve incher. I emphasize the words "heavy-duty." An executive using a terminal half an hour a week obviously has needs different from a clerk doing tedious data-entry work most of the day. Even the executive, however, should have a screen big enough for unexpectedly long sessions in front of the tube. On the other hand, suppose a bank teller must view just a few columns of numbers every now and then; he may never need a screen bigger than a few inches. Too large a screen, in fact, even in heavy-duty work, may expose one to glary reflections.

Size preferences can be quirky. I'll make do for the moment with the Kaypro's nine inches, but I wouldn't mind a bigger screen; another writer once said he'd like to hook up the same model to a twenty-one-inch monitor.

The next basic is the color. The two sexes have somewhat different tastes. Men, says John van Raalte, an RCA scientist, are less sensitive to colors in the reddish-orange range than are women. That doesn't mean, however, that, as a rule, women should automatically have reddish-orange monitors. For men and women the optimum range of light sensitivity is usually amber or green. Comfort is high in those ranges, too, at least for most people.[38]

Amber screens are popular in Europe, where one study showed a lower error rate compared to green and other statistics said more users liked amber.

American computer magazines have breathlessly praised amber. It's as if they were fashion publications thrilled by the latest from abroad. But *some* U.S. experts question the controls in at least one proamber study—for example, the number of volunteers, fewer than two dozen. And Bruce Rupp of IBM points out that it's harder to produce a steady, flickerless image with amber than with green. What's more, an executive with a

company planning to sell amber terminals said screens of that color burned out faster than did green ones.

Meanwhile, NIOSH says dark characters against a stable white background are especially promising; and Etienne Grandjean, a leading ergonomist with many admirers in the labor movement here and in Europe, agrees.

Perhaps there's a less jarring transition when your eyes move between the screen and the printed material you may be working with. It sounds logical enough, and in fact that's what the Macintosh and many other computers use. That's also the display style I saw in the Newspaper Guild offices in Washington.

"Do you see any flicker?" asked David Eisen, the guild's research director, who, in the labor movement, is one of the best-informed people on VDTs.

I studied the white background.

"The little lines," I said, "seem to be rolling into each other."[39]

The machine's regular operator also saw the roll but said the screen was comfortable, anyway.

The Guild machine, moreover, a Xerox 860, had the ability to revert to white letters against a black background, which would have eliminated the rolling. Would that all screens be as versatile, especially those used in many tasks or by people with different tastes.

No matter what the task, however, don't get caught up in terminal fashion. Stress the basics. Are the characters, for instance, shaped well? How big? At least .12 inch and preferably .16? Is the **dot matrix** at least seven by nine? Harry Snyder at Virginia Polytechnic Institute found that seven-by-nine matrixes produced "significantly fewer errors" than when subjects worked with those that were five-by-seven. If you can't find the information in a machine's literature, you might use a magnifying glass to count the number of dots making up the maximum widths and heights of the characters. Trying the large "N" and several more letters on my Kay pro, I learned that dot matrix was a mere five by seven—the bare minimum for light use; for a writer it could be better.

You might also back off twenty inches to see if the dots merge almost completely into the letters and numbers. Eisen

suggests looking for flaws like “flicker, character blurring at the edges of the screen, and adequate space between the characters and lines.”[40] Eisen obviously is looking at VDTs from the viewpoint of the union members. But unionists’ desire for comfort and ease of use often will overlap with employers’ desire for maximum productivity. Woe unto the employer who doesn’t take advantage of the overlap. In fact, Eisen’s observations here on keyboards and screens are within the ergonomics mainstream and shouldn’t be dismissed because of his affiliations.

“The two things you must remember,” sums up Waters, “are legibility and comfort. You may think at first that a five-by-seven matrix is fine. But after six months your eyes may say, ‘No, No!’—and you may get headaches and feel you need new glasses. Actually, you simply may need a better screen. You’ve just got to consider how often, long, and intensely you’ll be looking at the tube.”

When shopping around, you also should ask, “How many letters and numbers—how many columns—can fill the screen?”

For word processing you’ll normally want at least 80 columns across, the standard. Some screens, like that of the Victor 9000 microcomputer, can display 132, which can be just the ticket for spreadsheet aficionados with the right software.

You’ll also want to know if you can highlight selected parts of the screen, for instance, categories of information stashed away in the computer. You might use **reverse video**—a light background and dark characters if your normal background is dark—to keep track of columns showing names and addresses. Not interested in phone numbers? Then those columns for the moment would be the normal light-dark combination. In word processing, reverse video could show you the blocks of texts that you planned to move or erase or underline.

Two other amenities—more than amenities, in fact—would be easily reachable and adjustable controls for changing brightness and contrast. The Kaypro lacks a contrast control, much to my chagrin. At least I can adjust brightness—a “must” normally and one still “mustier” for people using antiglare filters, which reduce light from the screen.

Keep thinking what you or others will most use the computer for. Color graphics? Fine. But your multicolor monitor won't display characters as sharply as a black-and-white or **monochrome** screen would, and the screens might lose their crispness faster and add to the eyestrain of heavy word processing. One-color screens, then, would be best for typical writers and secretaries. On the other hand, if you're an executive or clerk working with many figures alongside each other, the color monitor might help you and your eyes keep the numbers apart. Might. Some people may object to color except for graphics.

Two kinds of color monitors are common. The **composite** monitor is technically more like a home TV than the **RGB** or "red/green/blue" kind. It's cheaper. But colors blur into each other more than with the latter type.

Whatever monitor you buy, keep the screen clean.

And don't be surprised if, in a year or so, the characters start looking a little fuzzy. Harry Snyder, a leading expert on the ergonomics of monitors, says the half-life of a tube in heavy use is normally about a year. Don't stint on replacements and jack up your people's error rates.

THE KEYBOARD

Remember Raquel toiling at a keyboard attached to her computer?

Maybe she's happy. She may have a well-built back, a graceful, flexible neck, wrists that don't quit, or simply a body compatible with her machine and furniture. But I still question the attached board for most people.

Unless Raquel spent many hours on the machine before buying it, she might not have known if she'd be comfortable.

The more time you spend at a keyboard, the more likely you'll end up with the right one. Test keyboards thoroughly. If you're buying several dozen, you or a staffer might spend a good three or four hours with the machine you're about to purchase. A difference of just 10 percent or so in the number of keystrokes per hour per operator could mean thousands of dollars annually to your business.

Even if you're buying a machine just for your own use, you should still put in a good half hour checking out the keyboard. That's true with any computer. But the odds are stacked against you if you buy one with an attached board. In Norway, in effect, computer keyboards by law must be detachable, and in Germany official standards require them in most cases (an exception exists for, among other things, limited-use portables with built-in screens and keyboards).[41] Increasingly, union people here are raising the issue—and quite justifiably, considering the feeling of most ergonomics experts. Detachable keyboards, in fact, were one of the issues over which a California union struck the local Blue Cross-Blue Shield organization.

"Well," you ask, "what about keyboards on infrequently used machines?"

You might, however, end up using the keyboard more often than you expected. So play it safe. Make all boards detachable. It won't cost that much more. Also, keep the cords at least four feet long. And unstrap the keyboards from the VDTs in the first place—which sounds insultingly elementary, except that I've heard of an absentminded company that, until a labor dispute, had forgotten to do so.

Also, don't let the best keyboards become status symbols in reverse. A well-meaning but wrong executive on the West Coast brags he does *not* have a terminal with even a good board. He's a fast typist but thinks he could spend his time better giving dictation. "An executive typing," he says, "is like hiring a brain surgeon to give out pills for a sore throat. If you're paying him $50,000 a year, why should he do a $20,000 job two hours a day?"

Most executives would agree. But this is rapidly changing; more and more executives are tapping out spreadsheets and eventually will do their own word processing. They may bat out rough drafts on computers or word processors, then have secretaries whip the documents into shape electronically without having to retype all of them.

Besides, you can learn typing at any age. And you needn't be an excellent typist for computers to help you; indeed, with mistakes easier to zap, the worst typists will profit the most. Take a Maryland architect-consultant named Jess McIlvain.

Before he got an IBM PC, he just couldn't write or type at length—worrying that the result "looked like the cat had walked over it." Two years later he was cranking out reports several hundred pages long.[42]

The new breed of managers, of course, may feel at home on the keyboard from day one. Some colleges even now require students to buy computers, many of which they'll almost certainly use for word processing. What's more, as you'll read in Chapter 11, executive keyboards can ease the transition in the future to telecommuting.

So don't impose your own work habits on a junior executive with fast fingers. Why shouldn't he or she have a deluxe keyboard if it helps him serve your company better? And you yourself shouldn't feel awkward with at least a good board for quick memos.

Mysteriously, IBM forsook the Selectric tradition in designing the keyboard of its original Personal Computer, where the left shift key, oddly, isn't immediately next to the "Z." The deviation left some computer magazine editors flabbergasted. Companies even started making keyboards for the PC—at several hundred dollars apiece—that retained the traditional layout.

"They're not like normal keys," my consultant friend Michael Canyes complained of the ones on the PC itself. "They click on and off like switches.

"A good key," he said, "gets stiffer as you press down. But the IBM's are either up or down."

Some cynics have a theory. Maybe IBM didn't want the PC to steal too many customers away from the Displaywriter costing several thousand dollars more. Yes, keyboards are a matter of taste, and unlike Michael, I can stomach the switchlike **tactile feedback**. But the shift location is inexcusable. IBM in effect admitted its goof; the IBM AT, a more powerful cousin of the IBM PC and XT, appeared with a much-improved keyboard.

At least the original IBM PC's keyboard surpassed that of the tiny, chiclet keys on the first PC*Jrs*. Reluctantly—after sales were flagging—IBM replaced the chiclet-style boards with more conventional ones.

Pity us "users." Even terminals intended for mainframes and minis can be turkeys. I actually favor my Kaypro board over a terminal—from Digital Equipment Corporation—which Waters once was using with a big mini at work. Blame the old-style programmers who didn't grow up with word processing. "Most can't type like a secretary," says Canyes, "so the manufacturers often skimp on the touch."

And isn't it strange? You can buy an electric typewriter with adjustable touch for $200 but not get it in a computer costing fifty times as much.

I asked David Eisen why he hadn't raised the touch issue. Wouldn't bad keyboard matches hurt productivity?

"That's more the companies' problem," he said. "We're more worried about health." He can't recall a flood of complaints from Guild members about keyboards with the wrong touch.

Union people, however, have talked about another change, flat keyboards, now popular in Europe. The tops of U.S. boards commonly slant at fifteen degrees. And Waters tells of an experiment where, given the ability to change the angle, most participants settled for the fifteen-degree one. A caveat, however, is in order. Maybe the people ultimately would have done better with a flat board and plenty of practice on it. Perhaps you want an adjustable board. But for me, anyway, it won't matter as much as touch.

Another issue is the QWERTY keyboard versus the more modern layouts.

"QWERTY" means the first six letters found on the boards of nearly all American computers and typewriters. It's a nineteenth-century legacy—a bad one. The early typewriters couldn't keep up with the nimbler typists, so the machines' designers thwarted the humans. QWERTY isn't alphabetical, it doesn't bring together commonly used letters like "t," "h," and "e," nor does it use finger muscles properly. The Dvorak board and other latecomers should work better. In practice, though, they might confuse typists, so here's a solution. Let us old-fashioned people QWERTY away. But think about buying machines you can switch over for people trained on more efficient layouts. A program like Smartkey—which electronically changes the keyboard—might be the answer if

you also relabel keys on machines used by Dvorak typists. The Apple II(c) even has a switch on the top of the machine to go from QWERTY to Dvorak. Some say the Dvorak improvement is dramatic. Waters isn't so sure. He says some studies have indicated that the Dvorak board offers as little as a 5 percent increase in speed and little reduction of errors. "So in the end," says Waters, "most people in the industry have decided not to tinker with the key arrangement."

No matter how they're arranged, your keys shouldn't be shiny; a matte surface is good. So are neutral colors rather than black and white, except, says Eisen, for function keys. My Kaypro sins. Its keys, like those on Digital Equipment's VT100, are a gleaming black, which, however, doesn't matter that much to me, since I can control my lighting and normally don't look down at the board when I'm typing. (Some other Kaypros have black matte keys.)

Function keys—the ones that let the operator delete a word or add a paragraph with a single touch—should ideally be a different color from the main keyboard's. The same for number pads. The function keys if possible should have labels indicating their purpose. If not, a chart near the function keys might show, for instance, that "P1" "Deletes Word."

Some people, however, say that function keys really slow you down, that they make you take your fingers off the main keyboard. I basically agree. The same would hold true for the use of Macintosh-style mice.

SPECIAL ERGONOMIC FEATURES

A dream VDT tilts. It swivels. It can move up and down on a pedestal. It helps you avoid back strain, stiff necks, glare, and headaches. It adjusts, so you don't have to. A good VDT can help compensate somewhat if you lack ...

Good Furniture

"People will adapt very nicely to automation," an IBM official once said, "if their arms are broken, and we're in the twisting stage now."

That was in 1975. Since then, however, in a literal way, some computer makers have been gentler with people's arms —and wrists and backs.

A variety of good computer furniture exists now, some in walnut, some in formica. With all the trimmings, you can vary:

1. The heights of the keyboard and of the computer or terminal.
2. How far the keyboard platform protrudes from the platform on which the computer rests.
3. The tilt of the computer—a useful glare-reducing feature.
4. The angle at which the screen faces you. You can swivel away to your heart's content to suit your posture or cut back on glare.
5. The height of your chair. You don't of course need high-tech furniture to do that—just common sense. For a computer operator, says David Eisen of the Newspaper Guild, a straight-back chair can become "a ticket to the orthopedic ward."

You might also shop for a palm rest and, if you're short, a leg rest.

An easellike copy holder could help as well.

And so can enough desk surface, shelves, or file cabinets for your paperwork. Why buy a detachable keyboard if you can't move it around because your desk is too cluttered?

Jon Ryburg, an ergonomics expert with the Facility Management Institute, a Michigan think tank owned by Herman Miller furniture, says computer gear may take up as much as 40 percent of a desktop. And yet does the space requirement for paperwork decline by that percentage? Hardly. So unless you enjoy seeing chairs used as desks, you'd better plan your furniture well.

Not that all improvisation is bad, especially if you're a professional or small businessman working at home. My Kaypro, for instance, rests atop an old carton from a toy store, and I've bought some little gray legs, the color of the case, to tilt the screen back.

That takes care of my ergonomics. Of course, my requirements in this case aren't the same as those of a company with dozens of VDT users.

Joan's old supervisor at the insurance company might scowl at this haywire, but so far I'm comfortable. I would be much less casual about buying furniture for others. For example, I'd make certain that the chairs and tables would be not just adjustable but easily so—and understandably so. Even an IBM salesman couldn't puzzle out all the ways to adjust the ergonomic furniture on which a Displaywriter sat. Despite such a flaw, however, special computer furniture isn't just a frill. An ergonomic desk and chair might cost several hundred dollars more than an ordinary set—even a lesser-known brand may—but your furniture could be good for a decade. And just a 5 percent increase in a cleric's productivity may pay back the extra investment in less than two years.

At the least, buy an adjustable chair and, ideally, a table of variable height. "A very short woman," argues Bob Waters, "may sit with her eyes almost a foot closer to the floor than a six-foot-two-inch man's." The home-row keys on the keyboard —the row including the letters A, S, D, and so on—could be twenty-nine or thirty inches above the floor in a *typical* case.[43] Other measurements? Upper screen-eye distance: 17¼ to 19¾ inches. Center of the screen: 10-20 degrees below the horizontal plane of the operator's eyes. Angle between upper and lower arms: between 80 and 120 degrees. Wrist angle: 10 degrees or less. The keyboard is at or below elbow height, and the table allows enough room for your legs.

Your goal, of course, isn't to make anyone fit the charts showing average distances. It's just to keep people productive and comfortable.

Above all, when shopping around to do this, be skeptical. "A lot of so-called ergonomic things," says Waters, "aren't ergonomic at all." He grimaces when he sees $300 wooden tables with fixed-level platforms for computer monitors.

They’re an expensive way to strain your neck. “The normal line of sight for human beings is fifteen degrees below horizontal,” Waters says. “People normally look slightly down even when they hold their heads up.” Needless to say, you and your neck will come out ahead if, using an old Apple II, you don’t set the monitor atop disk drives resting on the computer. Ignore the ads showing this compact pile. Their purpose is to sell computers, not save necks.

Lighting

Bright fluorescents are to computer users' eyes what a *drip, drip, drip*, is to the foreheads of Chinese water-torture victims.

They're rude, persistent distractions.

And as with the water torture, the fluorescents' victims may be captives of sorts. How many people can dictate the lighting in their companies' offices? Many. But not all. So the letters and numbers on their screens, the facts they need to do their jobs, may compete with the glare beamed off the glass.

What's more, the culprit needn't be just the fluorescents that light so many American offices.

"The window with sunshine streaming in may still be a psychologically gratifying link with the outside world," says Eisen, "but it spells plain eyestrain and perhaps headache for every VDT operator within range of the glare." Even brightly painted walls can sin here.

So can glossy paper. In fact, *any* paper is bad in one overpowering way. The proper lighting level for paperwork is much higher than for computer work. And yet most computer operators have yet to see the much-touted paperless office. How do you keep eyes comfortable with both paper and computer screens?

Here are some *possible* solutions to the lighting problem:

1. Removing half the tubes from existing fluorescent fixtures. You'll want, however, to make certain that some areas of the room aren't still overlit while others are light starved. Be skeptical. This is the miser's solution. If you can get away with it, fine. But don't count on it. Remember, the women at the insurance company in New York say they still suffered glare afterward.
2. Parabolic fluorescent fixtures with baffles to keep the light out of the places where it can cause glare.
3. Parawedge louvers, which, according to Eisen, "have been particularly effective on a number of newspapers." Small plastic cells turn light downward, so that, ideally, you can barely notice it at desks just a few feet from the one you're

illuminating. “Light should be cut off,” Eisen suggests, “outside a line emanating at a forty-five-degree angle from the fixture.”

4. Desk and floor lamps. You might buy rheostats you can plug in between them and the outlet to adjust the light level. And be careful otherwise. Shield your lamps so they don’t glare off nearby computer screens. Properly used, however, they could be a godsend for people doing both computer work and paperwork.
5. Indirect lighting. The disadvantage is the expense. You may have to repaint walls and ceilings and pay for a consultant to select the right tones. Moreover, indirect lighting may be hard to install in rooms with ceilings lower than nine feet. Used well, however, this is one of the best solutions.

As a general rule, think about a lighting level between 300 and 500 **lux**—between 32 and 53 **footcandles**. A lux tells how much light is hitting a certain area, and 9.5 lux would equal 1 footcandle. For rough measurements you might borrow a good lightmeter from a photographer. Don’t aim directly at the light. Sample, instead, desk and computer surfaces, among others, though not the screens themselves. For more detailed measurements and advice, hire a consultant or call your state labor department. Make certain you‘re in touch with the consulting rather than the enforcement branch. Yes, any contact with officialdom has its risks. But they’re low here. And you’re strengthening your hand in labor relations by documenting your concern for your workers’ eyes.

In fact, before you place your order for lighting, ask if your supplier can run a test in your office. Or can you at least visit offices using the product?

Also, all along, worry about glare as well as lighting levels. You might try the mirror test suggested by a veteran ergonomics expert. Place a mirror over the face of a computer screen. Then you can see where the glare is coming from—which window, which lamp; for all you know, the source could be a brightly colored painting or a glassed-in print.

Try to rid your office of glare instead of using a filter. “I believe in avoiding a broken arm rather than putting a splint on

it afterward," says Harry Snyder. If you need a filter, however, here are possibilities:

1. Coatings or etching applied during manufacture of the video displays. They needn't harm the viewing quality noticeably.
2. Coatings put on after manufacture. Generally, but not always, they don't work out.
3. "Colored plastic panels and etched faceplates," which, says Eisen, "have such damaging effect on brightness and clarity of the characters that they should be avoided."
4. Micromesh filters, favored by German ergonomists. Eisen says U.S. opinion of them "is mixed. They do a good job of reducing reflections, but the mesh makes for a restricted viewing angle, absorbs some of the light from the display, and scatters some of the rest, degrading the image."
5. Polarizing filters. They may reduce brightness and shorten tube life, since you must crank up the tube to compensate; at $100 or more, they are more expensive than the other add-ons. But they give you a better image than other filters. The contrast especially can be impressive.

Noise Reduction

Don't just buy the fastest, the cheapest, printer. Look for one with good manners toward the humans nearby—a *quiet* printer.

A daisy wheel can be a real offender. What more can you expect of a machine with a metal hammer constantly striking away? And dot-matrix printers often make a higher-pitched sound that mercilessly cuts through walls.

So ask your printer supplier for noise figures if you think this will be a problem. Military standards say that for work needing heavy concentration—in areas like libraries and conference rooms—the sound level must be no more than 45 decibels on the dB(A) scale, which allows for sensitivity of the ear at various sound pitches. Otherwise, aim for a level less than 65 decibels. You may be able to rent the necessary meter from a scientific instrument store. Measure the sound from the distance someone's head would be when he was working. Here again, you might ask the supplier for a look-see at an existing installation.

Put your printers if necessary inside padded wooden boxes; carpet; drape walls; install sound-muffling panels on ceilings and walls, perhaps.

The less echoey and factorylike your office is, the more productive it will be.

Air Conditioning, Heat, And Ventilation

Around the first week of January 1983, when *Time* honored the computer as the "Machine of the Year," a Commerce Department computer ungratefully stopped working and delayed the release of an important government report.

The reported cause was nothing more than a dehumidifier motor out of whack; perhaps the room got too moist for the computer sensor.

If so, I wasn't surprised. Computers and related machinery can sometimes be quirky about their surroundings. My old Anderson Jacobson daisywheel printer, later sold, wouldn't run unless the room temperature was above fifty degrees. Since I was comfortable at seventy degrees, I obliged the AJ.

In our attentiveness to machinery, however, let's not forget the people nearby.

"You can see the heat wafting out the backs of our VDTs," said a woman with the northeastern insurance office—and yet the firm didn't turn up the air conditioning. "What might happen," said Waters about a hot insurance office, "is the [overheated computers] may go down and they'll pay out extra money, anyway."

Look inside a VDT and you'll very likely find an orange glow in the neck of the tube. The heat there may be no more than a light bulb's, but on a hot day, with more than one machine in the same room, you'll want your air conditioning to be up to the job.

At the same time, having a room too cool—even in just a few places—can harm productivity. An employee in the insurance office said her coworkers, when not using the terminals, sometimes wore gloves.

As for bad ventilation, it, too, can jinx production and add to sick leave, and in recent years, especially, it's been a problem, as companies tightened up their buildings to save energy. People in high-paced jobs or those requiring concentration may suffer the most.

Healthy Honesty

When Laura Moore was pregnant, she neither smoked nor drank—not even coffee.

She did, however, operate a computer terminal for a telephone company in Renton, Washington, near Seattle, and she was one of three VDT operators there with problem pregnancies within a year and one-half.[44]

Laura Moore, after nineteen hours of labor, gave birth to a son with a birth defect called spina bifida. “We didn’t see it at first,” she said. “We saw a larger head and a foot that was a little odd and distorted. But when the nurse picked him up, then we saw this huge opening in his back, which is a spina bifida.” Laura was “devastated. Just devastated. We—I went through a severe depression afterward.”

Moore is just one of many people worried about VDTs. In Massachusetts a pregnant journalist, fearing radiation, wore a leaded apron. (A leaded apron’s weight on the mother might itself harm an unborn child.) At the *New York Times* two young editors developed cataracts and filed for workers compensation, blaming their computer screens.

“We’ve heard of cases of everything from bad dreams of computers chasing people to psychic distress where people have attacks of depression,” says Michael Smith, the ex-NIOSH man. “But it can’t be linked specifically to the VDT.” And yet NIOSH as of this writing was continuing safety studies. “We might find that it has nothing to do with the video tubes,” Smith says of problem pregnancies among terminal operators. “It could be part of the circuitry.... It may be from job stress.” Meanwhile, proven problems—like eyestrain—bedevil men and women on the tube. When 1,236 secretaries and word processing-operators replied to a survey done for a major disk-maker, almost 70 percent worried about potential health complication. Some 63 percent told of eyestrain, and 36 percent reported backaches. Almost 80 percent wanted better lighting and more time to rest their eyes.

So, regardless of how your equipment supplier vouches for your computers’ safety, keep two facts in mind:

1. There is a possibility, extra-slim, but still there, that low-frequency radiation from computers can seriously threaten the health of workers like Laura Moore and their unborn children.
2. More minor physical and mental problems from computers definitely do exist. You and your people, however, can either overcome them or at least live with them. Don't shrug the problems off. If you do, you'll only ruin your credibility when you and your employees discuss radiation and other possible hazards.

Most people, however, accept the inevitability of computerization. Employees usually know you need your machines to keep up with your competitors. So do unions. They have computers of their own. The major labor-management issues aren't over whether to computerize: they're over how to be safe and humane about it.

And often, by agreeing to requests like those for eye examinations, you'll be helping your company along with the workers.

Here is a summary of expert thinking about actual and possible health threats of computers:

RADIATION

Could low-frequency radiation from VDTs indeed endanger the unborn? Or might it cause cataracts? And what about x-rays?

A computer user sits much closer to the screen than most TV-watchers do; might this increase the danger? After all, a typical computer, like a TV, uses a cathode ray tube with a high-voltage charge. An electron gun fires these subatomic particles toward the phosphor coating on your screen. Toward you, in other words. Wouldn't x-rays created by this process be dangerous?

Well, throw away your $50 lead-impregnated acrylic shield! Experts feel that x-ray are a nonissue here.

The x-rays aren't strong enough; besides, there's too much leaded glass in the computer screen itself for you to suffer harm. I'd worry more about the chemicals in my typewriter cleaning fluid than about x-rays from my green screen.

Then again, some respected scientists *wonder* about low-frequency radiation given off by computer monitors. Until researchers can absolve computers of blame in cases like Laura Moore's, the VDT safety issue will remain legitimate.

"The wild cards in the VDT debate are the eleven clusters of problem pregnancies and miscarriages among women who work on or nearby VDTs," says Louis Slesin, editor of *Microwave News* and publisher of the sister publication *VDT News*.[45] Some computer industry spokesmen and federal officials think the clusters show up by chance. Slesin, however, while noting that the "normal" miscarriage rate in the U.S. is almost 20 percent, says: "The incidence of birth defects is harder to account for." And he says similar clusters haven't popped up among women tapping away on typewriters.

These clusters—found in widely scattered offices in the U.S. and Canada—may result from causes other than radiation. Some VDT operators feel less in control of their jobs than do traditional typists; and a remote possibility exists that this additional stress could take its toll on the unborn children. Slesin says fear of VDTs may itself increase the stress—a Catch-22 if ever one existed.

Seeking a definitive answer on the birth-defect and miscarriage questions, NIOSH in 1984 was planning a study of about 5,000 pregnancies in a two-year period. Perhaps one-half of the women would use terminals. And the study would tell if they had more miscarriages and children with birth defects than did the other mothers. It would not pinpoint the cause, however—justification for further study.

A possible culprit here is **very low frequency** (**VLF**) **radiation** from the flyback transformer.

The transformer whips the cathode ray tube's electron beams from one side to the other of the phosphor-coated screen, then back again. Typically a flyback transformer gives off radiation pulses at the rate of about 16,000 cycles a second, far below the AM radio broadcast band—hence, the term VLF. Could pulses at this frequency have biological effects?

We don't know about VLF. But a Spanish scientist named Jose Delgado says even very weak pulses of **extremely low-frequency radiation** (**ELF**), the term for below 300 cycles a second, have damaged chick embryos. Some authorities

question the "Delgado effect"; still, scientists in both the U.S. and Europe are undertaking similar experiments. Trying to gauge the possible risks from ELF, researchers may face certain technical complexities. Some scientists talk about "windows" of power and frequency. Just a slightly lower or higher frequency, for instance, might mean the difference between safety and danger for expectant mothers.

Like it or not, the jury is still out on the low frequency issue, and some companies may want to protect themselves legally—just in case—by transferring pregnant women from VDTs. Ideally you'd coordinate this policy with those regarding maternity leaves and other health benefits; then a woman would feel free to tell you immediately about her pregnancy instead of disguising it for as long as possible.

Even if radio frequency radiation is a culprit, there is some hope. Slesin notes that the flyback transformer is on the side or back of a computer monitor rather than in the front near the operator. That isn't the best news for someone sitting near the flyback transformer of a coworker's machine, but perhaps the VLF threat isn't so great to someone without any other VDTs nearby. "With the right office layout," says Mark Pinsky, editor of *VDT News*, "you might be able to greatly reduce exposure to VLFs fields. And obviously the risk to home computer users might be less without another machine around."

Although VDTs have yet to be proven free of radiation risks, please note that groups like 9 to 5 and the Newspaper Guild have been using at least a few computers in their offices for several years. Don't lie to your people that there's nothing to worry about; do point out that the risks are low enough to justify computerization's benefits.

"Can computer screens cause cataracts?" some employees might also ask.

Probably not. A NIOSH study at the Baltimore *Sun* found no greater number of cataracts among VDT users than nonusers (although the researchers noted that the employees on VDTs averaged less than four years at the tube—perhaps not long enough to suffer the cataracts).

To be sure, strong microwave radiation indeed can lead to cataracts. But VDTs don't give off microwaves, and no one

has suggested that ELF and VLF are responsible for cataracts. Maybe there are other causes. Regardless, a certain percentage of people, some in their 30s or even late 20s, will always develop cataracts—whether or not they work in front of a tube.

BACK AND MUSCULAR PROBLEMS

They *are* common—because, as mentioned earlier, some terminals force you to choose between the best hand-keyboard distance and the optimal eye-screen one.

And for the most part, the pains are avoidable.

Etienne Grandjean tells of a study in which 11 percent of fifty-three people on data-entry terminals suffered neck problems; 15 percent, shoulder troubles; 15 percent, problems in their right arms; and 6 percent, problems in their right hands. The study also included fifty-five people in traditional office work. No more than 1 percent suffered neck, shoulder, or right arm pains, and none had problems with the right hand. Olov Ostberg and Ewa Gunnarsson, two other European ergonomics experts, likewise documented the frequent muscular pains from computer-related jobs. They found that almost two-thirds of some fairly young clerks with a Scandinavian airline reported such problems. In the United States, NIOSH, in its 1981 report, also said terminal users endured more muscular and skeletal pain.

The outrage is that it's unnecessary, almost always, now that ergonomic furniture and detachable keyboards are on the market.

Don't blame your people for their pain. Buy truly ergonomic products.

And don't just buy for male executives or female typists, especially in this age when more women are working.

PSYCHOLOGICAL COMPLAINTS

NIOSH's 1981 report observed that VDT operators showed dramatically more anxiety and depression than people not on the tubes. The researchers qualified their finding, however. They noted that many terminal operators were in jobs more

routine than those of the non-VDT people, increasing psychological problems.

Could the machines themselves, however, have made some work more routine?

For me computers mean less typing and more writing. For a data-entry clerk, however, they may mean becoming part of what Grandjean calls "a man-machine-system." Not all workers object. Some, as Grandjean says, "are proud to be included in the new work of modern technology." But most people would still favor the human touch, with or without a computer. "The computer," it's been said, "is the ultimate unsupportive boss." A Cleveland office worker observed that another woman was "fast as the wind" on a computer keyboard after ten years at it. "But," said the worker, "it's really affected her personality. I used to wonder if something was wrong—she had no exuberance. Once she said to me, 'Rose, as soon as I sit down at that machine in the morning, I feel I'm going to cry.'"[46]

"You know," said a worker at an accounting firm, "when the boss brings new clients through the office to show them around, he'll point right to me working at the word processor and say, 'Here we have our wonderful new LEXITRON,' and then move right on. He doesn't bother to introduce me—just the machine!" Mightn't he also have bragged about the operator? Can you dismiss her as a whiner? Is it any surprise that on most days the woman and two colleagues suffered headaches, shaky hands, jittery stomachs? "The place looks gorgeous," said a worker, "and that's where the management's priorities lie. They're not really as interested in efficiency as they are in using people up and pushing them out the back door."

According to Grandjean, psychological reactions to computers will differ depending on:

- The type of work.
- The way the job is organized.
- The way it is introduced.
- Various personal attitudes.

To his list I would add "Surroundings." A newspaper installed dark blue panels, six feet high, around some VDT

operators. The dark blue may have cut down the glare, but at a cost. “All we see is the walls around us,” lamented one, “and sometimes the supervisor. The isolation is terrible.” Some employees might welcome isolation at times, especially a chance to work at home; but here management seems to have unwittingly created high-tech solitary cells.

EYESTRAIN

"I wore glasses before I came in," said a claims processor with the northeastern insurance office mentioned earlier, "and now I need a stronger prescription. And I can't even read a book anymore. Before I used to enjoy reading," she told me, "but now I can barely glance at newspapers."

Many computer-ergonomics experts would scoff at the idea that the woman's work is blinding her. No one has convincingly shown that the terminals cause a permanent deterioration in eyesight. There is, however, some uncertainty. "We don't know," said my ophthalmologist when I asked during an eye examination about long-term effects—and also when he prescribed new glasses.

Most ergonomics experts would be more reassuring. They would say, for instance, that, first, people's eyes weaken naturally as they age, and you can't automatically blame the terminals. Second, terminals place more demands on your eyes than reading does. VDTs, however, don't permanently harm eyes, according to a twelve-member panel of the prestigious National Research Council (NRC) which is connected with the National Academies of Science and Engineering. The NRC study, released in 1983, said no evidence existed that VDTs could cause "anatomical or physiological damage ... to the visual system." The panel felt that the VDT controversy should be a productivity issue rather than a health one. At the very least, however, it's a comfort one. Harry Snyder, the Virginia Polytechnic Institute expert, in 1983 said that three-fifths of VDTs then on sale were not even reasonably comfortable. Just consider, if nothing else, the resultant productivity losses!

Even if the computer isn't permanently blinding the northeastern claims processor, it's in a sense shortening her life. She has less time for the reading she loves. Presumably, she would agree with the findings of a NIOSH-sponsored study of San Francisco clerical workers. Ninety-one percent of the ones on terminals reportedly complained of eyestrain, while only 60 percent of the nonterminal users did.

How to reply to such complaints? Follow the lighting and glare suggestions outlined earlier and consider rest breaks or alternating VDT and non-VDT tasks. And educate your workers—ideally before you hire them.

Let them know you're doing all you can to reduce the risks. "I have a selfish interest in this, too, you know," you can tell them once they're working for you. "The lousier your eyes get, the more errors you'll make. Which hurts *me*."

Then hand them cards with a good ophthalmologist's name on it—or perhaps several possibilities—and say: "Make an appointment. We'll pay for it." Why should a company invest thousands or millions of dollars in computer maintenance without worrying about other work tools—employees' eyes? Have new employees' eyes checked in these NIOSH-approved ways, among others, during thorough examinations:

1. Refraction
2. Accommodation
3. Acuity
4. Color vision function
5. Degree of opacity of the lens
6. The possibility of a detached retina

Yearly, the doctor should test for refraction, acuity, and accommodation.

Make sure your health insurance covers bifocals and other glasses that your employees wouldn't need except for your CRT.

CRTs: Should They Go Down the Tube?

Yes. Not immediately. But sooner or later. CRTs are harder on the eye than the better flat screens will eventually be, and although scientists haven't proved that CRTs are a radiation threat, the small possibility remains.

These bulky antiques, however, have been to the computer establishment what gas guzzlers were to Detroit. The CRT isn't the most promising kind of computer screen—just the most entrenched.[47]

Admittedly, CRTs have improved to the point where some pocket-sized TVs can use them. But in compactness and low-power consumption, CRTs will never rival the flat-screen displays.

"People will begin using flat-screen portables as regular desktops," a New York researcher correctly says.[48] Flat-screen computers may not be as viewable now as the best CRT displays, but this may quickly change. What's more, flat-screen machines don't hog desks as the Kaypro II-style portables can. After all, the flat screens are essentially—flat. They don't need hefty transformers, moreover, and don't burn out like old vacuum tubes. CRTs *are* vacuum tubes. Low voltage is still another plus of most flat screens. Not that CRTs are normally a shock hazard, but you'll presumably feel safer if you didn't sit near a 20,000-volt gizmo flinging electrons around inside some glass.

Also, as David LaGrande, an official with the Communications Workers of America notes, flat screens may "eliminate the radiation danger, reduce the risks for pregnant women." And unless you spray a flat display with radioactive material, it just won't give you cancer.

Again, no one's proved that CRTs will turn people's bodies into tumor farms. But why gamble? Your caution won't hurt labor relations.

Flat screens, also, don't flicker tiresomely as many CRTs do, and someday they may boast more fully formed images than those from the CRTs. So you might make fewer errors reading material from the screen.

The word "might" is important. Many **liquid-crystal displays**—**LCD**s, like the wristwatch kind—showed much cruder images in 1984 than did typical CRTs. The broken-up letters might bother you just like those from the cheap dot-matrix printers.

Also, some LCDs offered horrid contrast between the screen background and your typing.

That was as of late 1984. Even cheap LCDs in the future could do away with the breakup and contrast problems. Already the Japanese are selling color TVs with LCDs.

Perfected, LCDs could make computerized offices brighter and cheerier. They don't glow. Rather, they reflect light, just like paper, so you needn't darken the office. In fact, light helps.[49]

And if LCDs don't fully pan out? There's yet another choice —**electropheretic** screens, which may offer decent contrast and even beat CRTs' sharpness. Here's the theory. A magnetic charge pushes tiny particles to the surface of the screens, and patterns of particles form images.

These gizmos will tax your battery less than some other flat-screen displays do. And listen to this: when you turn an electropheretic off, it *remembers*. The images on your screen don't vanish.

Now, combine that wrinkle with memory chips that use next to no power and can be running all the time. And what do you have? A computer that will automatically shut off without harm if you didn't tap a key after a certain stretch of time. Just like a calculator. So—battery makers, beware!

There are still other alternatives to CRTs. One is the **electroluminescent** screen—used on the Grid Compass portable—which glows and is sharper than the LCD. Electroluminescents in 1984, however, were far too expensive for the average computer buyer; the Grid was selling for $4,250, and much of that was the cost of the display. A second failing of electroluminescent screens is that they're electricity hungry. You can't operate them with miniature batteries.

Another LCD alternative is the **plasma panel**, which glows with a gas mixture consisting mainly of neon. Plasmas don't flicker. The characters are sharp; the contrast, excellent. But backup circuitry has been expensive; and even small plasmas,

with the accompanying electronics, cost several thousand dollars in 1984—a far cry from a $150 CRT monitor.

To sum up, the main advantages of flat screens are their lightness, low power consumption in most cases, safety, lack of flicker, and very likely a better view in the long run. As of late 1984 the trade-offs (at least in the case of LCDs) were:

- The broken-up, somewhat fuzzy letters and the low contrast between them and the background.
- The need to have the display at just the right angle from you to get the sharpest picture. This could get in the way if you were moving the LCD to reduce glare.
- The comparatively slow speed with which letters or numbers appeared on an LCD after you've typed.
- The general lack of full-sized 24-line screens with 80 columns. The Data General portable debuted with 24 lines and a screen measuring 11 inches diagonally—a welcome exception, even if the quality of the characters still wasn't good enough for heavy use.

Since many flat screens were on portables, there were other ergonomic problems not related to the display technology per se. In late 1984, most flat-screen portables lacked detachable keyboards. But the limitations of LCDs were the main problems.

A reporter friend, banging out stories for his paper at times in the field, told me he's survived the 40-column, 8-line screen of the Radio Shack Model 100 very well. But I'm not surprised. He's also brooked that clunky Select software, which gets in the way of corrections and insertions. Gene, you see, apparently knows what he's going to write—he needn't watch the screen as much. I wish I were as decisive. At any rate, what was right for Gene wouldn't necessarily be right for a clerk who'll be at the keyboard seven or eight hours a day.

No matter what hardware and software you end up with, don't lose sight of three goals, among others:

1. Getting the most work out of your people
2. Keeping them happy
3. Guarding your electronic files

Sometimes, alas, the easiest-to-use computers may be the ones most vulnerable to computer crime and loss of important information—the subjects of the next chapter.

Backups:

■ IX, Window Shopping, page 343.
■ X, Of Mice and Men—and Touch Pads, Touch Screens Etc., page 346.

10 Jewels that Blip

The words have a nasty metallic ring, as if to suggest helmeted policemen with black jackets and billy clubs. Watch out: the "data security" troopers are at the front door.

But a small business on the East Coast nowadays wishes it had enjoyed more "data security."

A fire melted its computer disks into plastic globs. The firm just missed bankruptcy after losing several hundred thousand dollars' worth of information—everything from accounts receivable to tax records. Scrambling to recover, salesmen leaned on customers for copies of old bills.

Arson? Maybe. A disgruntled worker *may* have short-circuited some tangled wiring. Proof never came.

Either way, however, the incident was a powerful argument for "data security"—the right kind.

It's nothing more than trying to make sure that your computer and its information are safe. This isn't to advocate overkill. Don't overprotect nonsecrets or facts that you can easily duplicate; for instance, instead of buying costly fireproof cabinets, you might simply keep backup disks at another location—perhaps a more secure approach, anyway.

Why, however, do I say "trying" to make your computer and its information "safe"? An ex-hacker, Ian ("Captain Zap") Murphy, now a computer security consultant, wisely observes: "You're safe from average crooks—they don't envision a nice, mild-mannered human being working at anything more than a souped-up typewriter. But you can never, never be able to 100 percent secure a computer system. Even the most trusted user could say, 'F— the damn payroll,' and destroy your records."

But in the best of all worlds, your electronic files are safe, accurate, and if need be, tamperproof and confidential. The equipment is sound. And so are you and others working with it. You've shown good judgment. You're ideally safe not only

from crooks but also your own blunders. You know you often can't keep paper copies of all your electronic jewels, your treasured business files, at least not without giving up the conveniences of computerization. You have faith, then, that your green screen, at your command, will display the right blips. I'm stretching the meaning of the word "blips" to emphasize the transitory nature of what you see on the screen. Without your stashing it away on a disk or otherwise—and without your making an electronic backup—it may be lost forever.

The unlucky owner of the East Coast company will never see his blips again because he violated a major precept of data security. He stored his original disks and his copies in the same room—the one with the fire.

"The remark at all times in cases like this is 'Why didn't the dealer tell me?'" says Harold Joseph Highland, a top computer crime consultant and author of *Protect Your Microcomputer System* (John Wiley & Sons, 1984).

A store can only sell you a computer, not common sense. Nor can this chapter impart it to you. It can, however, pound away at the elements of data security—people, policies, hardware, and software. They go together, these four. And so do the criminal and noncriminal parts of data security. If you've lost control of your computer files and don't know what's normal, you'll hardly notice the abnormal. You'll never thwart a computerized embezzler, for instance, with a gun. You will with good software. Buy it and errors in your electronic files may leap out at you. May. Remember Canyes's Law of Computing: "Sooner or later you'll feel like killing yourself."

In other places I've written about good software and other mundane ways to make yourself less suicidal. And here, too, you'll read of everyday calamities like coffee spilled on floppy disks. But this is also the fun chapter, the one with the stories about errant whiz kids and a computer crook who supposedly stole $8 million and got away with it.

Each of their sins met Harold Joseph Highland's definition of a computer-related crime. They were "committed using a computer as a tool."

"In other words," explains Highland, who has taught computer science at the State University of New York, "you

use the computer to get to financial records. Or to get to software if you're illegally copying software."

Estimates of the size of the threat have ranged from the double-digit millions up to over $5 billion a year. This uncertainty has sparked a feud between the icebergers and some computer makers.

Highland is an iceberger. He says that reported computer-related crimes are "just the tip of the iceberg," that the annual loot is at least $750 million and more likely reaches the billions. Another expert wrote a crime article livened up with a drawing of the *Titanic*. Meanwhile, the Computer and Business Equipment Manufacturers Association pooh-poohs all but the more conservative estimates. "Computer crime is not now, never has been, and never will be out of control," an association official once said, "unless security is completely ignored. And that is not going to happen."

"If that's your opinion, sir," counters Captain Zap, the computer felon now working as a security consultant, "why are fourteen-year-olds getting on defense networks? And what about adult criminals doing their thing on banks?"

Also, how about computer crimes against small business?

"No one's going to find out why Joe Blow goes out of business," says Ken Churbuck, a New Hampshire lawyer and former computer engineer, who believes that electronic crime may be the downfall of many more small businessmen than supposed. "You think Joe Blow can afford an investigation? You think anyone else wants to autopsy the corpse?"

Large business or small, however, don't swear off computers and buy quill pens for your accountants. You may or may not get robbed electronically, but you'll very possibly lose money if you cheat yourself of the benefits of computerization.

Although computer crooks may be difficult quarry at times, at least you can console yourself that they're normally *not* geniuses.

Consider a story from Highland. The law caught up with one crook—presumably more knowledgeable about computers than banks—after he asked a teller to cash seven identically dated checks made out to him. The embezzler had simply learned how to take advantage of a feature in the check-

printing program. It allowed checks to be reprinted in the event of mistakes; only his stupidity offset this programming error.

"You don't have to be knowledgeable," Highland says. "You can be an absolute idiot and try a computer-related crime."

Some of the victims, alas, show their own streaks of naïveté. One small business lost thousands of dollars to a bookkeeper who funneled it to relatives' firms via phony invoices. Such crimes happen with or without computers. But the company begged for trouble here by retaining an accountant old-fashioned enough to have felt at home alongside Scrooge and Cratchitt. Computers baffled him but not the embezzler, who knew of this vulnerability.

Executives at big corporations needn't be smug about such grass-roots examples.

Many large companies, for instance, have reduced *the crooks'* risks in computerized crime by auditing samples instead of everything—pulling one hundred checks, perhaps, out of a batch of four thousand. The young man trying to cash his seven duplicates worked for a large West Coast firm given to quick and dirty sampling; just tote up the odds of catching him through an audit if he'd been smart enough to go to different banks. Ideally, at least, your system should flag quirks like the seven checks.

You can also complicate life for computer crooks by studying classic cases of the past.

Mostly the criminals sinned with or against large computers. And yet eternal truths linger on even in the micro-mini age. In fact, some mainframe cases may mean even more to the desktop crowd today, with so many small computers hooked up as terminals on large systems. You might also say giant machines are acquiring plenty of pygmy siblings—joined Siamese style with them at the brains. And the big and small machines aren't just wired together by phone or otherwise. Increasingly, mainframes are sending electronic copies to micros outside data-processing departments. What's more, in power and capabilities, the pygmies are matching some big IBMs and Univacs of yore.

So whether you're using a $1,000 Apple or a $100,000 mini, you'll come out ahead knowing about the Golden Oldies of computer crime.

Computer consultants, especially Donn Parker, a prominent expert with the SRI think tank in Menlo Park, California, have labeled various offenses.[50]

Data Diddling

When a time-keeping clerk hoodwinked a railroad, he committed the most tried-and-tested computer crime: **data diddling**.

That's just jargon for fiddling with data before or during entry into the machine.

The culprit's duties included filling out time forms for three hundred employees, and he learned that someone had shown a fit of absentmindedness in setting up a computer system storing pay and hour records. The railroad put workers' names as well as their identification numbers into the computer. But the machine used only the numbers to track down names and addresses to print on checks. Manually processing the forms, however, humans normally ignored the computer numbers. They actually had the gall to think of the workers just by their names.

Wheels turned in the clerk's head. Why not sneak in overtime pay by using other people's names on the paper forms but *his* own number for the myopic computer? And so his income increased by several thousand dollars each year.[51]

The clerk's end came only when an auditor by chance looked over W-2 forms and asked why the railroad had been so generous toward the man. Confronted, the clerk confessed. There's a moral here: if you have a timekeeping and payroll system, don't rely on ID numbers alone. Attach to them the first few letters of workers' names. Also, include a cross-comparison of names and numbers in your auditing procedure.

Today scattered terminals—or micros or minis used as them—make data diddling as tempting as ever. A police officer in an eastern city told me criminals had walked into the offices of used-car lots, sneaked in a few minutes on terminals there, and altered financial records in a credit bureau's computer.

Forget about the mystique of computer crime. People have been diddling credit bureau files for years by changing or deleting paper records. Machines and lack of paper records in some cases just make their work easier and faster.

The Trojan Horse

A comely woman at a New England firm was the victim of what might loosely be called a computerized sex crime.

"She would be doing her electronic paperwork," Tracy Kidder said in *Soul of a New Machine*, "when suddenly everything would go haywire, all her labor would be spoiled, and on the screen of her cathode-ray tube would appear cold, lascivious suggestions." Someone had electronically wheeled in a **Trojan horse**—hidden unauthorized instructions in the computer's program.

The "sex crime" kept up daily for several weeks, leading an executive to observe that the villain must have "the mentality of an assassin." It was unfair. Young computer whizzes at the company played horse pranks on each other all the time. But this victim couldn't strike back. Gallantly, the woman's bosses set electronic traps to learn from which terminal the masher was mashing. The villain, though, was too nimble. "At one time," said Kidder, "he made his escape by bringing to an abrupt halt the entire system on which most of the engineer departments relied." Finally, one of the woman's protectors chatted casually with a suspect about the computer's wondrous vulnerabilities to pranks. The obscenities and glitches stopped.

This Trojan horse was just a prankster's, but the company may have squandered thousands of dollars in human and computer time to kill it off.

Consider, too, the company—Data General, the mini maker that Kidder admired.

Imagine a serious saboteur wheeling his horse into the computer of a company without the same knowhow.

It happens. Donn Parker says Trojan horse tricks are "the most common method in computer-based frauds and sabotage." A horse, in fact, may have shown up in the first federally prosecuted computer crime in Minneapolis in the 1960s. A programmer told an IBM 1404 to drop an unflattering series of bytes about his personal checking account—overdrawn.

Trojan horses are more of a mainframe and mini problem than a micro one. Normally, professional programmers don't run desktop computers.

But as computer literacy spreads, this might not matter so much, and besides, unsecured micros make such easy nuts to crack. "They're peanuts," Highland says, "not butternuts." Most micro systems today lack electronic console logs—requiring operator ID numbers—that some bigger computers have to tell who did what on the machines. In other words, there's no **audit trail**. John Lewis, an FBI agent teaching a course on computer crime, told me, "I can write a perfectly error-free payroll program on a micro, load it in from a disk, and run it. But I modify one or two lines in there, saying, 'When you find John Lewis's name, add $1,000 to net pay.'" You can even have the program zap the evidence immediately after the crime. Significantly, too, you can reprogram a micro in a fraction of the time you'd need on a mainframe.

And in the future the micros, while retaining their ease of programming, will develop more electronic nooks and crannies in which to hide horses. And what about the micros already hooked in at times with the big computers or using down-loaded data from them? If a saboteur or con man is giving fits to the giant machines, then the pygmy machines may suffer along.

The Salami Trick

You just can't make sense of your savings account statement. No matter what you do, it's a nickel off. You don't, however, pursue the matter—not over five cents.

All over your city your fellow depositors are thinking similarly.

A computer crook, meanwhile, is growing rich.

The nickels, dimes, whatever, add up. He works at the bank and has programmed its computer to round interest downward, for instance, rather than upward. The sliced-off money goes into a dummy account. From hundreds of cheated customers, maybe thousands, he's amassing enough over the years for a new Buick. He may even have told the computer to steal prudently and not clip anyone more than twice a year.

It's the old salami trick, an MO of countless embezzlers inside and outside the computer world—ranging from pudgy, fat-bottomed drones to glamour figures in Hollywood and on Wall Street.

An amusing salami tale comes from Thomas Whiteside's brilliant *New Yorker* series on computerized crime. The name "Zwanda" did the crook in.

Programming for a mail-order sales company, he rounded down sales-commission accounts and diverted the loot to a dummy account for a "Zwanda." The "Z" name made sense. The computer worked alphabetically, and he could more easily guide the money to the end account.

"The system," Whiteside says, "worked perfectly for three years, and then it failed—not because of a logical error on the culprit's part but because the company, as a public-relations exercise, decided to single out the holders of the first and last sales-commission accounts on its alphabetical list for ceremonial treatment.

"Thus, Zwanda was unmasked, and his creator fired."

Could Zwandas show up in your company's microcomputer —not just mainframes? Perhaps. It's no less likely than the micro case mentioned earlier in which the bookkeeper was paying bogus bills from his relatives' firms.

Of course, in the case of a micro, the trouble probably will be not in the way the program is written but in how it's set. Most micros, after all, use off-the-shelf software.

Superzapping

It's named after the "superzap" program used on some large IBM computers.

"Superzap" is known among the pros as a break-glass program, the kind you use in emergencies to change or divulge the computer's contents. It can bypass all security controls. You can also think of **superzapping** another way. The computer is a high-rise building, and this program is a master key to all the apartments or offices inside. Pity the building manager if a thief can counterfeit the key.

Donn Parker, the source of those comparisons, says a New Jersey bank lost $128,000 to superzaps.

The crook was none other than the bank's manager of computer operations. He first superzapped legitimately to change errors in accounts as his superiors asked. The main program wasn't working—hence, the superzapping. The bank was upgrading its computer system, the glitches kept piling up, and the operations manager zapped again and again, discovering the joys of ignoring the normal controls. The usual electronic logs and journals just didn't show his actions.

So, he decided, why not zap away the barriers to shifting the money to the accounts of three friends?

The bank learned of the crime only after a customer saw that his own money wasn't adding up right.

Superzaps like this, of course, are simply special breeds of Trojan horses, just as the salami tricks *can* be. Like the horses, the zaps aren't so much a micro crime now. They're more of a mini and mainframe one, but watch out for the future when garden-variety crooks are more learned and micros are more like the bigger computers.

The Trap-Door Trick

A **trap door**—or **back door**—normally is just a shortcut into the program, bypassing the normal security systems, meant as a debugging aid. Once the writers have a program up and running, they should get rid of the door. Large programs are so complicated that programmers sometimes leave the doors in as an emergency way for them to get back in if the main passwords are lost or the computer "hangs up." David Lightman, the teenage hacker in the movie *WarGames*, used the trap-door ploy to penetrate a Defense Department computer and almost caused a nuclear Armageddon.

In a real-life example mentioned by Parker, some automobile engineers in Detroit called up a computer service bureau in Florida, found a trap door, and could "search uninhibitedly" for privileged passwords.

"They discovered the password of the president of the time-sharing company and were able to obtain copies of trade-secret computer programs that they proceeded to use free of charge."

The electronic thievery didn't stop until the company found out accidentally. And it never learned how many other crooks were rummaging around inside the computer.

Once again, this form of crime isn't so much a worry for the desktop set as for those using bigger machines. At least for now.

The Logic Bomb

Heard the old joke about the Washington speech writer at odds with his boss? It's a favorite story among journalists and other wordsmiths.

The aide was tired of drudge work for a dumb, lazy but electable congressman who didn't even read the immortal prose ahead of time.

One day the politician, a square-jawed, movie-actorish man, was mellifluously speaking on the House floor. As usual, he was fresh to the material. But his rendition overwhelmed everyone, from the pols to the pages, to the tourists in the galleries. He *knew* he was on his way to the White House.

With actorlike polish he intonated through the third page, including the last sentence:

"And now, let the words ring out, loud and clear, to all corners of the earth—to our friends, to our foes, across every ocean, every mountain. You purblind piece of excrement, I quit, and you're on your own."

The fourth page, of course, was blank.

Malicious programmers must nod and wink when they hear the story.

For the speech writer had just the right kind of temperament to hide a **logic bomb**—a computer glitch that explodes, so to speak, only under certain conditions.

The conditions in the Washington joke were clear. The congressman mustn't read the speech to himself beforehand—something inevitable. He was dependably lazy. Nor must he understand the speech; no problem, certainly, for he was dumb about everything all the time. Above all, however, if this bomb were to "kill," he must be embarrassable. And that's why the bomb in a sense just maimed him—because, like most politicians, he never blushed.

In a real-life story told by Parker, a payroll programmer hid a bomb to erase the entire personnel file if he ever got fired—that is, if his own name ever vanished from it.

Simulation and Modeling

A crooked accountant embezzled a million dollars using **simulation**.

On his own computer he set up a mock version of the victim company's accounting and general ledger. Then he could figure out how his thefts would show up on the company's electronic books—and how to cover up the crime.

Scavenging

A Texan ripped off oil companies through computerized **scavenging**.

He used a computer time-sharing service bureau, the same one as the oil companies. This thief read scratch tapes—temporary storage tapes without the safeguards protecting the main ones—by phone off the service's computer. He was stealing secret seismic information to sell to the oilmen's competitors.

Finally, however, the service bureau caught on.

A worker there had grown curious. Why did a red "read" light glow at bizarre times? How come the customer was prowling through the tapes before entering his own data? Parker says a "simple investigation" ended the electronic scam.

Scavenging can be physical, too—nothing more complicated than rummaging through old trash barrels for printouts.

Data Leakage

“Hidden in the central processors of many computers used in the Vietnam War,” Parker says, “were miniature radio transmitters capable of broadcasting the contents of the computers to a remote receiver.

“They were discovered when the computers were returned to the United States from Vietnam.”

It was a **data-leakage** problem—defined by Parker and other pros as the removal of data or copies of it from a computer or a computer center. Culprits can even smuggle out secrets by hiding them in apparently routine reports. “Data leakage,” he says, “might be conducted through use of Trojan horse, logic bomb, and scavenging methods.”

You don’t have to be in the Vietcong or KGB, of course, to spy on a computer by radio. Today a smart snoop can walk casually into your computer area and leave behind a miniature transmitter—perhaps hooked up to the maze of wires that snake under the floor of many modern offices. “I could then find out everything that you were sending for a year,” says Harold Joseph Highland, “which is the life of the unit I could transmit with. I could buy it for

9.50 from any of the large supply houses. There’s one more expensive that will transmit up to five miles away. With the forty-buck one I can park across from the building and keep a tape recorder going.”

Wiretapping

Some say it's rare in the computer world. The thinking goes, There are easier ways to steal. Why tap when so often you can just call up your victim's computer and be greeted with a friendly electronic whine?

But don't count on wiretapping not existing.

Your local radio store carries cheap equipment usable for tappers.

And electronic banking and new computer services will grow, making wiretapping more tempting. A security consultant, J. Michael Nye, opened an unlocked closet of the second floor of an office building in Hagerstown, Maryland, and pointed to the telephone wires inside. "See these?" he asked me. "They're hooked up to a bank's computer. If you wanted to change the amount of money in a deposit, you could attach a portable computer and no one might be the wiser."

The wiretapping threat may increase because of the break-up of the Bell system—as more and more repair people parade in and out of wire closets.

You might be able to get around the threat, or at least reduce it, by electronically scrambling the messages you transmit over the phone wires.

For the moment, don't let fear of wiretapping obsess you unless, say, you're routinely transferring millions of dollars via computer.

Piggybacking and Impersonation

It's bone cold outside, the stranger looks harmless, and you let him in as you unlock the doors of your apartment building one night. The next day all the old ladies in the lobby are talking about a burglary.

You fret. Rightly. You may have let a criminal succeed in **piggybacking** his way behind you into the building.

It's happening, too, in computer rooms, which crooks use similar tricks to enter.

That's physical piggybacking. The electronic kind, rare, can happen this way. You punch in a password or key on your terminal and hook up with the computer, unaware that the piggybacker has a hidden terminal connected to the same phone line. Perhaps you haven't signed off properly. The computer keeps the connection going, and the piggybacker "rides" on.

Impersonation is what it sounds like, and it can be physical or electronic.

Leslie D. Ball, a Massachusetts consultant and college professor, once illustrated computers' vulnerabilities to such tricks. "Why is it more difficult to rob a bank of $2,500 than to steal millions from its computer?" he asked, and quickly answered the question.[52]

"During a security consulting project at an Atlantic City hotel," Ball said, "I spent the evening with an associate in the casino. At about eleven p.m. we headed for our rooms, but the elevator stopped where the computer center was located, and we decided to look around. The door marked 'Computer Center—No Admittance' was locked but had a bell beside it. A computer operator opened the door when we rang, letting us in without a word. For the next ten minutes we wandered through the center without speaking to the operators on duty." In effect, by acting as if they belonged in the room, Ball and the associate were impersonating authorized people. "Finally," he recalled, "we said, 'Thank you' and left. They were lucky we were not disgruntled heavy losers!"

A real impersonator, an ex-college professor named Stanley Mark Rifkin, passed himself off as a bank branch manager to steal $10.2 million. He bought diamonds in Switzerland. The law caught up with him only because, like many bright, cocky computer crooks, he bragged. That wasn't all. "While awaiting trial," Ball says, "he attempted a fifty-million-dollar transaction from another bank. When apprehended, Rifkin told a reporter that he thought he finally had all the bugs worked out."

Rifkin was just another example of an ordinary man using legally acquired skills to commit an illegal act.

However smart, and despite his background as a computer science professor-consultant, he was hardly a *genius*. "Master criminal?" asked H. Michael Snell, a publisher who'd dealt with him.[53] "I could sooner imagine a smoking gun in the hands of Winnie the Pooh. In fact, Stan resembled Pooh Bear: short, stocky, paunchy from too much good food and wine, a deeply receding hairline above an intelligent, sloping forehead. Quiet, unassuming, not the kind of guy who'd stand out at a cocktail party." Rifkin was good at puzzles, at problem solving, but as Snell and others agree, that's true of all talented programmers. You could say the same, too, of first-rate accountants and engineers. Rifkin's case made me think of Hannah Arendt's phrase about Adolph Eichmann, applied not to the Nazis but to garden-variety crooks within the computer field: "the banality of evil."

Rifkin's take happened to be larger than most. But his mind-set was the same.

Snell said, "He shared the dreams of many academics who feel blocked from great success and wealth, and he loved 'get-rich-quick' stories, such as a friend who struck gold in California real estate or the Silicon Valley's overnight millionaires."

Greed, however, isn't the only motive. "People who like computers are games people," John Lewis, the FBI agent, told me, "and they like challenges. It's 'me against the machine.' You give them a computer and say you can do anything but that, and that's the first thing they're going to do. You go back to the Book of Genesis in the Bible where God said, 'You can do anything in the Garden of Eden but eat from that tree,' and

what's the first thing people did?" We were in a windowless, fluorescent-lit room at the FBI Academy in Quantico, Virginia, where Lewis lectured on computer crime. He looked at a fellow instructor, a tall, alert man who started out in the bureau not as an agent but as a programmer. "I've seen Ken get ahold of material. Like this one program that said it couldn't be copied. Now he didn't care what the program did. The first thing he did was copy it. Because they said he couldn't do it. And he did it."

I thought of John and Ken three weeks later when I picked up a copy of *Technology Illustrated* magazine.

A stranger in Quantico, Virginia, it seemed, was dialing up the electronic bulletin boards on which computer pranksters sometimes left messages. The bulletin boards were a form of electronic mail. Callers could write out their thoughts for friends or anyone checking up on the highest-numbered entries. The mysterious computer dialer from Quantico, however, would just read, never send. Aware of the FBI Academy's location, one of the pranksters posted a friendly suggestion on a board.

He invited the Quantico caller to subscribe to the TAP newsletter—said to be "to phone phreaks what the *Wall Street Journal* is to stockbrokers."

TAP stands for a group named the Technology Assistance Program, a successor to Youth International Party Line (YIPL), whose own radical pedigree goes back to Abbie Hoffman's Yippies. "Al Bell" and Hoffman started YIPL. It was a high-tech display of Hoffman's *Steal This Book* philosophy, there being, however, a serious problem, one shared by society at large. The technocrats usurped the politicians.

They were, reportedly, "more interested in blue boxing Ma Bell than in pushing politics." Cheshire Catalyst, who was editing the TAP newsletter when I talked to him, said, "You don't have to be a phone phreak to read us—but it helps."

Lindsay L. Baird, Jr., a tough, no-nonsense consultant with famous corporate clients, told me TAP was a serious threat. "They're now using micro systems to test the 800 numbers methodically to see which ones have computers on them," he said of some TAP people. The corporate computers whine their strange mating call no matter who dials up, saying

electronically, “I am here, I am a computer, I am ready.” You might say they’re like an unlocked, unattended BMW left with the motor running in New York City. And Baird claimed, rightly or not, that TAP has some political zealots mixed in with the technocrats and that they could indulge in large-scale computer zapping over the next few years.

The TAPpers’ side was this: they illegally logged on to networks like Telenet and the feds’ because they couldn’t stand seeing expensive computer time go unused. “Nobody wants to pool it as a computer utility and make it available to everyone because it would probably not make a profit,” groused “A. Ben Dump” in the newsletter. Cheshire portrayed TAP to *High Technology* as basically just pranksters, at least in his case. “Good grief!” Cheshire once ghost-wired to a Telex machine; “I seem to have reached Adelaide, Australia. This is just a computer hacker in the United States out for a good time.” The TAPpers said they were against the Bell bureaucracy, not America at large, and, in fact, censored an article submitted to their newsletter telling how to build an H-bomb. “Among other things,” Cheshire worried, “anyone using that technology is going to take out the phone network.” I still wondered. Would TAP have printed the article if a way existed to H-bomb the countryside without toppling any microwave towers?

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Hacking: An Addiction to Be “Squelched”?

With *WarGames*-style break-ins in mind, someone once called hacking an addiction to be squelched.

That’s wrong. Hacking is more an addiction to be tamed.

The term “hacking,” perhaps born at M.I.T., just means someone who hacks away at computer problems until he solves them. Many hackers for some reason or another love Chinese food. Sooner or later a computer-crime expert will link computer addiction to ODing on monosodium glutamate.

Cheshire Catalyst is a prototypical hacker in many ways. He’s a thin, bearded man in his twenties,

extrapolite, who, when I saw him, was in Washington for an aeronautics and space gathering and wore a Space Shuttle tie and an Apple pin. His nickname indeed came from the grinning, vanishing cat in *Alice's Adventures in Wonderland*. Proudly he told me how his clock ran counterclockwise. Cheshire said he hoped someday to meet another backward-clock buff, Grace Hopper, a distinguished military officer who helped give the world the COBOL computer language.

Cheshire might find even more of a soulmate in Steve Wozniak, the Apple cofounder, who is perhaps one of the world's leading hackers—in addition to having been a phone phreak in his time. "Woz" and a friend snooped on computers across America. The friend was John Drapper, a bearded, somewhat maniacal-looking man who earned the nickname Cap'n Crunch because he used prize whistles from cereal boxes to steal free long-distance calls by way of a tone at exactly the right frequency. Later, Crunch wrote the EasyWriter word-processing program used on the Apple and later the IBM PC.

On balance Cheshire thinks that hackers do more good than harm. "Let's say you have money in a bank," he says. "Wouldn't you rather that a hacker get into its computer than a criminal did? He could warn the bank. If I had money at a bank, I'd feel safer with hackers checking out security."

Well, it depends. Some hackers are nothing more than electronic vandals. Some are a privacy threat; they're doing the equivalent of spying on mail and tapping phones.

Still, talented hackers may become real assets to corporations. They'll care infinitely more about your computer system—and all its quirks—than will programmers working nine to five for the money alone. Just a little oversimplistically it's been said that you can befriend a hacker merely by supplying a computer with enough RAM, encouragement, a long leash, and lots of chow mein.

■ ■ ■

The TAPpers, depending on your viewpoint, came across in *Technology* as reassuringly or distressingly middle class. Cheshire at the time of the article was teaching computer skills at a large corporation. "VAX-man"[54] worked as a computer programmer, "The Librarian" as a systems analyst, and another was, of all things, a middle manager for a defense contractor; indeed, every member reportedly boasted a technical background. Most, I suspect, perhaps nearly all, didn't see themselves as criminals.

"We're just an information service for the people," said one.

Well, okay. Maybe it's good that if G-men want to bone up on the latest electronic tricks, they need only log on to hackers' bulletin boards and read the TAP newsletter. Still, how many crooks have the same idea?

TAP's another indication that for the criminally greedy the "data cookie jar," as it's been called, is out there.

Lindsay Baird scoffs at computer trade associations' efforts to play down the problem. And he fires back with statistics of his own. "I've worked on thirty-five or forty cases," he says, "and only one was reported to authorities." The loot ranged from $40,000 to $29 million. And Baird, dismayed that some computer criminals' sentences are more shoplifterlike than adequate, jokes, "My wife tells me I ought to commit a crime."

"The security problems with computing systems in the 1960s was like a balloon deflated," he says, "and you could hold it in your hand. But now it's like a huge balloon inflated. Or a big bowl of Jell-O.

"You just can't handle it now, and the manufacturers have got to be concerned."

Of course you should remember that most corporate data are far from sensitive, that only the most self-important executive would view everything as a national-security secret. Also, Baird is hardly hurting his bank account in sounding the computer-crime alarm. Still, he's basically right in saying that computer buyers *with sexy data of interest to thieves* now may have three choices:

1. Burden programmers and others with electronic versions of heavy padlocks.
2. Keep their computer systems easy to use—and vulnerable. ("Then you're going to get raped.")
3. Compromise. ("You get half raped.")

Baird doesn't blame just the manufacturers for some computers' sievelike leaks. "Business isn't willing to pay the price to secure systems," he says—a complaint echoed in effect by the Computer and Business Equipment Manufacturers Association (CBEMA). It acknowledges the present clash between security and ease of use of computer systems. "If a computer could be designed with various levels of security as options, computer security might well be a marketable commodity," said a statement from CBEMA to a trade magazine. In recent years there has been much more research in this area, and when 32-bit micros become the norm, it will be much easier to beef up security.

When crimes do happen on existing systems, they're often covered up by top executives panicky over going to court or jail.

How'd you like to be the chairman of a corporation faced with an ugly data-security scandal—and the possibility of a stockholders suit? You needn't be in the scandal personally. Your stockholders could charge you with malfeasance, if not misfeasance, for *letting* it happen. So could the Securities and Exchange Commission and other feds. When companies hush up computer crimes, it's not necessarily for high-minded reasons such as protecting assets by playing down vulnerability to electronic crime. Consider Baird's experiences.

Called to a New England firm to do routine theft prevention, Baird merrily put himself on the payroll—not to steal but to demonstrate system weaknesses.

"I also," he says, "nicked the vice-president for participating in a $400,000-a-year kickback."

At another company, an accounting firm did the books at year's end and had to make an adjustment of $1.2 million. "Then," said Baird, "we went in some more and really did a number on that company. And we came up with $4.5 million in

proven losses. And it all had to do with their computer system."

But, you're wondering, how about that crook who stole $8 million and got away with it?

The story—perhaps apocryphal but told in the sedate *Smithsonian* magazine—is that bank officials confronted the thief in a restaurant over breakfast.

He coolly confessed. If they tried to jail him, why he'd blow the whistle on the bank's vulnerable computer system. And it would cost more than $8 million to fix.

So the bank officials just asked him to step down quietly.

Leaving the table, the crook smiled.

"I'll keep the eight million," he said, "but I'll pick up the tab for breakfast."

Definitely, then, Donn Parker was on target when he once called computer security "first and last a people problem."

People and Policies: Working with the Right Ones

Honest, loyal employees are more important than the latest security gizmos. Use common sense. Beware of the $26,000-a-year programmer who suddenly acquires a posh home and a sports-car collection. Don't pry. But don't shut your eyes, either.

Start with a sensible hiring policy. Decide on the questions you want to ask applicants and their references—about the prospective employees' backgrounds and characters. Then bounce them off your legal department. The rule of thumb is that you won't get in trouble if the questions are related to the job. IBM has said it doesn't even ask applicants about their ages or marital statuses. If there aren't legal obstacles, you might invest $25 in a credit-bureau check of a keypunch clerk but perhaps several hundred dollars for a top programmer. Keep in mind the notorious lack of reliability of many reporting services. Check for criminal records when hiring for responsible positions. A Maryland hospital didn't. It hired a convicted embezzler, a computer operator who later diddled $40,000 out of the system.

Granted, there are occasions when you might knowingly hire an ex-con to give him a chance. But ask the normal questions. What's he done to justify your trust since his sentencing? What are your risks? How much could he steal, and how?

Whomever you hire—ex-cons, Harvard grads, or combinations of the two—know how to respond to the common criminal motives.

Jay BloomBecker, a top computer crime expert, sums up one of the main motives by quoting the title of a collection of Doonesbury comic strips: *But the Trust Fund Was Just Sitting There*.

Reduce the temptation. Let your people know there'll be surprise audits—and mandatory vacations. A thief busy slicing salami might be loath to take too much time off, lest his or her replacement catch on to what's happening. Likewise, consider rotating duties every few months and also divvying them.

People who write checks with computers, for example, ideally won't be the ones approving them; in a small business, of course, this might not be possible.

The old need-to-know policy, of which the military is so fond, may also increase the criminals' risks—by increasing the need for collusion. This, too, isn't always possible, and it could boomerang. If employees aren't supposed to know what their colleagues are doing, maybe a thief would actually have less chance of being noticed.

Also, tell people that stealing—even small amounts from a large company—*will* hurt. If you can't prove how it will hurt the corporation noticeably, then you'd better make a good case that it will hurt them. Pretend you're a department store warning the nimble fingered: "All will be prosecuted." Well, within bounds. You needn't fire and prosecute a thirty-year man because he once used a company micro to calculate his average golf score.

But do remind your employees of the applicable theft-of-service laws, larceny ones, and others.

Not that electronic theft is your only problem. Whiteside tells of a computer-ridden North Carolinian, working for an insurance firm, who reportedly shot a handgun several times at the hated machine. And Harold Joseph Highland offers another cautionary tale. Executives at an East Coast firm fired a crabby woman, then returned the next Monday to find its floppies sliced apart with a paper cutter. They never proved her guilt. Regardless, *someone* moved the blade up and down, costing the company several hundred thousand dollars in time reentering the paper versions of the records into the computer. And that doesn't even include the orders canceled by customers angry over the delay. In yet another story, a disgruntled worker short-circuited a terminal by urinating on it.

"Hire well," says Jack Bologna, an expert on the "people" side of computer security, summing up ways to avoid such traumas. "Pay fairly, praise people for good work, give them opportunities for advancement, and make them feel comfortable talking over their problems."

Remember that the line can fuzz between outright sabotage and simple sloppiness induced by poor morale.

If there's a disaster and you're not sure if it's accidental or deliberate, however, don't be too quick to point your finger. You may find it chopped off with a lawsuit filed by your suspect, perhaps for less than $1,000, while your firm must spend several times that to defend itself. Unjustified accusations, also, hurt morale and may even add to security problems.

And if you do prove theft or sabotage?

Act. Don't cover up. Rather, cover yourself—legally. Tell your boss what happened. If you're mum and someone else reports the crime, your superior may consider you among the guilty. Also, don't discount the possibility that your boss may himself be either guilty or a part of a cover-up because he fears a stockholders' suit. You may have no choice but to report him to *his* boss. Press for an independent audit committee if you're powerful enough and if the size of the crime justifies one.

Should you fire someone for a computer-related offense, do it artfully.

"If they're in a critical job position, help them clean out their desk, collect their ID card and any office keys, and walk them to the door or to the personnel department," says Timothy A. Schabeck, who edits *Corporate and Computer Fraud Digest* with Jack Bologna. The FBI's Lewis says as much.

If you do prefer instant firing, follow Schabeck's advice to provide counseling and severance pay. And soften the blow, too, by warning everyone, when hired, that your axes are quick and sharp.

Mightn't instant firing, however, be brutal, anyway? Well, it depends on the amount of damage that a discharged employee could inflict and on how vindictive you perceive him to be. Ideally, you could minimize the damage by having backup disks or tapes out of the your victim's reach. Also consider how successfully you can keep the fired employee from returning to your computer—by ruse or otherwise? Is your office absolutely physically secured? Can you trust guards or janitors working weekends not to admit a familiar face?

It's all a part of bridging the gap between policy and practices.

Don’t just wait until a crime to make your staff security conscious.

Too often, warns James A. Schweitzer, a Xerox security expert, people protect information only if it’s on paper. He says, “There have been a number of cases where tapes and disks have mysteriously disappeared from places like desktops.” If need be, designate an employee to make sure others have locked up right by the end of the day. In less than a minute, using a floppy disk, a thief may duplicate hundreds of times as much material as he could on a paper copier.

Worry, too, about your people’s use of *modems*—the gizmos that transform your computers digital output into a whiny sound for the phone lines.

Don’t let them routinely keep sensitive material on disks that will play back to savvy criminals who happen to dial in.

This especially applies to Winchesters. They’re the oxide-coated aluminum disks that remain in the machine housing them, and they stash away many times the amount of information on most plastic floppies. Now imagine the delights awaiting a thief or snoop. Via your auto-answer modem he could rifle thousands of pages of Winchestered documents. Such electronic robberies needn’t happen, but until businesses get burned this way, they will. So if you’re sharing an electronic spreadsheet or mailing list with your branch office, do so if possible at a prearranged time during business hours when you know who’s calling. Tell your people to do the same.

You’ll also need a privacy policy—internal and external. Do you, for instance, want salary information on a Winchester disk that any of your company’s computer-users could read? And how about employees’ health records? Good data security should protect your people as well as your company. So limit your computerized records to the essential and tell your executives not to use their home computers to bypass privacy laws.

Worry, too, about an external-privacy policy. Are you respecting the rights of your customers, including those, who, by computer, may be transmitting to your company *their* electronic jewels?

It isn't just decency you want; it's also good protection against suits, whether from people or client companies.

Here again, set a firm policy against your people misusing their personal micros. Alan F. Westin, a Columbia University professor of public law and government, correctly warned in *Popular Computing*, "A financial officer of a bank might store information about the life-style, habits, sexual preferences and other personal behavior of large individual borrowers or key corporate executives." The banker might do this behind customers' backs to help decide who was "stable" enough for loans.

You'll also need a policy covering employees who use your computers for, say, maintaining their church's bingo books. Why not let them? It isn't the worst public relations. Some companies even allow their employees to play games after hours, tapping into company systems from home, and you, too, might experiment with this, provided it won't add to your data-security problems. Better a fringe benefit than a crime.

On the other hand, you've got to draw the line somewhere. Can you estimate how much this extracurricular use of your machines costs in wear and tear—in, eventually, replacement costs? Feel your employees out on this one if you're running a small business or hold sway over a large one. Would they rather enjoy computer privileges or better health insurance? You might offer cafeteria-style fringe benefits, with computer use as one of the options. Employees not selecting this choice might have to agree to it, anyway, if you discovered them using a company computer for personal purposes. This problem, of course, may lessen as the prices of small computers plummet and their capabilities grow.

Whatever the form of potential crime—theft or otherwise—keep remembering one of the basics of data security: It should cost neither more money nor morale than justified.

Hardware and Software

Now for advice on finding the *most* crookproof computers and programs.

Buy a micro with 16- or 32-bit word lengths and RAMs of 256K or more. Those specifications will let you use more elaborate codes to protect information. What's more, they might be less cumbersome than codes on an 8-bit machine. Look, too, for electronic design that lets your computer establish privilege levels—reachable through passwords. That way, Sally, the new secretary, can start out getting into the computer only for word processing. Helen, the payroll clerk, can have access to confidential salary information but not a top-secret budget that doesn't give her the raise she's been pestering you about. Questions exist about the effectiveness of passwords and codes, at least when the thieves or snoops may be sophisticated, but that's another story. Most experts will tell you that anything that can be coded can be cracked. The trick is to make it not worth the criminals' time and resources. Of course, the best safeguard is still the simplest: locking up the disks and computer after you or your people are through.

New minis, by the time you're reading this, may all be 64 bit or higher. They adapt to codes—and fancy electronic logs showing the kind of work done on them—more easily than do micros. And they might justify other costly security measures. Suppose, for instance, you want to follow the many government agencies' examples and pen in the tiny radio waves that computers emit so that eavesdroppers can't pick them up with sensitive receivers. A micro fortified this way might cost perhaps $10,000. "What's the sense of doing that for what's essentially a throwaway computer?" asks Harold Joseph Highland. The "throwaway," be assured, is an exaggeration, but his point comes through.

Of course, don't forget the disadvantages of minis.

Most machines at the mini level or above need professional programmers, and that's bad news if you're trying to stay in complete charge of your business.

Also, minis, because of their expense, normally won't pay for themselves unless they have at least several terminals.

And the more terminals you have, the more "doors" through which crooks can "walk."

Still, you normally shouldn't let security alone determine if you end up with a micro or with a mini. Remember the warning earlier in this chapter that security costs shouldn't overwhelm you. How often, for instance, is your information so sensitive that you're worried about criminals lurking in the bushes with the elaborate equipment needed to make sense of the tiny waves your computer emits? Your data might not even justify use of codes.

I myself haven't the slightest need for codes, user-privilege levels, anything other than locking up my disks, since I'm essentially a small businessman who is the sole operator of a micro.

Even the FBI doesn't really worry about security on some computers. At the time I visited the agency's academy in Virginia, several little Radio Shack models were purring away there—the same kind you'd buy off the shelf. The micros' software had passwords, but some agents could bypass them, anyway, which wouldn't be necessary, of course, since, in this case, the FBI *wants* the machines to be used.

Before saddling yourself with fancy electronic precautions, do see if a security service, a good, heavy safe, a locked room, or a burglar alarm would work instead. And what about simply carrying home some duplicates of your most important floppies? That possibility will become increasingly attractive as the disks' storage capacity increases. This isn't to say, however, that you should store Exxon's major corporate secrets in a dirty unlocked drawer next to old underwear. But a small businessman might consider taking his backup disks home.

If you buy a safe for your office's disks or tapes, think about fire protection. Check with your fire department. What makes of safes could be in the middle of the flames without the disks suffering temperatures of more than 115 degrees Fahrenheit?

Investigating locks and burglar alarms, you'll learn that your computer may be able to protect itself. How? Some gadgets can let only card-carrying employees—your people with

magnetic cards—enter a room. And they can tie into the computer to save you money. The same applies to burglar alarms. Of course, you might want nothing fancier than a strong lock bolting your computer to a heavy table. Don't spend more than the data are worth to replace.

You might also consider a guard service. The problem is that salaries add up even for quick nighttime checks.

After a few months or a year, you may be well on your way to having shelled out the cost of an elaborate electronic security system. Guards normally would be more appropriate for users of large minis and mainframes than for desktop types.

One advantage of physical security—most any kind—is that it can protect the computer equipment itself, not just your electronic files.

You've undoubtedly read of theft of computer chips from Silicon Valley firms. Now be prepared for reports of widespread computer theft, eventually, as the market grows for both legally bought and fenced merchandise. With computers shrinking in size, they may well be an even hotter item for fences than stolen Selectrics. Even Apples several years ago were too intimidating to a burglar, like the one who stole the silverware of an acquaintance of mine but passed over his computer. Be assured, though, that crooks are increasingly computer literate. There's even talk of the mob moving into computer crime, raiding government files, and, presumably, engaging in less challenging illegalities, like setting up computer-fencing rings.

With computer crooks in the future being smarter and more organized, you should think hard before depending on simply passwords or codes to protect you.

First, assume that at least some people may try to unravel your puzzles. A whole generation of prodigies right now is practicing by copying the supposedly uncopyable computer games on disks. In effect, notes Churbuck, the New Hampshire lawyer, each disk provides two puzzles. One is the original game. The other is the puzzle of figuring out how to make illicit copies. And at the University of Western Ontario, Prof. John Carroll surveyed students in two advanced computer courses and found that one-third had sought free, illegal computer time. It's been pointed out that the very best, the

very brightest, students have too many legitimate opportunities —on large systems—to worry about pillaging small computers. And that may be true. But by the late 1980s or early 1990s, some journeyman criminals may develop among the second-raters.

Second, don't shrug off a warning from R. E. (Bob) Kukrall, author of the handbook *Computer Auditing, Security and Controls*: "Cracking a computer system's defenses may be about as difficult as doing a hard Sunday crossword puzzle." He says that thieves managed in minutes to call up computer files that were protected by a five-digit code number. They just programmed the computer itself to try each of 100,000 combinations.

"In effect the speed and capabilities of the computer were used to violate its own security," Kukrall said in *TeleSystems Journal*.

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How the *National Enquirer* Gets Some Security along with Bargain Communications

Some *National Enquirer* reporters send in stories via computers, but there's little danger of rival tabloids spying on the computer collecting the articles.

The reason? There's no receiving computer, actually —just an auto-answer modem rigged up to a dot-matrix that spews out paper copies at several hundred words a minute.

The modem and printer can't send messages or relay stories elsewhere. But who needs that—not when some computer-smart *National Star* reporter might give his eye teeth to find out what the competition is up to?

To be sure, the scheme has some problems:

- The *Enquirer* can't transfer the reporters' stories to a computer there for editing, since they are on plain old paper but not in an electronic format. Editors, however, heavily rewrite the original stories.

Capturing reporters' key-strokes for the typesetter wouldn't help as much as at an ordinary newspaper.

● Theoretically someone could still steal the hard copy (just as he or she could sneak off with a floppy disk).

● The system isn't secure against telephone tappers who could translate the modem whines.

Still, the system is dirt-cheap. If knowledgeable, you could probably replicate it for less than $500 for the printer and modem. And you could send to it with just a $400 lap-sized portable.

Beyond that, the *Enquirer*'s arrangement may be safer than leaving an unprotected computer on the phone to collect unencrypted files.

■ ■ ■

Then there's the Dalton school case in New York City in which the four culprits, age thirteen, violated silicon sanctity hundreds of miles away. The feds caught up with them before they could steal Pepsi Cola, by coaxing an order out of a warehouse. But another computer didn't fare so well. The thirteen-year-olds destroyed more than one-fifth of the 50 million bits in the machine's memory, inspiring a magazine writer to call them "electronic Huns."

More recently, the 414 Gang out of Milwaukee—named after their telephone area code—broke into computers across the country. These half-dozen or so high school students, tapping on home micros, broke into more than sixty computers and among other things they:

- Hooked up with a VAX 11/780 at Sloan-Kettering Cancer Center in New York. Eighty hospitals across the U.S. were using the computer to help treat hundreds of radiotherapy patients.[55]
- Broke into an unclassified computer at the Los Alamos nuclear laboratory.
- Penetrated a Security Pacific Bank computer in Los Angeles. That may not have been so much a challenge. The account

name and password both were “SYSTEM”—a word that many computer manufacturers routinely put in new machines and that their customers often forget to take out. “TEST,” “DEMO,” and “MAINTENANCE” are other old standbys.

If teenagers can wreak Attilan havoc and snoop on a bank computer, then think of adults.

So use passwords and codes, knowing their vulnerabilities. Try, anyway, to give computer crackers a good challenge by avoiding use of obvious passwords like street names or those of wives or children. Consider a two-level password; also, maybe one with two words of pure gibberish; that’s what CompuServe does. And, obviously, purge the computer of standard passwords in the “SYSTEM” vein.

If your system permits dialing in through a modem, see if it can limit the number of tries that people can make before the modem hangs up the phone. Your dial-up computer should send its name until the caller has given the right ID. Be careful of overly helpful **prompts** that lead callers on to the next step. “A prompt saying, ‘Hi! This is the Last National Bank Disbursement Department,’ sort of gives the game away, doesn’t it?” says a *Creative Computing* article laying out precautions. Also, change passwords regularly. And if an employee’s leaving? Change the access codes.

Here’s what I’d ponder if shopping for a password or encryption system:

1. How hard, exactly, would it be to puzzle out? Just how many combinations would a computer cracker have to try? Could he easily do this through his own machine—or yours? You might want to consult a cryptography expert to learn how much of a challenge *this* particular program would be. You’d be surprised. You may see the manufacturer’s claims instantly deflated.
2. How compatible is the program with your computer? If security is so important, choose the protective software first, then the hardware—assuming, of course, that it will run your applications programs.
3. Is the security program easy to use? If it’s too hard, it’ll be self-defeating. “Ease of use” would include how much time the security software adds to your normal tasks.

4. Are you certain the program won't jeopardize the accuracy and completeness of your files by making you more accident-prone?
5. Should you expand your system, will the security software be able to grow along?
6. Do you want a **public key** encryption system? It works this way. You pass out a code that people can use in sending messages to you. Only you have the means to unscramble them, though.
7. Will your code be based on the **Data Encryption Standard (DES)**, published by the U.S. government and repeatedly tested by the National Security Agency (NSA) and the National Bureau of Standards? To this day the rumors persist that NSA has built in a trap door to snoop on DES-style codes. True? I don't know. Captain Zap says, "I don't trust it. I don't think NSA would have approved it if they couldn't crack it." NSA-approved codes are overkill in all but the most sensitive systems.

Telenet has a special interest in encryption software. It is the network into which thousands of computer users dial to reach other machines and services like The Source.

In 1984 Telenet claimed to be the first public network offering encryption software—a package for the IBM and clones that uses the public-key method and sells for somewhere under $600.

"You have a directory that has all the public keys in it," said Claudia Houston, Telenet public affairs manager, explaining the Phasor software's operation. "You look up the guy's key that you want to send a message to. You punch that key and your message gets encrypted."

For a two-page message, a Telenet man says that might take thirty seconds. Then you're ready to send over the phone lines. Even if someone wiretaps you, theoretically, he won't be able to puzzle out your secrets.

MCI Mail also offers encryption—through a customized version of a popular communication program—and other electronic networks will undoubtedly follow suit.

"Black boxes," or hardware that scrambles messages, might likewise help; the topic is too complex for me to cover here in

the detail it deserves. This equipment usually costs well into the thousands. One security expert, J. Michael Nye, even puts out a consumer's guide to black boxes.[56] A good black box could be just a special modem with scrambling circuits built in. "If no one else produces a good, low-cost modem with encryption," says Nye, "I might start doing it myself."

■ ■ ■

Captain Zap's Wisdom on Protecting Your Dial-up Computer

The Captain and friends stole—via computer connections—over $100,000 in goods and $212,000 in services, including a $13,000 Hewlett-Packard minicomputer. He received a $1,000 fine and two and one-half years' probation, with fifteen hours a week community service.

Far from being 100-percent antiestablishment, however, Zap is a Philadelphia Republican fond of wing tips. ("They show good breeding.") And a computer security consultant, a client, praises him as "a damn good technician." A computer-crime expert named Jay BloomBecker isn't so keen on the use of e×-criminals in security: "There are a lot of people just as bright who have stayed within the law." Regardless, Zap has some good tips for security-minded computer users, especially those with dial-up machines. Among them:

- *Don't think of computers as gods.* "Remember, there's just another human at the other end."
- *Spread out your computer numbers; you might even use different telephone exchanges.* Don't have numbers adjacent to each other—like 555-1212 next to 555-1213. If you do, your computers will be easier targets for hackers with *WarGames*-style dialing programs that scan local exchanges for computer numbers.

That's good advice from Zap. In the same vein, even if you have just one micro, you might consider trying to get a phone number in an exchange miles from your actual location. You might even want to use a tie line to another city. It all depends on whether you think the costs would justify the added protection; for many businesses they wouldn't.

Also, you might keep your modem number secret from people who don't need to know. A Hollywood director, fearful that computer-smart science-fiction fans might tap into his dial-up machine, used such a precaution. Only he and his regular callers knew the number. His super-secretive approach obviously wouldn't have worked in a typical business, especially one with many phone lines coming in. Also, nothing's foolproof; suppose an electronic snoop unlocks your building's wire closet.

- *If possible, use modems faster than 1,200 baud.* Then, says Zap, "most hackers' modems can't keep up." Most small computers' modems transmit at 300 baud, about 300 letters or numbers a second.
- *Remember that hackers can be ingenious.* "Don't be smug just because you have a dial-back modem. That's a device that makes callers tap out a special code, and then it rings them back at their authorized location. You can get around it by tying into the central office and setting up a three-way call—without anyone hearing you. I know hackers can set up three-way calls. I've done it myself."
- *Protective devices, however, are better than nothing at all.* "Despite their limitations, I'd still install a call-back arrangement or a device that asked you for a code—or maybe a combination of the two. A combination usually would be much better."
- *Don't get hung up on protecting your dial-up computer with just hardware or just software—use both.* "Black boxes can help keep the wrong people from breaking in. But you also need good security software to control *how* deeply even authorized people can get

into your computer. You want some people—like customers—to have only *partial* access to the goodies inside your system."

- *Watch what you throw away.* "Some hackers can log onto your dial-up computer after first poking through your trash—for printouts with passwords and similar material." Another hacker jokingly refers to "The Dempster Dumpster Library."

■ ■ ■

Don't lose track of security threats around your office itself while worrying about modems and encryption. Would you believe that you can't absolutely erase an electronic file—say, a letter or report on your disk—just by following the directions in your software? A snoop might recover the information with a special program like Disk Doctor. Luckily, however, you can zap a sensitive file by magnetically "writing" over its part of the disk. Say you want to wipe out a letter 500 words long, File A. Well, do the following:

1. See if your disk has a file at least 500 or 600 words long. If so, make a copy. If not, type out a file that long. I'll call this new file "B."
2. "Write" File B's contents under A's name. "Overwrite" in other words.
3. Erase A.

To *really* erase an entire disk? Well, don't depend on your computer's "copy" program or "format" program. Instead, just sweep a magnet over it—within a quarter inch or so.[57]

So much for the James Bond kind of data security. Now on to coffee spilled on floppy disks.

Whether it's coffee or Coke, unless you're careful, you're possibly going to be your own biggest data-security threat. Just ask people like Betty Cappucci, a quality-control manager with the Dennison Kybe Corporation in Kopkinton, Massachusetts. "Most of the time," she says of returned disks, "it isn't the disk—it's spit or fingerprints. All you have to do is look at offices with people eating their lunch near their computers."

“We see disks coming back with cigarette ashes and coffee stains,” said Jack Fitzgerald, who at the time was a field engineer with another disk maker.

And it isn’t just the very smallest computer users who abuse their disks. “The big problem in computer facilities,” he says, “often is cleanliness. I’ve been to a large investment firm in New York City and seen apple cores on the floor, Big Mac containers near the disks. And yet they were complaining of data-loss problems.

“This was a major investment firm with all sorts of ads on news programs and football games about how carefully they protected your money,” says Fitzgerald. “No investor lost money in this case because the firm at least had backup disks. But the company itself lost thousands of dollars of processing time—money they could have spent helping their investors earn more.”

A programmer with a Florida accounting firm, however, didn’t even have a backup when his disk crashed on a large computer.

“He was actually crying on the phone,” Fitzgerald recalls. “He had lost two disks. And he was willing to pay $20,000 to get data off them. His job was on the line.

“I’ve had disk crashes myself,” Fitzgerald says, discussing his off-hours work on his micro. “I was developing a small game similar to Space Invaders. I lost power on my computer and about three hours of work. I ignored one of my basic rules, which is to back up about every 20 lines—make a copy on a second disk.” Captain Zap’s rule is, “Every fifteen minutes, save on both disks.” That’s extreme. Like all forms of security, apply this in relation to the trouble it would take to recover a loss.

Even Paul Lutus, famous in the industry for his work developing Apple software, has a scary crash story.[58]

He’d toiled to develop a new program, of which he took two copies to the company. An electronic glitch cost him one of the copies. The sun melted the other. It seems that Steve Jobs, an Apple cofounder, had put the disk under the windshield of his car. “I ended up very carefully prying apart the case of Jobs’s copy and switching the floppy disk inside to another case so we could recover the programs,” Lutus says. “I haven’t always

been so lucky.... For me the biggest drawback to personal computing is the quality of the mass storage. I dislike floppy disks intensely."

Here's how you can help your floppies and data survive threats more immediate—sloppiness and stupidity:

1. Zealously enforce a no-drinking, no-eating policy around disks, at least if trouble develops.
2. Remember the Rothman Dirt Domino Theory. Dirt, dust, and grease often can sneak up on your floppies indirectly, in stages. You start with clean hands. Then, however, they fall domino style when you touch a dirty table or one with your office mate's submarine-sandwich drippings. You return to your own desk briefly before you yourself leave for lunch. You don't work with floppies then, and you wash your hands after eating, but during your brief stop at your desk before lunch, you've already left a trace of grease behind, anyway. Your disk box picks it up when you set it on the wrong spot on the desk. Then, working with the floppies, you lay one atop the box. Now the disk itself fails. Alas, most disk failures aren't gradual like a recording that gets progressively noisier until you can't stand to listen to it anymore—they tend to be sudden and total.
3. Realize that floppies don't always mix well with office materials that correct errors the old-fashioned way—erasers, for instance, white-out fluid, or that unavoidably flaky correction tape.
4. Know about other natural enemies of floppies or at least of the data on them. Beware of airport metal detectors. A disk maker says this isn't a problem; but don't gamble, since a magnetic detector, misadjusted, might still mush your data. Beware, too, of telephones atop disks: the magnets in them are powerful.
5. Don't even let your floppies rest against your computer's screen, which, like a television's, can be full of static electricity, attracting dust.
6. Remember that the more information you can pack on a floppy, the more vulnerable it may be to damage from dirt, fingerprints, magnetic fields, and other causes.

7. Clean your disk heads. Don't use rubbing alcohol. "Try something like a Freon-based material with 91 percent pure alcohol," Fitzgerald says. "You can get it at some computer stores." Or, after every twenty hours of operation, use a cleaning diskette, three of which typically come in a $15 package. Each disk, says Fitzgerald, will last about thirty cleanings.
8. Have head alignment checked, to reduce disk errors. With heads out of whack, your machine may be the only one that can read your disks—not even identical machines. A crude way of assuring proper alignments, in fact, might be to see if other machines can read disks written on your micro.
9. Buy quality disks. Of course, the more you spend on disks, the more expensive your backups become—discouraging you from making them. Find a balance between cost and convenience that suits your security needs.

Timing—that's the secret to saving your electronic diamonds or rhinestones on your floppies, whatever the quality.

In the past, working just with paper, timing meant to me nothing more than the Rothman Chronological Method. The newer the document on my desk, the closer it would be to the top of the file. It wasn't the most efficient way. But I rarely lost material, just temporarily misplaced it. Computerizing, however, I worried.

"Floppies are treacherous," my friend Michael Canyes said like a John Bircher discussing commies. "They always trick you when you least expect it."

"Thanks," I said. "The way you're encouraging me to computerize, I'm beginning to think you actually want to sabotage me. Help me lose my manuscripts and all that."

"Just back up your copy page or so," Michael said.

"Isn't that a lot of trouble?"

"Maybe twenty seconds. Then you're protected if the power fails. Or maybe your computer. You can't afford to have your material stored just in on your chip. It's just temporary. You cut off the current a fraction of a second, it'll forget everything. You've got to get your stuff on the disk ASAP."

All right, I supposed my creative juices wouldn't dry up during the half minute the disk drive was whirring.

"The 'Save' command on WordStar is **KS**," Michael said. "Just hold down the 'Control' button on your computer while you're doing that. Then you'll hear a whir and the disk drive clicking away." Somehow my Kaypro was coming across as an animal to be fed during training; the clicking could be the sound of a dog chomping up candied biscuits after a successful lesson.

"You're also going to make backup disks," Michael said. "Sort of like electronic carbon paper."

"I don't have time," I said.

"You'll find time. You can do it in just a minute or so. You can even use a scratch disk to be safe."

"What's a scratch disk?"

"Suppose the power failed or something went wrong with your machine while you were making your copy," Michael said. "Then you could be up the creek without a paddle. You might lose both the original and the copy."

"So?"

"That's why you have a scratch disk. You copy on it first. If something goes haywire, then you're still safe. Because, during your last work session, you made a backup."

"Theoretically," I said.

"And if something goes wrong while you're recording on your permanent backup disk, then you can just work from the scratch disk. It's just what it sounds, sort of a scratch pad."

"Oh, I'll use paper, thank you," I persisted. "The best backup yet. It'll be years before it falls apart. And who knows? Maybe by then the Library of Congress will be preserving my manuscripts."

Michael withheld a guffaw.

"Well, I can type a mean streak on my Selectric," I said. "I can get my stuff back into the computer in no time."

Always the patient teacher, Michael didn't argue.

Presumably, however, another writer nowadays would have agreed with Michael immediately. His editors had been looking forward to having the printer set type from the disk he'd submit with the paper version of his manuscript—a crowded floppy storing every single byte from his toil. Then

the editors could bring the book out six or eight weeks faster, with the disk in the printer's hands. But in this unlucky man's case the disk never reached the printer's hungry computer—he hadn't, alas, made an electronic copy. A case of hubris if ever there was one.

You might avoid such traumas by following the Rothman Chronological Method II (RCM II), a lazy man's form of data security for those with fast printers:

1. Every five minutes or so, type out the "KS" or an equivalent and dump your work of the moment into the disk—for, ideally, permanent preservation.
2. Every half an hour make a printout of your recent work. With a fast printer, that'll still be faster than messing around with an electronic copy at this point. Remember, you still have the backup disk from your last work session. So even if the original fails, you'll need to reenter just the newest material.
3. Every day make your backup floppy. You might forget about the scratch disk and make two copies.

What about working with hard disks? Well, Winchesters are more dependable than floppies. On the other hand, they commonly store many times more material than do the soft disks—meaning perhaps a fiftyfold increase in your agony if one fails.

"Always try to use an uninterruptible power supply with your Winchester," warns Fitzgerald, whose former company produces hard disks as well as floppies. Some manufacturers say their hard disks don't need this protection. But, in general, it's a good idea; here's why.

Normally, the head picking up the magnetic patterns is only ten or twenty thousandths of an inch from the oxide-coated disk. The disk is aluminum—and shear-prone in the event of a crash. Instead of the typical soft whirl, you'll hear an ear-piercing squeal like a car brake out of adjustment, except that the aftermath will be more costly. Repairs may run into the hundreds of dollars, not to mention the loss of data.

Not every power failure will produce a disk crash. But why gamble with your Winchester and its data?

An uninterruptible power supply will protect them by pumping out juice long enough for you to know something is amiss and shut the disk down. It sells for several hundred dollars, commonly, and is normally worth it.

"Also," says Fitzgerald, "be sure the drive is grounded and shielded as the manufacturer recommends. If not, power surges could cause it to lose track of its data."

He suggests one more precaution. Since the disk and the head are so close, why not warn furniture bangers? This could change. Hard disks are shock mounted in some portables nowadays, so that the equipment isn't quite *that* delicate. But I'd still try not to be too klutzy around it—and to be careful in other respects.

You can back up a Winchester in one of several ways:

1. Dumping to floppies. It's cheap but slow. Then again, you can speed up the process by updating only the files you've been working on. You just "write" over them.
2. Transferring the Winchester's contents to a special tape drive large enough to hold them. This method is fast but may cost you a good $1,500.
3. Dumping to an ordinary videocassette recorder. Although slow, it's okay up to around 100 megabytes or so, and you can set the VCR timer to "watch television" off the Winchester at night when you're not using it.

"Interesting," you say, "but how about the lap-sized portable I'm considering? How do I protect the information inside that?" The best way, of course, is not to lose the memory and the rest of the portable; as a well-practiced raincoat forgetter, I'll never be the ideal owner of a lap-sized portable.

Common sense, too, suggests that you not store a lap-size portable inside a car with the sun blazing down—bad news for heat-sensitive chips and other parts.

If your portable uses a **bubble memory**, your data-security problems are milder in some respects than with other kinds. The bubbles are tiny magnetized areas inside a small metal container. Magnetized "north," a bubble might mean a bit specifying "one." Magnetized "south," it could mean zero. (You'll recall that bits form a byte standing for a letter or

number.) Magnetic bubble memories aren't that much faster than disks, but they *keep* remembering forever—unlike the CMOS (Complementary Metal Oxide Semiconductor) RAMs used in many portables.

An RAM will develop amnesia if your power fails, and a CMOS RAM is no different. It's just that the CMOS keeps the power requirements extralow so small batteries can dribble out the needed juice after you've "officially" switched your machine off. This "hibernation" may last weeks or months. (Check your instruction manual.) You're in great shape, however, only as long as your batteries are; the Eveready commercials may talk of nine lives, but your data may have only one. Someday your care may count more than ever. Low-cost CMOS RAMs may eventually store thousands of pages on one chip; and power failure might not be the only risk.

Imagine. You can tap out a chapter of your 1,000-page great American novel some bitter winter night, lazing on the rug by your fireplace. Your lover is stroking your back and—ZAP! Since CMOS RAMs are such low-voltages devices, think what thousands of volts from static can do.

Here's one solution to the portables' static problems. Before computing, you might discharge yourself on a nearby vent or anything else that's grounded. You can also spray your home and office rugs with Static Guard or its equivalent. And you also can use a static mat—cheap at your local computer store—if the zaps persist.

What about a plane thirty thousand feet up? Then you might try discharging yourself against a metal ashtray before using your portable. If it's all plastic, with no metal parts, by the way, your risks are much less than otherwise. But they're still there.

Whatever style portable you're using, remember the importance of backups—however inconvenient or costly. Through a cable called a **null modem**, you can pipe valuable reports from your portable to a larger computer a few feet away. You may want to do this, anyhow. Your lap-sized computer simply may run out of storage room much more quickly than a bigger machine and may lack floppy disks to spread those bits and bytes around. So make sure your portable

software lets you zip material back and forth between machines.

"And in the field? What backup technique, then?"

Well, you're often stuck with slow, tape-style storage. And mini-disk drives may be expensive and take up room if they're not already in your portable.

But why not see if your company will let you send valuable reports over the phone for temporary storage in its big computer? You can also stash them away inside a desktop computer hooked up to the portable the same way. And there's yet another answer. Rent electronic storage space on a commercial computer network like The Source of CompuServe.

In the future, maybe computer memories—on little portables and desktops alike—won't be so temperamental. Perhaps there will be superreliable CMOS RAMs. Or how about practical, low-cost disks that you use lasers to "read" and "write" on? Dreams, dreams!

Meanwhile, most of us struggle along with floppies and must keep thinking, Backup! Handle carefully! Clean! Maintain! and How often? In summary, keep asking yourself:

1. How much time or money does it take to enter your data or set up your computer equipment?
2. How easily could you duplicate or replace it?
3. How much time or money do you have for copying, cleaning, maintenance, whatever precaution you're taking?

Do keep data security in perspective. Remember, even if you must be a zealot at times, it's just part of surviving with your computer. Harold Joseph Highland, a data-security stalwart in his work—a believer in two backup disks of book manuscripts—tells of people who make out very well with far less copying. They are students at the University of Minnesota, computer-science majors, and they trudge through snow and ice carrying unbacked-up floppies in their books. Their professors are tolerant. If a disk fails and a student's assignment is late, they understand. The students can't afford too many floppies, and some just don't have the time for backups. It's the same, perhaps, at countless other colleges,

and maybe that's only right for twenty-year-olds who'll learn soon enough about disappointments beyond the campus.

But you're in business, perhaps, without a friendly professor ready with a sympathetic nod. Your making regular backups is just plain good sense, and if you don't, you deserve what's coming to you.

Isn't that what data security should be about?

It needn't be Orwellian at all. If anything, in fact, Winston Smith had more of a data-security problem than Big Brother. Privacy, certainly, is an important data-security element, as is what the jargonists call **integrity**—accuracy and completeness of files. Think of Winston Smith and his appreciation of history and Big Brother's propensity for tampering with the contents of back issues of the *London Times*! Even if "1984" has already become a year, the number, to true believers in data security, remains a warning.

This will be especially true as more and more machines swap secrets over the wires between home and office.

11 Wired to Work

John Fuller's daughter is grown now, and he's taken over her room, cluttering it with computer and boating magazines and his Heathkit micro. At first glance it looks like the computer room of any of thousands of hobbyists. You may, in fact, catch whiffs of smoke from Fuller's soldering gun.

It's an unlikely setting for a working office of the U.S. Navy.

And yet that's exactly what it was when Lieutenant Commander Fuller responded to my notice on an electronic bulletin board asking if anyone at home was hooked up to his boss via computers.

"I've been getting away with it for six months," Fuller drawled proudly.

On the verge of retirement from the navy, he was determined to telecommute in civilian life, too, perhaps as a management consultant, his military job. "It seems foolish for me to get in a car to go to an office," he said, "if I can go to that office by phone. I'm much happier not having to get into traffic for forty-five minutes each morning. I can have coffee and read the *Washington Post*, and I'm not tense. I work fewer hours. But I don't have five or six guys to talk to about ball scores, either. The government's getting a better deal from me working at home."

In fact, Electronic Services Unlimited (ESU), a research firm in New York City, found typical productivity increases between 15 and 20 percent.

So it isn't surprising that at least 250 firms, including some big names like American Express and McDonald's, were allowing work at home as of 1984. Many more companies might be. They might have kept quiet, however, fearing either (1) union resistance or (2) pressure from employees who wanted to telecommute before management was ready for them to do so.

"I look outside my Manhattan window and think some cities are going to be transformed—streets will be empty," *InfoWorld* quoted an ESU official.

That might have been stretching it. In 1984 only several thousand people were full-time telecommuters on a payroll. But Jack M. Nilles, coiner of the word "telecommuting," said the number may have reached twenty thousand if you included other people.[59] Lone individuals, stockbrokers, even a software house organized "on-line," were trying it. And Nilles, a future studies researcher at the University of Southern California, was predicting perhaps as many as ten million wired workers by 1990. He said most of the ten million would telecommute only part time. Still, that would be a huge number, perhaps one-fifth of the information workers in the United States.

You might beat the crowd in the most obvious way—by becoming a do-it-yourself telecommuter, perhaps without even leaving your present job. "Wired to Work" will explain. You'll also learn how your company might benefit from large-scale telecommuting. Even small firms can come out

ahead. A growing translation service in Washington, D.C., squeezed into the basement of the owner's home, lends tiny Radio Shack computers to workers.

Telecommuting may very well help your firm reduce real estate costs; hire better people, clerical and professional; and get a head start on your competitors, mixing high tech with decency and managerial common sense. No, I'm not going to suggest putting a "For Sale" sign tomorrow on your corporate skyscraper. Telecommuting isn't for every worker or every company. American bureaucracies, however, public and private, are not yet tapping the full potential of telecommuting. As far back as 1970 Commerce Department statistics showed that half of American workers dealt in information, whether it was travel agenting, technical writing, or filling out 10K forms.

Match those statistics with Jack Nilles's estimate that more than 2.5 million nonfarmers in the United States already work at home, and you can appreciate telecommuting's prospects.

Fuller's case, in particular, shows how countless Americans might leap at the chance to telecommute.

His employer was a bureaucracy, a huge one, hardly a trendies' citadel, lacking an official telecommuting program, and yet he carved out his own niche as a wired worker. The Navy allowed a few other men from his office to write and think at home. But the resourceful Fuller went a step beyond; he took the initiative of hooking himself up electronically. And he told me, "I'll never again work where I don't want to be." It seemed so logical. Now that telecommuting was technologically possible, why shouldn't employees *ask* for it? Why shouldn't telecommuting be a grass-roots movement among professionals in large organizations, not just the province of corporate planners and rich escapees from Wall Street? Moreover, with his down-to-earth wisdom expressed plainly in a Georgia accent, John Fuller couldn't be shrugged off as a dreamy hacker.

The purists might not have accepted Fuller into the telecommuting fold, since he was still spending at least one-quarter of his forty-hour week in other people's offices. To me, though, he was all the better an illustration of how people and companies could gracefully change over.

As an in-house consultant, Fuller went from office to office, telling, for instance, how the Naval Academy could set up a cost-analysis formula for its laundry or how a base commander could consolidate two computer systems. His "clients" were not completely "on-line." And he appreciated the value of face-to-face meetings where he could smooth ruffled feathers with southern humor. "I may look like another alligator," he would tell bureaucrats intimidated by the presence of a management consultant, "and I may be taking you away from your work, but I need information from you to help you do it better." Fuller would also stray into his boss's office from time to time for library research and to remind people he was still breathing.

Every few days he reminded them in other, more meaningful ways. He would load up his little Heath computer with disks containing the report he was working on and a communications program. The computer would then pipe the output to his modem, which sped the results to a Wang word processor in his office—well, his former office.

A secretary would capture the information on a disk, watching in appreciation as Fuller's work flashed across the Wang's screen at several hundred words per minute.

"The secretaries don't admit to being threatened," he said. "They're still busy transcribing the stuff the other guys bring in. And if the others were transmitting it like me, they'd still need to do the final formating, editing, the modifications required of these things.

"Besides, there's got to be someone there who answers the phone."

Baby-sitting a computer by the phone doesn't sound like the most challenging task, but one day many of the secretaries themselves may work at home.

Granted, some management-level workers worry that telecommuting would lower their own job status by forcing them to work keyboards. "If I were a civilian at some companies and I sat down at a keyboard and composed my day's work," Fuller admitted, "a clerk or administrative-type person might complain to the personnel office that I was clerical rather than professional and should be demoted.

"As the younger generation of managers grows up with keyboards and rises higher in the power structure," Fuller said, however, "you'll find the stigma fading." By century's end, moreover, a voice-controlled computer might sell for less than $1,000. Good-bye, typing! You may still use a keyboard, actually —but just to clean up sentences where the computer confused "sleigh" with "slay" or muddled similar combinations.

Should you, then, even today, follow Fuller's example and make yourself a telecommuter?

Consider:

1. *How much public contact does your job require and in what form? And how much contact do you have with your coworkers?*

   Fuller didn't need to have strangers passing through his office. His job, rather, called for him to go to "clients." Also, he was working on his own projects, not entangled in office-wide activities, and he didn't need constant feedback from his boss.

2. *Does your job require much office politics, and how secure are you in it?*

   John Fuller was about to retire. Had he been a young manager fighting for a promotion, he might not have chosen to remain most of the time out of his boss's sight. Then again, he did have the benefit of a superior more enlightened than many. His boss wanted results, not mere attendance.

   Margrethe Olson, an associate professor at New York University's business school, warns that some telecommuters may suffer at promotion time. She correctly wonders about "the long-term career potential of an employee in an environment where visibility is still critical to promotability." In a 1982 paper Olson observed: "Some form of management by objectives, either informal or formal, generally needs to replace 'over the shoulder' supervision, in spirit as well as in fact." As she once said, "Culture changes more slowly than technology."

   Keep in mind the experiences of a vice-president of a New York consulting firm who telecommuted from Florida.

When the *New York Times* interviewed him, he insisted that he remain nameless, lest the wrong people in the firm find out about the arrangement.[60] "I still think there's a mentality around there that people who work at home are not working," he said, adding, however:

"I like to have uninterrupted periods of work alone. If I have to stop and go to a meeting for two hours, I lose more than two hours."

3. *What becomes of the clerks and secretaries whose work your telecommuting may change or reduce?*

Fuller's "disappearance" from his regular office didn't put anyone out on the street. It merely lightened the secretaries' work loads.

4. *How expensive, and how much trouble technically, would telecommuting be to your company and to you?*

In Fuller's case it was relatively easy. His office already had the word processor, and as a computer hobbyist he already owned the Heath micro. Ever ingenious, he devised an easy way of entering data so the Wang, which justified margins by the paragraph, could function with his home system, which did so by the line. (See Backup XI, "The Micro Connection: Some Critical Explanations," for more tips on links between your own micro and the office's.)

John Fuller's electronic hookup cost next to nothing. A modem like his —the device allows a computer to talk over the phone—would sell for about $100 today. Faster modems may cost $300-$600.

It pays to check out technical specifications and shop around. The old compatibility rule applies here: don't believe that any combinations of equipment will work together until you've actually tested them out. Obtain a store's promise that you'll win a refund if the systems won't talk to one another electronically. You'll also need to make sure that the computers have communications programs that function together. A good communications program for a micro—one that's easy to use and lets you store information to be transmitted—can cost less than $150. Even free software may work for you. I didn't pay a cent for my MODEM7 program, which the writers placed in the public domain.

Normally, as a do-it-yourself telecommuter, you should favor micros over "dumb terminals." At least make certain you can easily accumulate large masses of material to shoot out over the phone lines. That way you'll conserve your company's phone and computer resources. Suppose, however, that somehow they're both unlimited and you don't mind a phone line being tied up while you're dumping material into the big corporate computer. Then maybe you can get away with a dumb terminal costing just a few hundred dollars.

5. *How do you normally gather information in your job? By phone? By looking over written material? By tapping into your company's computer?*

If facts normally reach you by phone, you can install a special business line and tell your colleagues that, no, they won't disturb you at home—that your work is what the line's for.

Written material is trickier, of course. One answer may be a facsimile machine, which could cost more than your computer but may be justified if drawings are part of your work. In the future, even cheap personal

computers will have attachments to scan written documents and zip the images over the phone lines. Already some expensive Wangs offer this feature.

Meanwhile, like Fuller, you may want to catch up with written material by visiting your office every few days, or you may try a formal or informal messenger service—perhaps a coworker.

If you must tap into your company's own computer, make certain you can do so without any data-security complications. And consider how accessible your corporate data base is to begin with. Maybe there aren't ways of conveniently plugging in—in which case you'd better rid yourself of plans for do-it-yourself telecommuting.

6. *Would your family leave you alone while you telecommuted?*

   You must work out a deal with them that includes a place to work without interruption, rules for phone messages, and so on.

7. *What about potential marital problems?*

   "If you work in your employer's office, your spouse doesn't show up very often," says Walter I. Nissen, Jr., a programmer-consultant who, off and on, has been telecommuting in various jobs since the late 1960s. "But if you're home, your spouse can get angry at you, face-to-face, right there." He finds telecommuting to be easier with his wife now working as a social worker.

8. *Do you have the drive to do your job alone?*

   "I'm not a Theory X man," says Fuller, referring to the school of management that says people work best with the boss peering over their shoulders.

   Don't mess with do-it-yourself telecommuting if you aren't a self-starter—a useful trait even in corporately initiated programs. Don't recommend it to anyone lacking this trait.

9. *Can your boss measure your performance objectively? This isn't necessary but it helps.*

   Michael K. Caverly, a recently retired captain and John Fuller's former supervisor, couldn't give any precise figures comparing the overall quality of the telecommuter's work to earlier times. But Caverly was plainly delighted. He believes that Fuller performed better without having to worry everyday about the horrors of rush hour. "I almost feel guilty about it," he said of Fuller's diligence. "He would rework a problem all night long, and I'd feel almost as if I were taking advantage of him. In our office we did thirty-three studies one year, and John's studies were the only ones that came in on time all the time."

Jeremy Joan Hewes is also sold on telecommuting. "Can you work at home?" Hewes's own boss asked when he hired her for *PC Magazine*, an independent publication for owners of the IBM PC.

"That's where the computer is," she replied happily.

It made sense. Hewes had her North Star micro there, after all. What's more, she'd written a book on "worksteaders," as she called them, and by her late thirties had worked at home most of her professional life. So why not use her North Star there and modem her stories in? She might even edit others'

articles sent over the phone lines. The magazine wouldn't have to jam another human sardine into the cramped offices it then occupied above a restaurant in northwest San Francisco. She could work better alone. The pay would be the same for her hundred hours a month. And she could enjoy tax breaks on computer equipment, supplies, even some of her rent.

The magazine, in return, ended up getting more than five thousand words a month from her, sometimes double that amount, while, at the same time, as an associate editor, she regularly oversaw at least one other writer. She also did additional work for which she was paid beyond the hundred hours.

"It's a lot less chaotic at home," said Hewes, who also was writing books. "I don't have to dress up. I normally wear jeans or corduroys. I can start work at dawn in my bathrobe and answer the phone that way if it rings while I'm headed for the shower. I don't have to drive through traffic jams every day. Or stand up for twenty minutes on a bus, hanging on for dear life to a pole, jolting along the street. I work in surroundings I've created."

She created them with both the IRS and aesthetics in mind. Her apartment, near the Golden Gate Bridge, was on the second floor of a seventy-year-old house with high ceilings and leaded bay windows. A bookshelf and wooden cabinet set the computer area apart. Her keyboard and video screen were atop a custom-crafted table with fruitwood edges; she can work alongside her cocker spaniel-poodle, and through the bays she could see a doll-repair shop. It was vintage San Francisco. No matter that neighbors' punk-rock music once besieged her ears or that practice pitchers sometimes thudded tennis balls against the house or that apartments cluttered what once were sand dunes. Several times a day she switched on her answering machine, a device she deemed necessary for worksteads. Then she'd swim laps at a nearby pool or walk her dog amid cypress and eucalyptus trees, perhaps with friends, perhaps alone, perhaps mulling over future articles for *PC*, where she once warned would-be telecommuters of the need for "regular breaks from the concentration of work." At the same time she lectured herself and others on the need for self-discipline. She trained her friends to realize that she was earning a living, not goofing off—a confusion that may fade as telecommuting becomes a more mundane pursuit.

She kept her sanity and a schedule—well, a writer's equivalent of a schedule—by remembering how she had promised to research X material by Y date and how she *would* complete an article on time. "I go to an editorial meeting," she said, "and I say, 'Here's what I want to write for the March issue.' They say, 'Oh, gosh, someone else is doing that,' or, 'Why don't you do this?' or, 'Fine, hand it in by the fifteenth.'"

"Rarely," Hewes said of her editors, "can I imagine them calling me at eight in the morning to transmit a story in an hour."

Mostly, in fact, she sent in her stories at night through her computer. Her IBM—she loyally bought one to replace the North Star—talked over the phone to the magazine's machine with an automatic-answer modem. She could tell the office computer to save her copy on a disk. Except for light editing and formating, no human normally needed to type another keystroke; *PC*'s computers tied in with the printer's.

It sounds HALish, depersonalized, but like Fuller, she and others at the magazine tried to infuse their work with as much warmth as they could.

No one at *PC* was leaving martinetlike orders—unaccompanied by conversation, phone or otherwise—on the green screen. And Hewes painstakingly consulted over the phone with her writers. Moreover, while Hewes worked from home at least seventy of the hundred hours, she was at the *PC* offices several times a week to socialize, pick up mail, and swap ideas. And she would have come in, occasionally, anyway, even if she lived fifty miles from the magazine. (Also, she was in the field for face-to-face interviews, just as Fuller, working for the Navy, would visit his "clients.") As the telecommuting movement grows, workers and supervisors alike should remember to *see* and *speak* to others, not just key to each other.

Whatever the case here, both Hewes and *PC* were tickled with her telecommuting arrangement. "We're not paying for office space, electricity, desk space," said David H. Bunnell, then publisher and editor in chief. "She even provides her own coffee." An office for her might have cost the equivalent of $1,200 a year. More important, however, Bunnell happily noted the thousands of words she writes for each issue: "She couldn't be more productive, and she does her research conscientiously. Like the article she did on printers. It was obvious she'd surveyed twenty or thirty manufacturers in the field."

Close to a year later, Hewes told me that she was no longer telecommuting regularly. Bunnell had been so happy with her work that he had appointed her editor at the book division of *PC World*, which he had started after leaving *PC Magazine*. Hewes still loved the concept of telecommuting. But she understood its limits better. "When I was an associate editor of *PC Magazine*," she said, "I was actually more of a writer than an editor, and I didn't have to be as much a manager as I am now. But now I have to juggle ten book projects and do budgets and go to several meetings a week. My ideal thing would be to go to the office two days a week and work at home the other three. I figure I'll work on that for next year. Now all I've got to do is get everyone I need to see to come in the same two days that I do!"

Bunnell himself offers another qualification in praising telecommuting—not everyone has the needed discipline—but he says telecommuting can work especially well for people who write or sell. One New York magazine publisher, in fact, developed a special computer system for handicapped people, featuring written prompts to keep sales pitches consistent. And Bunnell thinks that telecommuting can work for executives, too, with the right system, taking advantage of computerized records of the words they keyed in.

Can clerical-level workers, however, also telecommute happily?

A South Carolina case illustrates both the blessings and *potential* pitfalls of telecommuting for clerical people.[61]

Blue Cross-Blue Shield there says it isn't running an electronic sweatshop. The telecommuters' rewards are roughly comparable to those of the regular office workers, and some cottage keyers can actually come out far ahead. The program has been going on for years. And there's a long waiting list.

Ann Blackwell, one of the keyers, transmits her work back to Blue Cross at the crack of dawn; then she can fix breakfast for her two children and take breaks for household work and lunch. “I’d rather do this than go to the office,” she said. “I don’t have to dress. I don’t have someone looking over my shoulder all the time to see if I’m working.”

In a typical day a “cottage keyer” processes 360 claims forms from doctors. The pay is sixteen cents a claim, or $57.60 for the 360, minus a levy of $10.20 for equipment rental, meaning that the worker ends up with $47.40 before taxes.

That’s $2.18 more a day than full-time employees at Blue Cross receive for similar work, if you consider the full timers’ benefits like holidays, sick leave, vacation, and disability and health insurance. A good clerk could earn some $12,000 a year. And $12,000 is nothing to sneer at in South Carolina where many living costs are low.

However:

1. The cottage keyers are paying more than $2,600 a year to rent their machines. Doesn’t this smack of company-store tactics in a mining town? Why not finance the purchase of the worker’s own machine, which he or she might pay off in a year? Blue Cross official Tim Blackwell—who has given his company some useful feedback based on his wife’s experiences—defends the steep charge for the machines. He says it’s actually an incentive. The more a cottage keyer works and earns, the smaller will be the percentage of her income going to pay for the terminal cost.
2. The telecommuters don’t get the security that full timers do.
3. Likewise, the cottage keyers lack the normal fringe benefits. The program could delight a wife whose husband holds a steady job with good health insurance and other benefits. On the other hand, the arrangement could be bad news for a worker depending on the telecommuting for his or her main income. Significantly, women head most single-parent households.
4. The keyers may not be sharing the experiment’s rewards fifty-fifty. Excluding minor administrative expenses, the telecommuters’ services cost the firm $47.40 a day on the average, minus whatever profit the company may make off the terminals it rents to the workers. Let’s say the final expense is $45. By contrast, the regular workers cost at least $50.52 a day if you include vacation, fringe benefits, and the $5.30 that the firm pays for a terminal lease. Missing, however, are the expenses of office space. Also, the company’s getting slightly more work from the telecommuters with only about 12 percent as many errors!

Could an antitelecommuting backlash develop as workers catch on to the economics?

Already the American Federation of Labor and Congress of Industrial Organizations and the Services Employees International Union have proposed the outlawing of computer homework. Given the political climate of the mid-1980s, that seemed unlikely. This could change, however. Gil Gordon, an ex-Johnson and Johnson personnel man turned telecommuting consultant,

correctly warns against using telecommuting to bargain down workers' pay or bust up organizing drives.

"There's nothing new about shift work, piecework, which is what pay per line of information is," says Karen Nussbaum, president of 9 to 5, the National Association of Working Women. "Or pay by keystroke homework. That's a step back into the Middle Ages, if you ask me, and into the cottage industries."[62]

A difference exists, after all, between creative jobs, like Hewes's, and those that, in any setting, will be drudge work. The question is Where will the typing, the data entry, the other labor, be more palatable—home or normal office? And ideally that's a worker-by-worker, company-by-company, decision. Perhaps some workers will eventually strike for the *right* to telecommute. In fact, Glenn E. Watts, president of the Communications Workers of America, while frowning on electronic scabbing, once said that telecommuters might even plug into union gatherings. Union opposition to telecommuting could very well change. The big variable is whether companies will follow Gil Gordon's wise advice not to use telecommuting as a union-busting ploy.

Of course, presently, home work isn't for all. Today a telecommuter can't make steel, cars, or refrigerators by remote control. He or she can't cook a Big Mac, sweep a floor, run a supermarket checkout, or load a truck; for telecommuting is now strictly the province of white-collar workers and professionals. Indeed, companies in predominantly blue-collar fields may decide that certain office jobs just defy wiring in. Suppose an auto worker suffers a series of late paychecks. Will a payroll clerk sitting in a comfortable suburban home be as responsive as he might be dealing with the man face-to-face?

Even in basically white-collar fields, some bosses and employers may look askance at universal telecommuting.

Some, for instance, may miss the hints of body language, the blink of an eye, the tapping feet, the little, subtle signs that many people feel to "read" friend and foe. Others simply miss *seeing* people hard at work. A Seattle hospital administrator, a telecommuter supervising two others working at home, says: "It ultimately comes down to an honor system."[63]

So if you don't trust your underlings and can't objectively measure their output, you'd better keep your workers at the office and watch for eye blinks.

Not that every employee will want to telecommute, anyway. Management Recruiters International, Inc. asked six thousand people if they'd be willing to telecommute several days a week. Only 36 percent said they would. That's still an impressive percentage, and it will grow as more people appreciate telecommuting's virtues and it becomes more socially acceptable, but there'll always be skeptics like Jack Smith.[64]

He's a columnist with the *Los Angeles Times*, which once freed him of his commute. After six weeks, however, his granddaughter broke his typewriter, and he temporarily returned to the newspaper, where he rediscovered the joys of face-to-face contact and decided to remain. His columns perked up. He had missed "the friendly faces, fresh in the morning; the clothes; the gossip; the flirtations; the benign conspiracies; lunch-hour expeditions; the open forums

on war and peace, Reaganomics, and the Rams quarterback controversy, none of which could be examined with such reckless spontaneity by anything canned for consumption on your home computer."

"He realized that he really came back to the office not just to write but to renew his interaction with human life," says William Renfro, a Washington consultant.[65]

Then again, Maxine Messinger, a gossip columnist with the Houston *Chronicle*, writes happily on a computer at home and brags that she hasn't been to the office in years.

"For a long time it's been far more efficient for me to work at home," says another confirmed telecommuter, Hollis Vail, a part-time management consultant with the U.S. Geological Survey.

"I use my computer for writing, reports, and sending reports and messages," he says, "and I can get all the data I want from the system." The U.S. Geological Survey has thousands of people using electronic mail, and Vail can even hold conferences over the wire and record the results on his computer disks. Then he can sum them up. In fact, he can electronically cut and paste to produce policy documents reflecting many viewpoints.

David Snyder, now a professional futurist and consultant, fondly remembers the computerized conferences of his days as an Internal Revenue Service official. "I wrote a book with eight other people," he says, "and we didn't meet until it was written. It was a much better product because we could work that way. The travel would have been too expensive. And the mails would have been too much of a delay." The coauthors left their contributions in each other's electronic mailboxes for perusal and change. Back then Snyder was on a government computer, but later he hooked up an Apple in his Maryland home; he was planning to connect with aunts, uncles, and other members of his extended family, nationwide, who, together, do consulting and produce films. "You can't have a mom-and-pop steel mill," he said. "You can have a mom-and-pop information factory."

Rank Xerox, the office equipment giant's joint venture in England, is helping to pave the way for Mom and Pop.

It's letting managers and other professionals telecommute. They're no longer salaried, and they give up pensions and perks like company cars; but the "networkers," as they're called, normally sign two-year contracts guaranteeing them work at least two days a week. Business with other companies may take up the remaining days. In a sense the Rank Xerox program could be a large corporation's version of the hundred-hour-a-month arrangement that Jeremy Hewes worked out with the computer magazine.

"Clearly," says Derek Hornby, staff support director and a member of the Rank Xerox policy committee, "we need and will always have a 'core' staff within the head office for day-to-day management. Many functions, however, can be fulfilled by networkers."[66]

Computer work, pension advising, management training, even putting out the company newsletter, are some of the tasks with which the networkers may help core staffers. Who qualifies for the program? Someone the company wants to keep but whose services it needs only part time. The first networker, Roger Walker, a former personnel manager in his late thirties, helped cut costs

in the most direct way, eliminating his job. He was planning, anyway, to venture out on his own. But the Rank Xerox program eased the transition.

"What do you answer," I asked the company, "when people say, 'Isn't this really just an outplacement scheme?'"

"The rough cost of someone going networking," said Phil Judkins, a Rank Xerox spokesman in London, "is approximately three times the cost of their compensation if they were simply declared redundant by Rank Xerox."

More than a year into the program, how were the volunteers doing?

"Extremely well," said Judkins—all of them. He said two networkers seemed "well on the way to one-million-dollar turnover companies."

And Rank Xerox, needless to say, didn't supply all that business.

Along the way the corporation was benefiting from the useful business contacts that the new entrepreneurs were making outside the company. Sensibly, it discounted its model 820 microcomputer for the networkers. They could not only do their normal work but help show off a company product.

Runaway expenses, though, especially rent, were the real spur behind the experiment.

The rent on Rank Xerox's international headquarters, in London, had doubled in just two years. Small wonder, then, that Rank Xerox wanted to trim every speck of gristle from its headquarters budget. And by late 1983 the knife seemed to be slicing well. The forty-three networkers were helping Rank Xerox save a third of a million dollars a year in office space. Judkins said: "We have rid our books of this sterile expense."

In the United States, Mike Bell, Xerox real estate executive, is busy toting up the advantages of another form of telecommuting—moving some corporate operations out of expensive downtown areas.

"Why should a company have row after row of workers taking up desk space in back rooms in large cities," he says, "when it could modernize its office machinery and farm them out to offices in the suburbs? An average office worker and his desk take up 200 square feet at $20 a foot in big cities. That's $4,000 a year just for rent. Suppose you could move him to a suburb with rent at $12 a square foot. Then rent would be only $2,400 a year."

If the employee was in a suburban office tied in to headquarters via a computer-telephone hook-up, you might save as much as $3,000 over five years—even if you counted expenses like equipment costs.[67]

And you might save $8,200 per employee over a five year period if the workers were at home.

The chart below assumes that (1) each employee takes up 200 square feet, including corridor, aisle, and file space, (2) the downtown rent is $20 a square foot, which is perhaps half of some Manhattan rents, (3) the suburban rent is $12 a square foot, (4) you pay home workers $4 a square foot in rent, (5) your investment in equipment for each telecommuter is $4,000, (6) the effective tax rate is 35 percent, (7) you'll receive a tax credit of ten percent of the computer gear's initial cost and (8) depreciation is straight line over five years. Yes, $4,000 is more than the computers might each cost; the inflated figure helps fudge for miscellaneous expenses like moving expenses and phone bills. As for tax laws, they can change. But the credit—as distinguished from depreciation—accounts for only a tiny fraction of the money you're

saving. One last point: the chart below doesn't consider interest on what you'd be saving in rent.

Large companies, of course, could mix different forms of telecommuting and employment arrangements. They might even let some workers shift back and forth. Some employees, some of the time, anyway, would work at home, while others might be at companies' regional or neighborhood telecommuting centers of one kind or another.

Jack Nilles's kind of neighborhood center—at least one of the kinds he's proposed—would be organized by corporate function. One center would bring all the accountants together, for instance,

A COMPARISON OF OFFICE EXPENSES PER WORKER

CASE 1: DOWNTOWN OFFICE

Years	*0*	*1*	*2*	*3*	*4*	*5*	*Total*
Rent	0	4,000	4,000	4,000	4,000	4,000	20,000
Tax Reduction at 35% Rate	0	-1,400	-1,400	-1,400	-1,400	-1,400	-7,000
Total Expenses	0	2,600	2,600	2,600	2,600	2,600	**13,000**

CASE 2: SUBURBAN OFFICE

Years	*0*	*1*	*2*	*3*	*4*	*5*	*Total*
Rent	0	2,400	2,400	2,400	2,400	2,400	12,000
Tax Reduction at 35% Rate	0	-840	-840	-840	-840	-840	-4,200
Investment	4,000	0	0	0	0	0	4,000
Tax Credit	-400	0	0	0	0	0	-400
Depreciation Credit	0	-280	-280	-280	-280	-280	-1,400
Total Expenses	3,600	1,280	1,280	1,280	1,280	1,280	**10,000**

CASE 3: HOME OFFICE

Years	*0*	*1*	*2*	*3*	*4*	*5*	*Total*
Rent	0	800	800	800	800	800	4,000
Tax Reduction at 35% Rate	0	-280	-280	-280	-280	-280	-1,400
Investment	4,000	0	0	0	0	0	4,000
Tax Credit	-400	0	0	0	0	0	-400

Depreciation Credit	0	-280	-280	-280	-280	-280	-1,400
Total Expenses	3,600	240	240	240	240	240	**4,800**

and another would house a company's public relations department. This idea does have the important advantage of, say, letting accountants pore over their electronic ledgers in each other's company. Yet what about the unlucky ones who lived in suburbs across town?[68]

They would prefer, presumably, the kind of center propounded by Richard C. Harkness, a former professor at the University of Washington who later joined Satellite Business Systems.

Under the Harkness plan, an employee would go to the center closest to his home. "He might even walk there," Harkness says. According to him, a large company might have as many neighborhood centers as elementary schools—leasing offices for individual workers or small groups. Imagine a professional building with a real estate agency next to a stockbroker, a doctor across the hall from a commodities trader. Well, that's how it would be in a building housing neighborhood centers, except a sign outside a suite might say "General Motors" rather than "Dr. Pearlman." Of course a company might instead have fewer centers and lease whole floors. Stepping off the elevator, you'd see the foot-high letters reminding you you were in GM territory. Workers would benefit from the companionship of perhaps several dozen colleagues, quick access to secretarial and copying services, and similar support.

"My way is more radical than locating people by jobs," says Harkness, "since an accountant could be in one place and his boss in another." Computer networks would maintain entire organizations; a whole new branch of management science would develop to hone procedures to manage telecommuters. Perhaps the day will come when IBM will endow Harvard Business School with a telecommuting chair.

A third form of neighborhood center would be a munytel, as I'll call it—a municipally or privately run center with terminals capable of linking up with many companies' equipment. Individual employees, not companies, might rent munytel offices.

Munytels would not bolster employees' corporate loyalties; but some companies wouldn't care, favoring other ways.[69]

Munytels, moreover, could be ideal for free-lance telecommuters who valued a clear line between home and office. Workers would be at these neighborhood centers all the time or whenever they preferred and space was available. Fed up temporarily with toiling alongside a sullen spouse at home? Then you'd flee to a munytel, unless your free-lance work involved confidential company information; in which case you might drive to a GM or Prudential suite with a spare terminal.

Neighbors with similar or complementary skills might gather at munytels and pool resources to seek contracts from large companies. Why not use computerized lists to bring together people in the first place? "Neighborhood work centers could themselves become employers, selling clerical or

professional services to other organizations," said one of the consultants working with Harkness on a landmark telecommuting study for the Stanford Research Institute in the late 1970s.

Munytels, in addition, could be drop-off points for messengers from corporations' headquarters. They would deliver printed material—books, for instance—that companies couldn't flash across the screens of telecommuters at home and munytels.

Also, and perhaps just as important, munytels could serve as informal neighborhood clubs.

They could offer food and drink and a chance to mix electronically transmitted gossip with the face-to-face kind. "Meet me," a stock suggestion might go, "at the munytel."

Moreover, for telecommuters unable to handle their children and jobs simultaneously, the munytels might provide child care. And in poor neighborhoods, the munytels could combine work facilities with training.

The prefiasco Continental Illinois Bank in Chicago, despite its bad luck with "problem loans," did some enlightened work in this field. It experimented with a word-processing center twenty-five miles away at a community college. The bank used it for both training and actual bank work, a logical combination; the students have learned on equipment similar to what they would use on the job, not simply the obsolete machinery that many schools must skimp along with. Corporations, encouraged by tax breaks or government subsidies, might together establish munytels in poorer neighborhoods.[70] They would provide the businesslike surroundings that some workers might prefer over home offices in slums or public housing projects.

Munytels would be *one* response to some thoughtful criticisms of telecommuting made by Janice C. Blood, 9 to 5's information director.

"If you're a secretary earning $11,000 a year," she says, "will your employer build you an addition for your computer room? Even a small Apple wouldn't be too attractive an addition to my living room."

Blood is also worried about the cost of the equipment itself, asking, "Should someone get a cut in salary just because her boss gets [her] a new typewriter?"

More likely, however, clerical workers instead would receive *some* more money for turning out a lot more work. Whatever the case, munytels could be a solution to the equipment issue—in addition to the obvious one of company-supplied computers in various cases.

But workers should still be free to use their own terminals. Remember Hollis Vail's preference for *his* printer?

He's right. I could never stomach working all day on, say, one of the older Apple IIs, which some companies may still use as their universal microcomputer. My Kaypro's keyboard has a silkier feel. The screen is more viewable than many Apple monitors, and I'm a confirmed WordStar addict. Even if voice commands become the norm, I may well be among the last of the keyboard diehards. And yet, were I telecommuting, it wouldn't matter. A corporate computer would care about the right series and speeds of bytes, not

how they originated. So I might be able to keep using my electronic equivalent of a buggy whip.

Just about anybody, moreover, will be able to afford a *useful* small computer before the end of the century—because sooner or later one will be cheaper than today's typical TV sets. Flat screens and keyboards will sell for a pittance as mass production and robotics drive down costs. So much for that one of Blood's arguments.

As for her fear of an Apple system cluttering up her living room—well, the home computer of tomorrow will probably be smaller and better looking. Or it'll be part of your TV. If not? You may hide your equipment in a handsome, wooden cabinet that will convert to a genuinely ergonomic table of adjustable height. No, I don't know of a product like that now. But already stores in trendy Yuppie areas are springing up with names like "Computer Support," and some of their offerings may be as fit for your living room as for your office.

Less easily answered, however, is Blood's worry of "a Mae West employment profile"—broad at the top, narrow at the middle, wide at the bottom. That is, there might be lush job opportunities near the top around the equivalent of Mae's bust. A few senior managers could electronically monitor the masses toiling at home—could count and time their keystrokes.

But between the top people and the ones entering the data, companies would need many fewer run-of-the-mill supervisors.

And that would pinch off some promotion opportunities for the clerical workers.

In some ways, however, companies might make nonsupervisory work more palatable. They might, for instance, pay clerks not by individuals' keystrokes but by those of small "telegroups," where peer pressure would keep every member productive.

Also, companies might follow the example of Volvo, the Swedish automaker, and rotate some workers' tasks. Some numbers crunchers might swap assignments with word-processing people. Indeed, companies could pay extra for versatility. Word-processing work today is sometimes more complicated than regular typing; but that might not always be so, and corporations could relieve some of the boredom of repetitious jobs simply by letting employees exchange them.

Still another legitimate worry is the distribution of the economic benefits of telecommuting. What's to prevent employers from abuse of the piecework payment system if the government lets it become the norm? Could piecework be just a gimmick to help impersonally squeeze the last drop of blood from the clerical telecommuters? Is telecommuting a mean-spirited or enlightened response to the day-care problem? I suspect some companies *are* mean spirited. Not all. But some. Ideally, however, this won't deprive society of telecommuting's benefits. Munytels, after all, could help solve the child-care problem, and changes in the labor laws could guarantee the fairness of the piecework system for all. Existing ones do cover clerks doing piecework. They must, for instance, keep time records to show they're collecting the equivalent of the minimum wage.

In a related matter, a controversy was swirling in 1984 around a 42-year-old federal ban on commercial home knitting—an issue of interest to companies considering telecommuting. Unions were fighting for the ban; the Reagan administration, for courts to overturn it.[71] Perhaps the Reaganites would want *no* restrictions on corporate use of telecommuters, which is unfortunate considering the opportunities for electronic sweatshops, of which the sleazy will certainly want to avail themselves. Ideally, either (1) I'm wrong about the Reaganites or (2) future administrations will take a more enlightened attitude.

Telecommuting also has energy implications—good ones. With widespread telecommuting, oil price increases would no longer be so scary if another energy crisis threatened the United States.

Jack Nilles once calculated that the typical computer terminal uses less than 125 watts, and a phone line takes up no more than a watt. Then he matched those figures against a private automobile's typical energy use during commutes, and he found that telecommuting would have a twenty-nine-to-one energy advantage. Compared to mass transit systems loaded to capacity—a rarity in most American cities—it would still enjoy two-to-one superiority. With ten million telecommuters, the country might save three-quarters of a billion gallons of gasoline a year.[72]

"At least in the United States," notes Richard Harkness, "commuting accounts for 35 percent of all auto and truck fuel consumption." Much, maybe even most, of the thirty-five percent would be trips to jobs convertible to telecommuting.[73]

Ticking off statistics, Harkness illustrates the profligacy of American energy consumption. "The average U.S. worker commutes about twenty miles each day. Eighty-four percent of those commutes are by automobile, 65 percent with only the driver. Two hundred and twenty million Americans consume 18 million barrels of oil per day, roughly 30 percent of the world's supply." He also notes the cost of America maintaining forty thousand miles of superhighways and 4 million miles of streets and roads. "It has been estimated," says Harkness, "that 248,500 U.S. bridges need major repairs at a cost of $47 billion."

And beyond the energy and financial prices, what about the psychological ones? Even part-time telecommuters can greatly reduce the stress on their nerves and schedules, perhaps lowering medical costs for society. "An employee who drives an hour to work would save sixteen hours in commuting time each month, or the equivalent of two eight-hour workdays, by working at home two days a week," says Frank W. Schiff, a Washington economist.[74]

Even battle-scarred urbanites with short commutes might relish the chance to work at home two days out of five. Skyscrapers and their occupants keep hogging downtowns, aggravating congestion and tension; and a taxi trip of just a dozen blocks in New York City can take a half an hour at lunchtime.

In Houston, meanwhile, some gun-toting commuters are literally murdering each other, saying in effect: "Your right of way or your life!" Jon Verboon, a *Houston Chronicle* reporter who has worked the police beat, told me, "It's not uncommon for shots to be exchanged between motorists who are

hacked off at each other"—sometimes over right of ways. An accident needn't have occurred.

Motorists killed more conventionally on the way to work, of course, are a hefty percentage of the fifty thousand yearly highway fatalities. But how could a telecommuter die? Electrocution? Cutting his wrists on a broken video tube? Forgetting about the rather unlikely radiation risks—which flat screens would reduce if these dangers existed—computers needn't be lethal like cars.

By converting to telecommuting, then, companies in the end might save employees' lives as well as energy and money.

Firms making the transition would do well to consider what will be in the data base into which the telecommuters would tap. The range of requirements is as wide as the range of business activities. A good data base for telecommuters, however, isn't that different from the ones that some managers are already using by way of terminals on site. Here are the traits:

1. Ease and speed of use. You needn't be a computer expert or wrestle with inconveniences like dialing fifteen-digit numbers to reach the main computer. The system explains itself on screen if you want it to, though experienced users can switch off the menus when they're ready. You ideally don't have to wade through an instruction manual. The system tells you when you're tapping out wrong commands. Also, it's fast. You can start using it in a hurry, and you don't have to wait more than a few seconds at the most for it to respond to your commands. And you constantly feel in control. You can easily search through the data base for the information *you* want.
2. Friendliness. A good system isn't just easy to use; it's also boy scout polite, sprinkling its prompts with "Thanks yous" and avoiding intimidating terms like "illegal information request." Commit a careless mistake on some data bases and they'll throw back lawyerish words suggesting you're on the verge of a jury indictment.
3. Reliability. The system doesn't lose information.
4. Confidentiality. Clerks aren't privy to the same information as the company president.

Indeed, basically, the same traits would be ideal for some other kinds of software, especially the kind governing the operation of **networks**. That's the term for the hardware and software that lets machines talk to each other. A network can be a **local network**, linking machines within the same office, or it can be national or even global. Someday, if they haven't already, Bell and other companies may develop software especially meant for corporate networks of telecommuters.

While widespread telecommuting isn't yet a reality, Peter and Trudy Johnson-Lenz have come as close as anyone to realizing its full benefits. They live in Lake Oswego, Oregon, and as they're fond of pointing out, "We don't commute. We telecommute." They communicate routinely with business associates around the country and find electronic mail a boon to late risers on the West Coast with contacts and friends back East. By the time I

reached them, they felt liked caged animals inside a media zoo. The papers had leaped at the opportunity to write about a certified electronic cottage. Peter and Trudy had even ended up in a BBC documentary on computers and the future—a vivid contrast to besuited, tied scientists shown in antiseptic laboratories.

"We're the hippie couple," joked Trudy. "Peter's the one with the beard."

But they're hardly refugees from the old Haight-Ashbury; Peter is a former statistical analyst, and Trudy helped run a rural education program after a few years as a high school teacher.

Today they're hooked into the Electronic Information Exchange System (EIES), a national computer network set up by Murray Turoff, one of the world's leading experts on networking. Through EIES they've done research on telecommuting for projects funded by the National Science Foundation. They help colleges, nonprofit organizations, and others set up computer networks. Indeed, "on line," they even met partners in the business they started to refine and promote a new software system called MIST. That stands for Microcomputer Information Support Tools. One of MIST's many features can help your computer stay in touch with others—send electronic mail, for instance, or pick the brains of a micro with a big data base.

"P + T," as they sign their computer messages, had been on line since 1977, and it seemed right to ask them for advice on making small business contacts through networks. Peter couldn't talk that evening, the victim of a temperamental printer, but Trudy offered these suggestions, among others:

1. *Whatever network you're on, see if there's a directory grouping subscribers by interest. Which match yours?*

   "You can send a hello message saying, 'This is who I am. Now tell me something about you.'" This electronic mail could simultaneously reach a number of selected subscribers. Then, for instance, two stockbrokers, in New York and Washington, could exchange financial and regulatory gossip. Other small businessmen might simply discuss common problems. The Source and a rival network, CompuServe, each boast well over sixty thousand subscribers; so, obviously you do have a good chance of reaching the right people, at least if they're professionals or well-off. With customers typically earning $50,000 or more, The Source isn't the way to catch up with welfare mothers.
2. *"You must take risks," Trudy warns. "You must be able to ask strangers if they can help you. There are different levels of getting to know people for business purposes."*

   If you're looking for a business partner for a major venture, for instance, don't rely just on electronic communications. Talk on the phone before you team up; meet him. But Trudy says networks are fine for minor transactions. "We've written papers with people we've never met," she says, "and we worked with Turoff for two years before we met him face to face."
3. *Tap out your messages knowing that people cannot see your expression or hear inflections in your voice.*

"You may even want to type 'Chuckle,'" Trudy says, "if it's something where you're being sarcastic or ironic." Of course the written word has advantages. "You can ask people questions and say things without confronting them directly," she says. What better way to brainstorm wildly?

I'll add other advice: try electronic bulletin boards. They work, believe me, at least on computer-related topics. Jeremy Hewes, for instance, reached me through The Source, which, at my request, had given me a demonstration account, a blush, electronic equivalent of a press junket.

"Hello," she tapped out after seeing my note on a bulletin board for IBM owners. "Here are a few thoughts for your book on telecommuting and related matters."

We followed through by phone—but The Source paved the way.

And we could just as well have been those two stockbrokers swapping gossip electronically. It's a distinct possibility, since half The Source subscribers use the service in full- or part-time occupations.

Don't, incidentally, give up making electronic business contacts just because you can't afford The Source or other brand-name services. Discount, no-frills networks will be springing up without, say, stockmarket reports. Check out prices. Experiment. Get on a service for a trial if the connect charges aren't formidable and see if you're meeting your kind of people. A network, in that sense, is just like a bar.

Also consider local boards for which you don't even have to pay long-distance charges.

John Fuller phoned after I "tacked up" a notice on a board for Heath owners around Washington, D.C. Rainer Malitzke-Goes, an employee with a large communications satellite company and an invaluable source of technical information, reached me through another local board. Our computers, however, can also talk directly, without a board or network, so I'll check some technical details in this chapter by zipping it to him electronically.

Besides helping you make business contacts, your computer can ferret out facts in a hurry.

Want to see if anyone else has started a dog kennel specializing in Afghans? Well, a magazine article or abstract, stashed away in a computer two thousand miles away, may tell you. Just dial up the right information service. For a listing of data banks by subject, consult *Information Industry Market Place*, published by Bowker, 205 East 42nd St., New York, N.Y. 10017.

People living in small towns without good libraries will find electronic data bases especially useful.

A Tennessee doctor, Frederick Myers, spent two and one-half hours on the road when he periodically went to a medical library sixty miles away. Now his microcomputers bring him Medline. It's one of the hundreds of data bases available through Dialog, the giant information service in Palo Alto, California. Myers told *Personal Computing* that Medline let him "do in ten minutes what it would take me hours to do at the library going through the hardbound indexes." His patients have benefited. While a patient in the

emergency room lay with stabbing wounds in his stomach, Myers ferreted out relevant abstracts via Medline.

Electronic data bases don't just save time. With them you can pick up odds and ends of information that printed indexes might not bring out.

Suppose you want to know which celebrities have endorsed electric toothbrushes on television and, searching manually, you don't find anything in the toothbrush articles. What next? Well, the data banks' indexes might cover even one-paragraph mentions of electric toothbrushes—little references in articles about advertising or about the VIP toothbrush endorsers.

But beware. Electronic information services and data bases can cost up to hundreds of dollars an hour to use. You need to know what to tell the data bases to spew out the facts you need. And that can take time. Luckily, some companies have developed programs that let you map out your strategy off-line instead of giving commands while the ticker is running. One, called In-Search, runs on IBM-style micros, and can save you thousands of dollars over the years if you're a heavy Dialog user. Even at $399 In-Search would seem worth it.

I can appreciate this all too well, having squandered $35 in a few minutes trying to tap Dialog for my "Jewels that Blip" chapter. An experienced librarian at a public library operated a terminal for me there. And yet at the time even she could find next to nothing on crimes *against* microcomputers. In-Search might have saved much—and maybe even most—of the $35.

Under the circumstances, in fact, I would better have spent the $35 on long-distance calls to the right authorities, which is what I did. Information services aren't panaceas. Most of this book comes from old-fashioned print and interviews.

My work habits will change, however, as more people tap into data bases and the costs decline; I'll be very selfish and put in a good word for Dialog and the rest, hoping eventually to share these economies of scale!

■ ■ ■

Of Packets and Freight Trains

Packet switching lowers the cost of computer communications nets and information services, making it possible for you to send 1,000 words coast to coast for as little as $1.

The technique, developed by the military, lets many machines jabber away at once on the same phone line.

To tap into a packet-switching net, you typically dial local numbers or 800 ones reachable nationally. Giant networks like Telenet and MCI Mail use many different phone lines, but that's still a fraction of what they'd need without packet switching.

Just imagine each of the nets' phone lines as a rail line. Many trains (**packets** specifying the starts and ends of extrabrief computer transmissions) can zip over the tracks at once if you keep them from crashing into each other. The trains carry freight (bits and bytes of information). Electronic labels assure that the cargo reaches the

right destinations (the gizmos that forward the information over the phone line to the receiving computers).

Naturally, the use of common trains and rail lines (a **packet-switching network**) is more efficient than replicating the arrangement for each cargo recipient (each computer).

This explanation, though simplified, sums up the technique according to Vinton G. Cerf, a top packet-switching expert.

Incidentally, packet-switching techniques can also increase the efficiency of networks connecting computers in the same office.

■ ■ ■

Even now, if you can pin down your topic by name, you can pay next to nothing to use electronic data banks and similar services on occasion. You needn't even cough up a fat subscription fee. Through MCI Mail—$18-a-year basic charge—you can use the Dow Jones News/Retrieval Service. It's one way to watch companies of interest. Regularly, during the writing of this book, I would ask Dow what Kaypro was up to. I merely typed ".KPRO" and a carriage return, and the computer spewed out the latest Kaypro news; even at 300 baud the bulletins took less than a minute or so to reach me. My cost? Maybe forty cents a shot. Just before Ballantine wanted the final version of this manuscript, I learned of stockholders suits against the Kaypro—facts that I might not have known in time without the Dow Jones wire.

My experience illustrates the speed with which the information services can update their indexes and articles.

The *New York Times* index at your local library, for instance, may be weeks out of date. Without a computerized search you'd better either read "All the News That's Fit to Print" every day or be willing to flip through perhaps a month's worth of papers.

You can even read condensed articles daily from major papers on line—long before they thud against your door, which they may never do if they're in cities a continent away. CompuServe offers the *Washington Post*, for instance, among others, plus the Associated Press, the major American wire service. The Source flashes bulletins from United Press International. And there are electronic editions of specialized publications like the *U.S. News Washington Letter*.

"Buy stocks now," the *Letter*'s first electronic edition said presciently in 1982.

"The very next day, August 17," gloated a news release from The Source, "the stock market went through the roof."

Not surprisingly, big newspaper and magazine companies are tinkering with electronic information services. Often, rather than home computers, the services use Teletext (using cable television lines or broadcast TV) or Videotex (phone lines).

Of course lines may fuzz between technologies. Television-based systems are growing cheaper; and someday your portable TV may have a built-in computer, a socket for a keyboard, and a flat, high-resolution screen fit for word processing and electronic mail. Call it a Vu-Write. Make it a first-class

color television. But also a computer suited for clerks and professionals alike. Give it a memory system less quirky than floppy disks. Develop idiot-proof software selected by simple switches. Mass-produce a Selectric-style keyboard, detachable, or, eventually, a good voice recognizer. Throw in artificial speech, too, once it's perfected, and include a built-in, high-speed modem or the equivalent. Sell the Vu-Write for $200 at the local Sears. Or perhaps to companies who can recruit clerical telecommuters by in effect offering free TVs.

Somewhere in Silicon Valley, a savvy company may be at work on a Vu-Write now; and if it succeeds, maybe mass telecommuting will be with us sooner than anyone thought.

No matter what, Vu-Write or not, energy crisis or not, think about telecommuting and related innovations before your competitors do. One intelligent step would be the use of electronic mail where appropriate.

Backups:

■ XI, The Micro Connection: Some Critical Explanations, page 349.

■ XII, MODEM7: An Almost Free and Fairly Easy Way to Talk to Other Computers, page 354.

■ XIII, Why Not an Electronic Peace Corps?, page 366.

12 How I Found “God,” on MCI (and a Few Other Odds and Ends About Electronic Mail)[75]

You won’t find the Devil listed on MCI’s electronic mail network. But you’ll find “God,” William F. Buckley, Jr., musician Peter Nero, IBM, other Fortune 500 companies, me, and at least one hundred thousand more subscribers, including a Western Union official who’s keeping up with the competition.

“God” is a man in Morgantown, West Virginia, and his listing popped up when, out of curiosity, I typed “God” after MCI’s “To:” prompt.

I don’t know if “God” is a preacher or a businessman whose company has a distinctive name or initials. I’m happy to see him registered with MCI, however. When I went looking for “God” earlier on the net, the computer said in its literal way, “God not found. Enter a postal address or TLX (Telex address).”

I still can’t scare up “Satan,” at least electronically; but MCI’s reply to my last “God” entry showed both the breadth and versatility that MCI and other systems may acquire if E-Mail boosters are right. The devil actually may be on MCI any day now. Several hundred thousand Americans are hooked up to one mail net or another, and more than five million should be tapping out messages that way by the end of the decade. In Virginia a financial planner has used E-Mail’s speed to save a $300,000 deal threatened by a legal deadline.

With E-Mail you can:

- Send messages computer to computer within an office or around the world. At their convenience recipients can flash messages across their screens or print them out.
- Use a computer to zip messages to special centers near recipients. The centers print the messages, then deliver them

by courier or local mail. That's how you can overcome one of the original drawbacks of electronic mail—the other person's lacking a computer on the same network.

- Send and receive messages via the Telex network—which, of course, is why MCI Mail politely asked for "God's" Telex number.

"E-Mail can be nothing more than the computer equivalent of a telephone-answering box ... storing messages for people to read when they have a chance," says Steve Caswell, a consultant who edits *Electronic Mail & Micro Systems*, a leading industry newsletter.

"At its most complex level, it's a very intelligent ultimate communications device."

Electronic mail's roots are in the telegraph, Western Union telegrams, and Telex machines. Computerized E-Mail has sprung up in the past two decades; it grew in the military and academic communities and spread to government agencies and high-tech companies like Texas Instruments. Within the past few years, thousands of home users and other businesses have jumped in.

Competition is keen. The Western Union man is on MCI because he wants to see how it stacks up against his company's own E-Mail operation, EasyLink. GTE Corporation and International Telephone and Telegraph offer E-Mail service. So does The Source, which lets companies set up their own E-Mail networks without investing in giant computers. Instead, they piggyback on The Source's computer bank in the Washington, D.C., area. Users can dump messages into The Source's computers over phone lines or log in to see what messages await them.

Anchor Financial Services, in Phoenix, Arizona, used The Source to rig up a network it hoped would lead to well over $1 million in annual commissions. One hundred financial planners were on line, and Don De Young, senior marketing vice-president, expected some fifteen hundred by 1985. They'd be able to place mutual-fund orders for clients, conduct other transactions like placing insurance and annuity orders, and pick the brains of Anchor's financial experts.

One planner, Joe Schopen of Norfolk, Virginia, already has used Anchor's E-Mail to save a $300,000 cable TV-related deal. Ten investors wanted a tax break, available only if a Virginia agency approved their partnership documents before the end of the year. At the last minute, Schopen learned of additions that would be required; E-Mail gave him the speedy delivery that he needed for the investors to sign the legal papers in time.

"Without electronic mail," he says, "we very likely would have lost those sales.

"I've heard we're getting a 10 percent increase in productivity because of our faster turnaround and because our clients can electronically learn when other people receive messages for them."

Some other advantages of E-Mail are:

1. Lower phone bills. In a Midwestern office of the H. J. Heinz Company, a secretary says the CompuServe network had cut her phone time by 80 percent. Using electronic mail, for instance, Sue Clark can send a memo to dozens of offices at once.
2. Elimination of telephone tag. "We can type a memo at the end of our workday and have a response [from the West Coast] by the next morning," says Philip Selden, an Ohio-based executive with Owens-Illinois Inc., who is using Western Union's EasyLink service.
3. An end to garbled messages. Errors and misunderstandings decline when people can write electronic messages.
4. More efficient sharing of ideas. **Computer conferencing** is an example. A group of people with similar interests can keep a running record of their electronic conversations.

   Say you're an oil company with dozens or hundreds of offshore rigs. How to share ideas on efficiency, safety, other related topics? Well, via radio-telephone link in some cases, your rig people might log onto an electronic network. There they might read and add to the remarks left by other people in this ongoing conversation.[76]

   Now let's say somebody wanted to "speak" to only one other person on the network. He could do it.

Likewise, he might form a subgroup—say, one of people interested in helicopter safety.

E-Mail also is a boon to travelers using portable computers. Peter Nero says that while on the road, he often must reply quickly to proposals for concert appearances. So he taps out letters in midflight on a lap-sized Radio Shack computer, then zips them over hotel phone lines to his office. In Los Angeles a machine prints them for his secretary to mail.

There are other virtues of E-Mail—MCI can even arrange to print letters on your letterhead. A ten-year-old drew his own Bucky Beaver logo for letters to Grandma, and a Chicago bank follows up with laser-printed letters to impress the millionaires its sales reps call on.

E-Mail also can add new wrinkles to old friendships, business and private. Two and one-half decades ago, an elementary-school pal named Geoff Fobes moved to India with his parents, and we started scrawling letters; I even fooled myself into thinking I could learn Hindi from a book he mailed. Not long ago I introduced Geoff—by now in North Carolina—to MCI Mail. "Well," he typed, "it seemed only karmically fitting to be writing you first. Many glorious surprises when your letter began to appear. My father was dazed and said this was a historic moment. Seems melodramatic, but then he is an old State Department manual typewriter man."

Electronic mail, of course, also has its negatives. Take Nero. He might have used direct phone hookups to his office computers many times, or perhaps other networks; but as of spring 1984 he was far from a regular on the MCI network. Months after I "mailed" a message to him, I hadn't gotten an electronic receipt confirming that he had read my "letter." And I'm still waiting for "God" to reply. As of early 1984, MCI had picked up sixty-five thousand of its subscribers from the Dow Jones News Retrieval Service and the Bibliographic Retrieval Service. And many had not logged on even once. Some registrants—including "God"?—didn't even know the E-Mail service existed.

So MCI was flooding subscribers' mailboxes—the paper kind—with brochures telling them of IBM PCs and other

goodies awaiting people if they signed on electronically to enter drawings. “God” theoretically might have won “a luxury vacation in Hawaii.”

“Since the programs were announced,” said the *Wall Street Journal*, “weekly [electronic] volume has risen 20 percent.” MCI in late 1984 boasted 150,000 subscribers.

By now it may have another feature. Pay extra and a *computer* will ring you up and read you your message. And eventually—maybe even right now—you’ll be able to pay bills and see your bank balance via the network.

Still, fearing loss of privacy, some people won’t use MCI Mail and similar services.

“Electronic mail,” said my literary agent, Berenice Hoffman, ever vigilant about her clients’ privacy, “is for letters addressed ‘Occupant.‘”

Perhaps for this very reason, MCI Mail’s bills don’t list the recipients of messages unless you want. In that limited sense MCI is more private than the telephone system.

You shouldn’t use E-Mail for confidential correspondence, however, if you can’t protect your message with electronic scrambling.

Ian (“Captain Zap”) Murphy, whom MCI Mail lists under his real name, really bought that point home. “Any easy way to get into MCI’s operating system?” he asked.

“Come on, Ian,” I said. “Let’s not court temptation. That would be like giving an alcoholic a bottle of Jack Daniels.” We joked over it. He said *those* days were behind him. And yet I wondered whether, even now, hackers were unraveling the security of the MCI net.

E-Mail had and has other drawbacks. High-tech intimidates some executives; others see typing as a threat to the executive image.

Then there are technical glitches. Gil Gordon, the telecommuting consultant, gave up MCI Mail in disgust because for some strange reason he had trouble getting his micro to show new lines on the screen properly when he was typing letters.

Also, even though MCI ballyhoos itself as a link between many kinds of machines, you normally can’t underline something on your Xerox 860, say, and have it show up right

on someone's IBM running Perfect Writer. MCI strips the special characters for underlining, boldfacing, and several other typographical trimmings. (Among word processors, there are no such standard codes for such features.)

"MCI's using us as guinea pigs," complained Peter Ross Range, a Washington writer whose double-spaced letters were turning single-spaced when MCI printed them. That happened with WordStar, the popular word processor. MCI put out a detailed explanation of how to avoid such problems, and I passed on the basics to Peter, who said, "What's the point if it takes that long and I can just call a messenger from an express service?" Peter also found that on some days MCI Mail just wouldn't work at times; I myself noticed that, too. And some people's $2 MCI letters, passed on to the U.S. Postal Service for delivery as "hard copy," were taking several days to arrive. Still other MCI messages, hard copy or electronic, never reached their destinations at any time. Service to New York seemed the worst but was better to medium-sized cities, especially in the Midwest. Those are all issues crucial to business.

MCI Mail dates back only to late 1983, and by now maybe things are much better. Perhaps software makers and MCI and rivals will cooperate in a big way someday so that you routinely can get boldfacing and other "luxuries" if you stick the right command in your electronic file.

Glitches and all, MCI still works out for budget-minded writers and consultants. A "mailbox" is just $18 a year, and if you can dial up MCI locally as people in most large cities can, you pay a mere $1 to send 1,000 words computer-to-computer in the U.S.—including Hawaii. Indeed, Jim Fallows says he and some other *Atlantic Monthly* writers routinely use the service for trying articles out on each other.

In addition, MCI offers some neat little wrinkles for heavy-duty corporate users. Companies with in-house systems can set up bridges between the MCI and their existing electronic mail nets. As the MCI bragged in its on-line newsletter, you can simultaneously "send a company-wide memo electronically on your internal system; copy your attorneys, who subscribe to MCI Mail; copy your vendors with laser-printed, first-class letters," and "deliver the boss's copy the same day at his

conference in Dallas." If the boss is in London, a letter written on your computer can reach him by courier after a machine prints it out. What's more, for a fraction of the cost of Telexes, you can directly reach business associates' computers in England or a number of other countries.

Of course, especially if you're a business, do look at the other E-Mail networks, too. I've written much here about MCI simply because it is one of the largest networks and I'm most familiar with it.

All the E-Mail services, at any rate, offer the same advantages over conventional letters: speed. Even skeptics see the potential. Peter Ross Range, the man with the WordStar-MCI woes, says, "I want the day to come soon when I won't have to lick another stamp."

Some of the most useful electronic mail can go from person to another in the same building or complex—a capability made possible through local networking, discussed in the next chapter.

13 Net Gain$

Back in 1983 a young CPA named John Madden came to work as information systems manager for Carsonville Metal Products in rural Michigan. He found just two computers there —an IBM mini and an Apple III.

Like most computers, they were loners. The IBM, used for accounting, didn't pass its figures on to the Apple to be put in reports or maybe spreadsheets. The Apple didn't talk back.

Today, though, Carsonville not only owns more machines; they're more sociable. Its twenty-one Kaypros speak to each other through a **local area network**. That's gobbledygook for nearby computers swapping electronic files or programs—and sharing goodies like printers.

People, too, are communicating better. They needn't swap floppy disks as often or fight their way through as much paperwork. Thanks to the computer network, Madden says, Carsonville may enjoy $1,000 a year more in *effective* work time from each office staffer. That's not all. Sales normally are around $12 million a year; Carsonville competes in the dog-eat-dog areas of defense and auto-parts contracts; and the network may help win millions of dollars of new business. With facts handier, the executives can more easily submit low but realistic bids.

The secret is simple: The WEB network, which in late 1984 was listing for several hundred dollars per computer.

The WEB's price sounds outrageous. It isn't. Had Carsonville used Ethernet or another of the much-touted networks, it might have spent well over $1,000 to wire in *each* computer—perhaps several thousand with all the trimmings included.

Instead, Madden went by the philosophy of this book. He shopped around for the least costly gizmos that could do the job well.

Souping up the IBM mini wasn't the answer. It offered 64 megabytes of storage, the equivalent of 32,000 double-spaced typewritten pages. But Madden worried if it could run programs fast enough with a number of people tugging at it simultaneously. "We had five terminals, and we dropped it to four," he said, "because our mini slowed down horribly even with five." Going the mini route, Madden would also have had to spend perhaps $30,000 on at least twenty more terminals without the brains of a full-fledged computer. In addition, he'd have had to buy new software and other hardware, so the final costs might have totaled up to $100,000. Besides, Madden cherished the notion of a "democratic" system. Machines at all locations should boast plenty of power; then people would feel more in control, and the whole system wouldn't fall apart if a Big Brother computer broke down.

Madden might also have gone another route, buying a **multiuser-system** micro—one computer and a number of dumb terminals, somewhat like the mini arrangement.

That, too, however, wouldn't have been "democratic."

And with too many people piled on the supermicro, it might have run programs at the pace of a crippled snail.

UNIX, the software system developed by Bell Laboratories, was good for multiuser arrangements and allowed much more speed—but few computer and software companies had UNIX offerings out yet.

Madden, anyway, wanted his machines to run proven CP/M programs like dBASE II and WordStar; he felt they were powerful enough for the jobs he required; he needn't mess with the more fashionable 16-bit, IBM-style micros. Hard disks would help, though. "I'd been a partner in a public accounting firm," he said, "and I'd picked up a hard disk for myself, and it ran much faster than floppy disks, and I didn't ever want to go back to floppies."

So he set his sights on Kaypro 10s—with hard disks built in—and began mapping out his networking scheme.

With twenty-one Kaypros, each offering around 10 megabytes of useful storage, his company's computers could stash away over 200 megabytes, or more than three times the space on the IBM mini.

“I don’t think people appreciate the power of micros in a network configuration,” he said.

But which network to buy?

“We were just looking at the ability to share and update the files on our disks from any location,” Madden said. “And we wanted the ability to share equipment like printers. We didn’t need an elaborate electronic mail or message system. We already had intercoms. And we also didn’t need the ability to transmit graphics.”

From the start Madden knew he hadn’t the slightest use for a deluxe network, such as one called Wangnet, which could transmit voice and even TV pictures but didn’t come in a version working with the Kaypro.

Well, how about Xerox’s Ethernet? Xerox was hoping that Ethernet would become an industry standard, and some users loved it. “Ethernet has been very good for us,” said a computer man with the Kentucky state government, a test user; he told *Computerworld* of “excellent productivity gains.”

Ethernet, though, like Wangnet, didn’t run with the Kaypro at the time Madden was shopping, and it also had too much capacity for him.

What’s more, a version of it crashed during a demonstration when two people were trying at the same time to read an electronic file. Madden moved on. Reliability counted most.

Speed mattered, too, and he tested The WEB to see how fast it could move files from one Kaypro 10 to another.

“We set up machines A, B, and C,” said Madden. “We had machine A giving the commands for a file to be copied from machine B to machine C. At the same time, we had C transfer a file from A to B, and we had B transfer a file from A to C.

“People at all three machines hit the return keys at the same time”—to give them commands—“and then we watched what would happen.

“We found that the machines copied the files without errors in maybe one minute.” And the files were about 100K long, around fifty double-spaced typewritten pages.

Madden also tried another test to see how much The WEB would slow down the speed at which people could run programs. He compared:

1. How long a Kaypro took to sort dBASE II files electronically while not hooked up to the network.
2. How long it took while connected to the network.
3. How long a second Kaypro needed to sort the dBASE files in the first machine via the network.

"In each case," said Madden, "there was an increase in time, but it was still acceptable."

So Carsonville bought The WEB and saved a pile compared to doing it with an old or a new mini.

The Kaypro 10s cost $2,750 each, which, multiplied by 21, came to $55,000, and The WEB in a test version was $250 per machine for the software and a circuit board. That was just about everything but odds and ends such as $80 for 1,000 feet of telephone-style wire. Total expenses? Much less than $70,000. And even with The WEB's list price of $350 per machine, Carsonville's costs still were *at least* $30,000 less than those of souping up the mini system or buying a new one.

Later, Madden discovered a glitch. The WEB let people flash short messages across each other's screens, a feature called "flash," and it crashed dBASE II.

He felt his people wouldn't need that wrinkle, however, and they could avoid the problem just by disabling "flash."

Ed Bigelow, president of Adevco, Inc., which made The WEB, said that if Carsonville had wanted "flash," then Madden could have had the network or dBASE II modified to snuff out the glitch.[77]

Whatever the case, the little dBASE II problem showed the importance of prospective customers putting networks through their paces with various programs—ideally, *before* buying.

Here's a summary of questions to ask in setting up a network:

Do You Need One?

Don't be expensively trendy. You have just three other people in the office, and the paperwork isn't piled that high? Then you might be much better off trading floppies.

But if you're a busy law office, you might want to get a lot of standard, boilerplate paragraphs from a hard disk shared via a network or multiuser system.

Especially you might consider a network or multiuser system where more than one person is constantly dipping into the same data base. Suppose Production wants to know five times a day how many widget parts Inventory has left in fifteen categories. Then a network could help. The Sales Department, after all, may want to use the same computer to find out how many finished products are in stock.

Of course, if there are five hundred people dipping into a data base, a mini or mainframe would be the ticket.

Also, even Bigelow warns against bringing networks into companies in which people won't be willing to keep their electronic files in order.

He recalls one office in which "people had been using electronic typewriters and they'd switched to micros recently and were careless about where they put their disks. They even left magnetized scissors and paper clips on them.

"People didn't trust each other's diskettes—or diskette habits. And on a network you can't be sloppy. You could destroy everything if management hasn't set up the system well. Even on some good networks people can wreak havoc on each other's files by overcrowding disks with information. There can even be network saboteurs.

"You can't network unless people act as a team and care about their colleagues' records. If a company's isn't like that, it might be better off with a strong data-processing department to police everyone. Or they might just use micros not connected to each other—so that people will crash only their own disks.

"They might network only after they've successfully run employees through a training program to promote good work habits."

In General, Do You *Know* What You Want To Do—With People and Equipment?

You're really planning your office, not just shopping for a connection between computers.

All kinds of questions pop up—for instance:

1. How extensive do you want your network's file-sharing capabilities to be? Translation: "How important is it for people to share their paperwork electronically?"
2. Who'll manage the network? Who'll determine who can see what electronic files? Who'll keep track of passwords? Who'll make sure that a careless but talented worker can't destroy irreplaceable information? You don't, by the way, want your network manager to turn power hungry. "He shouldn't be the network police," jokes Bigelow. "He should be the network janitor—in the sense of keeping everything in place electronically. You might also think of him as a network teacher. He can help tell people the right way to do things." Bigelow, in fact, warns against one person holding sway over the others by being the only one familiar with network procedures.
3. Do you want to assign special network-related duties to other people? One employee, for instance, may be the custodian of an expensive laser printer and make sure that other people are using it most efficiently.
4. Who will work at what **node**? That's jargon for a location or **work station**.
5. Will some people share work stations? If so, you'd better decide which tasks in your office are going to be done in what corners of the room.
6. Which computers will store which electronic files?
7. How many printers and other gizmos will people share, and where will they go? Presumably, you don't want a printer five hundred feet from the people feeding their files into it.

   You also should decide how many expensive, letter-quality printers you need and how many cheapies like dot matrixes.

Make up your mind—before your office wastes $4,000 on a second laser printer when just one might do.

The same idea might apply to high-speed modems if your network allows computers to share them.

8. What kinds of computers are you planning to hook up? The WEB as of mid-1984 was running only with Kaypros. But a version for IBMs was in the works.

One advantage of a big-name network, however, is that it *may* more easily get machines of different brands on speaking terms. That could count if you're planning to trade in your old micros soon.

There's a caveat. Some networks may work with many machines but may not be as powerful as those dedicated to one brand.

So Apples and IBMs might both share the same hard disk but might not be able to read each other's files without costly add-ons.

How Fast Do You Want the Network to Transfer Information?

It'll depend largely on the type of network—a topic covered later in this chapter.

Wangnet will zip information over the wires many times faster than will The WEB; it's a boon for those who need that capability but a frill for those who don't.

Mind you, a network itself isn't necessarily the main determinant of the speed with which files zip back and forth between machines.

The speed of your computers' floppies in many cases will count more than the network's transmission rate, and that's true to a lesser extent of Winchester hard disks. Different networks, of course, may work faster or slower when teamed up with the same computer. Also, some networks seem fast when you don't have many users. But then, with a large number, rival networks are faster.

How Much of a Load Do You Want to Put On Your Network—and Can It Handle It?

How many computers do you want hooked in? And how much of a strain will they place on the network before it crashes or slows down to a bothersome extent?

If people are running data-base programs on colleagues' files, a network might only work with a few users, but if they're just occasionally swapping electronic files, the same system may accommodate hundreds of computers.

That's especially true, say, if you're a publishing house with many writers but few editors. The writers may not communicate much between themselves, so that the handful of editors are the only ones really taxing the system. And since they're not running other people's programs, even the editors won't be that much of a burden.

The same principle might apply to an educational network in which one teacher is overseeing many students.

Is the Network Reliable in Other Ways?

Are the wires and connectors strong enough mechanically, for instance? How much does the network tolerate mistakes—how crashproof is it? And what about the software? Suppose two people at once are calling up a directory to find out what's on a common disk. Will the director accurately list *every* file? Does the network perform well not only with the directory program but with other utility-style software in CP/M, MS-DOS, or whatever operating system you're using?

How Easy Must the Network be to Use?

The WEB is easy but not for the *untrained* novice. Using the Kaypro version, you need to know at least the basic CP/M commands.

But once you do, you're just about home free.

Take the PIP command, which, among other things, lets you transfer files from one disk to another on a machine by itself. To switch a file named TEST from drive A to drive B, you'd load a PIP program into your computers temporary memory. Then you might type **B:=A:TEST**.

Via The WEB, though, how do you try to reach someone else's drive?

Well, you could issue a similar command. Only, instead of saying you wanted to reach drive B, you might ask for drive H —which is how the other person's drive might be electronically known around the office.

That's with The WEB set up the simplest way. Even with The WEB in a more complex form, however, the procedure wouldn't be much harder.

On the other hand, The WEB isn't the system for you if you're hoping just to press one or two buttons to send information on its way.

What Special Features Do You Need?

Ask, ask, ask the sales reps about what's available.

Remember, some networks won't let you share printers or modems or even send files to another computer. Also, will printing take longer to set up remotely than with all the equipment by your side? How easy is it?

Also, does the network have **queuing**? If user A and user B both send out files to be printed on the same machine, will a disk hold user B's file until A is done? If there's queuing, have you given up something in return?

Find out, too, if the network is **interrupt driven**? Let's say someone's getting information off one of your computer's disks while you're typing. Where should your computer concentrate its processing power? On the network? Or on your screen and keyboard? Better make it the screen and keyboard, since you want your machine to record *all* the keystrokes you're putting in. And on an interrupt-driven system, this can happen. So there's less chance of "Now is the time for all good men to ..." coming out as "Nwi thetme fr all good mn...."

Is error checking in use? Will the computers ask if the others received the signal okay? Will they start again if they didn't?

Also, what about machine A using its software to work with the contents of machine B's disks?

And can you use your pet word-processing software to print an electronic file on someone else's printer without getting in the way of the program he's running at the time?

What about electronic mail and equivalents of The WEB's "flash" command? Can you easily open your electronic mailbox to see what messages are awaiting you? Will your computer even tell you on screen when you have a "letter"? Will it beep at you? If there's a flash-style arrangement for short messages to appear on screen, can you turn it off? Not that E-Mail and "flash" are pure delights. You may not be at the screen to receive your electronic message; with a phone message or an intercom, on the other hand, the other person would know immediately that you weren't. Then again, with

E-Mail or a flash-type arrangement, you can help soften the effects of telephone tag.[78]

Also, how about **file locking**, which keeps user A out of a file that user B is working on? That's probably a "must." You can't have someone changing numbers at the same time you are and see the results add up wrong for both of you.

Another question arises. Do you want people from field offices to be able to dial in via modems? This dial-up experience—along with the general-network kind—might help you eventually make the transition to telecommuting. Obviously, however, modems may mean security problems.

Local area networks, of course, just like multiuser systems, have security risks even without modems. You'll perhaps want to set up the network with passwords and **user-privilege levels** so that only you can get into every nook and cranny of the system—and no one can read *every* electronic file. It's a question of management style. In fact, in respecting people's privacy, you might even arrange for only them to be able to read some information stored on their hard disks. At any rate, do investigate the security capability of a system very carefully before buying. Don't let a network's technical failings complicate office politics.

Needless to say, too, make sure that no one can find his way to the payroll data base to give himself an unofficial raise.

What Kind of Protocol Does the Network

Use?

"Protocol" is just a set of rules telling how computerlike gizmos speak to each other.

By the way, networks can share a protocol but still not be on speaking terms. The WEB uses Ethernet's basic protocol but can't hook up to it, since Ethernet transmits information faster across the network.

Wait. There's one other complication. Different Ethernet-style systems—from different manufacturers—speak different dialects.

"Assume nothing," says Bigelow on the issue of whether different networks or machines will work with each other. "Nothing's obvious."

Before buying, insist if possible that the sales rep set up his hardware and *show* you the "compatibility" he's been claiming.

How Easy Is the Network to Install?

A WEB-type network might be a nightmare for the lazy and sloppy. It requires hooking printed circuit boards up to the right leads of chips in the Kaypro. And you must also solder the telephone-style sockets into which your computer's network cord plugs.[79]

But a good data-processing department shouldn't have any problems, according to The WEB's makers.

What about small businesses without data-processing people?

They might buy both their computers and the network from a systems house if possible—a company that will do more than the average computer store in getting various machines to work well together. But you've already bought your computer? And a good computer store or systems house isn't nearby? And the network maker can't vouch for any technicians near you? Then you might avoid the networks that need soldering and other grubby work.

Even if a well-regarded store or systems house does sell you the network, see if the technicians will get it running *before* they set it up at your business and you officially take delivery. Better still, see if they'll do that before you officially accept delivery.

How Much Support Will the Manufacturer

Give You?

Often, if software comes with a computer, the software house will buck you back to the computer manufacturer if you have a question or problem.

And that may or may not be true with network systems.

If the network is built into the computer, you might want to see if you can also get direct support from the company responsible for the networking system.

It works the other way, too. If you buy a network from an independent manufacturer, is the firm familiar enough with your computer to make sure the system works well with it? Know exactly who will do the servicing and consider a service contract, which usually costs 1-2 percent of the hardware costs per month.

In shopping around, you shouldn't worry about jargon so much as you do about the performance of the network as *you* perceive it.

Below, however, are some necessary terms to master. We'll begin with three kinds of **topology**—the word for the way a network is laid out:

A Bus

A cable hooks up a bus network's computers in parallel in the manner of lights on some Christmas trees.

A bus network may offer advantages in office layouts. You don't have to clutter things up with a whole series of wires running back to fancy equipment in a central location. You just lay one main wire with sockets that the individual micros plug into.

Other equipment needs *may* be simple. The WEB, a bus network, requires printed circuit boards for all computers, installed in the machines themselves. That's about it other than the software and the wire.

Fancier systems using a bus—like most versions of Ethernet and Corvus Systems' popular micro network called Omninet—need a **file server**.

A file server can be a computer minus the keyboard and screen but with extra communications ports to help signals get in and out in a hurry. It's connected to the hard disk, which stores and relays the electronic files that people send it. In some networks a file server can also be a regular computer simply assigned to the job.

With a server arrangement you're always sharing files with the server rather than directly with other members of the network. The hard disk is between you and the machine you're trying to reach.

By the way, *if* everyone must use software from the server, that means a very, very busy hard disk—and potentially slower running programs.

A Star

In star topology, the individual computers are at the points of a starlike layout of cables radiating from a file server.

If the server conks out, everyone in the network is out of luck. But then that could also happen in rare cases if a printed circuit board in a bus network became mischievous in the worst way.

Normally, computers on a star network can't be more than perhaps 200 feet apart, and perhaps much less.

Corvus's Constellation network uses the star.

Most multiuser systems—which I won't call true networks—use the star arrangement to hook up the dumb terminals to their central brain.

A Ring

Messages zip along a circle in one direction until they reach the right computer. If the ring's broken, the network crashes.

Also, distance may be limited to less than a few hundred feet without costly repeaters. With the right equipment and enough money, however, you can go much farther.

One beauty of a ring arrangement is that in small networks the speeds can be very fast. Larger networks slow it down.

A ring network often uses **token passing**. Think of the children's game where, when you're caught with a ball or other object, you're "it." The kids try not to be.[80]

In token passing, though, the computers don't mind being "it" at all. Getting the "ball" means they have the okay to send to another machine through the ring.

If you as a computer get the ball, you get the privilege of replacing it with the message you want to send. You "hold" the ball until the message you've sent comes back to you through the ring. Then you send the ball on its way to the next computer. The whole process, of course, is almost instantaneous.

Some people say it may be easier to design software for a ring, since the token passing means there's no chance of signals colliding.

Radio Shack's Arcnet uses token passing.

You also may end up grappling with different wiring styles.

Telephone Style

WEB-style networks mostly use a cable somewhat like the kind between the outside of your house and your phone jack. This cable has four **conductors**—individual wires within it. Commonly, two "hot" conductors carry computer signals. Between them, often, are two **ground wires** attached to the computers. You need good, solid ground connections for the networks to work right.

Twisted Pair

A twisted-pair network is what it sounds like—one normally using a pair of wires that twist around each other to form a long spiral. The twisting makes the cable less sensitive to electrical interference from radio transmitters, air conditioners, or other appliances.

Shielded Wire

You could also guard the twisted wires from electrical interference by enclosing it in woven copper or metal shielding.

Coaxial cable is a common form of shielded wire. It's costly—it may sell for more than $1 a foot. Coaxial cable could be four times or more the cost of a twisted pair. It consists of one or more thin wires buried in plastic-type insulation under the shielding.

"Coax," as the pros say for short, is the kind that's normally black outside and looks like a thin snake that stretches on forever. (The pronunciation is "co-ax.")

Not that the color's important. "We use powder blue," says a man with one network company.

Ethernet and Wangnet both use coax; so do cable-TV installations. In fact, some cable companies have transmitted computer signals. A TV cable doesn't care if you use it for carrying a gangster movie or a bank payroll.

But just because Ethernet uses coax doesn't mean it's normally good enough to carry most TV-like signals. It is just **baseband** in capacity. You'd normally use Ethernet simply for computerlike messages or maybe some telephone; it's like a single, high-speed highway.

Wangnet, however, is **broadband** and can carry TV. It resembles a whole transportation network—a highway, air corridors, and a river.

You have many well-separated channels. In fact, Wangnet is piping along signals at radio and TV frequencies. And the right gadgetry can separate them just as easily as a good television does. You can go for miles with Wangnet—much farther than with Ethernet, which may need signal boosters after several thousand feet.

People at Wang, Xerox, and the others can get truculent and maybe even paranoid about their pet networks versus their rivals'.

"There is no light at the end of the tunnel yet," said a friend of mine who's a systems analyst. "Everyone is looking over

everyone else's shoulder to see what they're doing." And it isn't just the computer industry. The PBX[81] makers, the switchboard manufacturers, want their shares of the action, too. This works the other way, too. IBM in 1984 said it would make Rolm—a major PBX maker—part of the Big Blue empire.

Room exists, of course, for many styles of networks—even in the same companies in some cases.

Bigelow aptly likens networks to word processors. We don't all use WordStar; why should we all be on Ethernet?

With the right hardware, in fact, a twisted pair or maybe even a bus network might merge with the baseband and broadband ones. Networked second- or even third- or fourth-hand micros might speak to mainframes. The state of West Virginia in 1984 planned to buy hundreds of IBM computers. Many reportedly would be on Omninets. As of mid-1984 an Omninet could have only sixty-three micros on it—but why not link many Omninets to big-time networks? A man at Corvus assured me that's exactly what his company was working on for customers like West Virginia. AT&T may have had the right idea. It planned a network to work with Ethernet and Corvus, plus the RS-232-style arrangement that you already use to hook up computers with printers and modems.

That could be just the solution for some large companies that feel they're just innocent civilians in the network wars.

Meanwhile, if you're with a small company like Carsonville Metal Products, home in on your immediate needs. Again, don't worry about high-powered networks designed for the Fortune 500 crowd. Maybe all computers someday will work with Ethernet, say, and perhaps it'll be just as cheap for you as a WEB-style net, but it isn't now. Meanwhile, if an Ethernet-equipped firm wants to talk to your computers today, there's already a network in place with fairly common technical standards: the telephone system.

Everything still sound scary? Well, just forget the jargon and simply pin down the sales reps to make sure that the network will do what *you* want.

Hire a consultant if need be. And follow the normal rule of computer shopping and check with existing customers to see if

they’re happy.

Wise network shopping, as indicated earlier, can pay off.

In mid-1984, Madden, taking advantage of The WEB, was putting the finishing touches on some software modifications. With them, whenever Carsonville made new sales or bought new supplies, he could instantly see the results on the companies’ general ledger; and just as important, he and his colleagues could easily keep up with the costs of their existing contracts. They could compile a historical record, too, a big help in planning new bids. Now that Carsonville’s computers were talking, the humans might be talking more—about the new business that the sociable machines could help bring their way.

14 As The Jungle Thickens (AKA the Great Modeming)

This was to be my future chapter, the one about microcomputers in the year 2001. I at first wanted it short. So often the micro future prematurely becomes the micro past; and why devote too much space to making a fool of myself?

And why not spread the risks? Arthur C. Clarke seemed a better prophet.[82]

Several months earlier, in fact, he'd agreed to an interview via modems and the satellite links between Colombo, Sri Lanka, and Alexandria, Virginia. So now I'd show that my little Kaypro, with a free software program and a $150 modem, could talk almost instantly to a stranger's computer on the other side of the planet for perhaps a fraction of the cost of a telex. It seemed fitting. Clarke, after all, had written *2010* with WordStar and decades ago had practically invented the idea of communications satellites.

And if I failed to catch up with Clarke by computer? Well, I supposed it would be like a train journey to Outer Mongolia; I at least could write of the experience of *trying* to get there and of the people I met along the way.

I'd cop out in one more respect. Rather than ask Clarke the usual reporterish questions, I would turn the job over to others. The first was Eric Meyer, twelve years old, who was learning assembly language, a feat at any age, and who planned to start a software company called New Technologies.[83] The second was a Fortune 500 man named Jerry terHorst, head of Ford Motor's public affairs office in Washington, D.C., and former press secretary to Gerald Ford. The third was Margaret Phanes, assistant to David Kay, vice-president of the company that had made my computer; the fourth, Seymour Rubinstein, a science-fiction fan and the developer of WordStar. The fifth was Rob Barnaby, the WordStar writer. The sixth was James

Watt, co-owner of the Haunted Book Shop in Annapolis, Maryland, and a descendant of the eighteenth-century Scottish inventor. The seventh, Lynn Wilson, a former railroad telegrapher, had taught me some amateur radio theory when I was twelve.

Eric himself had just passed his novice examination for an amateur license, and over the phone, with a push button, I tapped out my idea in international Morse code.

"How," I inquired, "would you like to ask Arthur Clarke some questions?"

"Who's Arthur Clarke?" Eric replied by voice.

It was a pardonable response. Clarke's *2001*—the book and movie for which he's most famous—had come out several years before Eric's birth. And yet as much as anything, Eric's reply showed where we were headed in this age of specialization. He might someday be programming the future equivalents of HAL, developing new forms of artificial intelligence, and yet he apparently had not heard of HAL's creator.

I told Eric who Clarke was. "No, thanks," Eric tapped.

"But he's the most famous science-fiction writer in the world," I said, and explained the kind of issues that he might ask about.

Eric, however, still wasn't completely impressed. "Does he understand technical things?"

I assured Eric that Arthur Clarke was technical enough to be worth his time. "We're going to do this by computers over the phone lines," I said. "In fact, I'd like you to send your questions to me by computer. Then I'll store them inside mine. And then I'll shoot them by computer to Arthur Clarke there in Sri Lanka. You'll be communicating machine to machine, sort of."

"Where's Sri Lanka?"

"It's an island in the Indian Ocean."

"Would you use my communications program?" Eric asked.

Eric wasn't talking about software he'd bought. It was what he had *written*.

"No," I said. "I'm going to use MODEM7, because I'm familiar with it."

"Couldn't you say you used a communications program written by Eric Meyer, age twelve?" he asked. It wasn't the worst twist in the world—good for the book, good for Eric, who, as a reporter's son, showed a precocious public relations sense. "I won't use it to reach Clarke," I said, "but you can use it to send your file to me."

"All right."

"Read *2001*," I said.

Eric readily agreed.

"I remember the title," he said later, "but I was out when one of the kids in my class gave a report on it."

"I'll want your reaction."

"Okay."

We also attended to another matter. Eric didn't own an amateur radio rig yet, and I offered to lend him my Heathkit, a little five-watt transmitter-receiver stashed away in the closet of my efficiency apartment.

"Is it digital?" Eric asked. Did it have, in other words, a "non-dial" like those newfangled watches?

"No."

"I was hoping it was."

"It's transistorized." That was good enough for me. Who needed a radio without a dial?

Eric took me up on my offer, which included the gift of some old chassis and capacitors and other parts, forgotten until now in the crawl space of my parents' home. And I was pleased that Eric accepted, for I liked the symmetry of it all. Two decades earlier Lynn Wilson had given me some of the very equipment I'd be passing on to Eric. And so I visited my parents' basement that weekend and reentered the past, not only my own but also that of electronics, including computers in a sense; for perhaps this is how the micro age had *truly* begun—hobbyists swapping parts back and forth until someone accumulated enough to build a system that actually worked.[84]

Lynn Wilson was all over the crawl space. I picked up a 6146 transmitter tube on which he had playfully magic markered, "For David, K4DIG, DX King." DX was the amateur radio jargon for long-distance communications.

I lingered in that basement, thinking that somehow, examining the past, I might better understand the future. There were no new clues, however, nothing but bulky transformers and spaghettilike wires and resistors and capacitors and the other odds and ends of my youth. But what a record my junk pile was of the American electronics industry. Half gutted, near the 6146, reposed a silvery ARC-5, a war-surplus receiver. Had it flown? ARC-5s were what American bombers carried during the Second World War. Had a B-17 crew kept in touch with England with my ARC-5 while pummeling the Third Reich? Had my receiver seen action over Tokyo? Scrapping it, had I inadvertently defiled History? Near the ARC-5 I saw a giant condenser for a transmitter. With row after row of plates on a metal shaft, it looked like an electronic potato slicer. I thought of fingernail-sized chips in computers today; the big potato slicer might as well be an artifact from another species. There in the crawl space the 1950s showed up in little vacuum tubes the size of pill bottles. They were a reminder of the short-sightedness of the U.S. electronics executives who had stayed years too long with vacuum-tube technology. Just what did this mean to American computer makers facing similar challenges? There was an object lesson here. Many portable computers from U.S. companies had flat screens, for example, but most of the display designs came from the laboratories of Japan. Although IBM would prosper—even if half of the innards of its PCs came from the Orient—many of the smaller American manufacturers might die. And even the larger domestic companies could suffer in the price ranges where computers were mere commodities; with flat displays and better memory chips, Nippon might again make us relive the transistor fiasco. I groped, poked, and wandered some more. And there in a dim corner I found the 1960s, too—in the form of a Nuvistor, another pygmy vacuum tube, another refinement of the obsolete. By the 1970s Heathkit was finally offering transistorized ham transmitters like the one I'd lend Eric. Heath still sold quite a few updated versions of the little HW-7. But now the amateur radio magazines seemed half filled by ads for solid-state equipment from Japan. How long until computer magazines looked the same?

I went upstairs. My parents, who for years had been patiently awaiting the removal of the clutter from the crawl space, had second thoughts. What if I injured my back dragging the equipment to my car? Why couldn't Eric and his father come for the tubes and chassis?

A passage from a novel—the name escaped me—came to mind. It was almost as if, by removing my old childhood toys, I were aging both myself and my parents.

I left the equipment at Eric's after a meeting of the Kaypro writers group to which he and his father belonged. They lived in a white house in a greeny neighborhood high above most of Washington: a good location for an antenna, a great "QTH," as Lynn Wilson would have put it in ham talk. The Meyers had filled the house with the paraphernalia of their obsessions. Downstairs Rima Meyer was at her spinning wheel; a huge loom dominated what normally would have been the dining room; and upstairs was the book-packed den where Gene, a *Washington Post* staffer, had been working on a long history of Maryland.[85] No one spoke of the odd juxtaposition—a Kaypro used to write of hogsheads and sailing ships.

Eric, a small, curly-haired boy, helped lug the radio gear into his bedroom nearby. Then we soldered up the Heathkit's connectors and began hearing international Morse code and Spanish babble on the 15-meter band. He was amazed. I could make sense of the dots and dashes at twenty words per minute; he could copy at only a quarter of that speed. "Hey, don't worry. You'll learn it much faster than I did," I said. "You learned BASIC. I haven't the mind for it. Anyone who can program will be a whiz at code." And how much more useful computer skills would be. Take communications; 20 words per minute was one-thirtieth the speed of my dot-matrix printer. And yet I was dismayed to hear Eric speaking so enthusiastically of the day when he could transmit in voice. To Lynn Wilson and me, ham radio didn't exist without code. We were like the old man at my newspaper back in Ohio who couldn't stand a city room bereft of typewriters. Computers, in fact, had even violated the sanctity of code. A micro's video display could flash out the letters summing up the holy dots and dashes—the ones I'd so painfully learned in my youth. I

felt like a sailboater tipped over by the wake of a motorized yacht.

I snapped off the Heathkit. Eric and I went downstairs where Rima, a tiny woman named after the bird-girl in *Green Mansions*, was still at her spinning wheel. She dreamily looked up at us and proclaimed herself an anachronism. Children like Eric, she said, would be different from those before them—would think more abstractly in this video-game era. She wrote poetry; she heard voices; would the computer children do the same? I thought of Rob Barnaby, the WordStar writer, who had said he heard "a voice from the back of my head"; it wasn't the same back-of-the-head voice as a poet's, but it was there, anyhow. Someday Eric might be another Barnaby.

Later that evening I demonstrated WordStar for the Meyers. Father and son agreed: WordStar moved words around faster than did Select, the word processor with which our Kaypros had originally come. I turned to Rima. "Computers are supposed to be very good for poets," I said. "You can consider the possibilities. You can learn what words look like before you commit yourself to paper." Rima listened politely, but I thought I might as well be showing off an electric guitar to a mandolin player. Gene and I discussed the Arthur Clarke connection. It was iffy. The telephone lines might not work; Clarke might be away on a business trip. Gene wouldn't ghostwrite Eric's questions for Clarke, but he did have one he hoped would make the list. "At the writer's group," Gene said, "this businessman was telling me how he fired his secretary when he got his computer." How did Clarke feel about such situations? It was a common but acceptable question, I felt—one just as reasonable as any that science-fiction writers and philosophers might raise about the origin of the universe.

Two weeks later I rang Clarke, around eleven in the morning, Virginia time. A little sleepily, he answered. He was tired after a trip promoting the *2010* novel in the United States, and right now he could not recall me. "Remember," I said, "we talked several months ago, and you said we could get together on the modem." Clarke had phoned late one evening after I'd written him questions about WordStar, and in a sense we were now even; for my mind had drawn an absolute blank when this

stranger had begun in a British accent, “David, you’ll never guess who this is.” Well, I asked now, could we still get together on the modem? We’d run a test to be ready for the questions from Eric and others a few days later. “Call my computer store,” Clarke said. He was using BSTAM, alas, a communications program that didn’t work with my MODEM7 software. Imagine my disappointment. I’d been hoping for quick computer-to-computer contact, over 8,900 miles, with the inventor of the communications satellite; and now a mundane problem confronted us—a simple lack of software compatibility. BSTAM in some ways was a Rolls of a communications program, excellent for transmitting large blocks of data over long distances. In fact, Clarke had used it to send his New York publisher some changes in *2010*. And yet, for communicating with me, his BSTAM disk was nothing but a worthless piece of plastic, because it snubbed MODEM7-style programs—perhaps the most common among micro users. It was as if Clarke were a lonely billionaire in a chauffeured Rolls. His ride might be velvety, but he would never meet the commoners in the Chevy in the next lane.

After calling around the country, I finally located a review copy of BSTAM. Eric helped me test it out over the phone. “May I come over and watch you talk to Clarke?” he asked. I hesitated. Hadn’t Eric already modemed his questions to me? His being in my apartment seemed redundant. Then, however, I remembered my youth, when Lynn Wilson would invite me to his attic for DX sessions. It was like angling. Lynn might not snag those stations in New Zealand or Morocco, but it was still the electronic equivalent of treating a boy to a morning of trout fishing in a mountain stream. Now Arthur Clarke would be the new DX. Of course, the Rothman-Wilson analogy didn’t absolutely hold, for Eric knew more about computers than I did. “Sure, Eric,” I said at last, “sure you can come.”

With Eric and his mother watching a few days later, I punched the “0” and confidently said I wanted such-and-such number in Colombo, Sri Lanka. A tape-recorded voice soon came on with a New Yawkish accent, announcing that all circuits to Sri Lanka were busy. Well, what did I expect? Sri Lanka wasn’t one of the great centers of global communications. And yet it still seemed vaguely bizarre. Why

shouldn't Sri Lanka enjoy instant contact all the time with the whole world? Why not? *Arthur Clarke* lived there. Perhaps on my tenth try I finally heard the musical tone of Clarke's number ringing. "Eureka!" I yelled. Once more Clarke himself answered. He warned me that he was rushing through a movie project and some books and was months behind in his correspondence; the most I could hope for in reply to the questions would be a series of "Yeses," "Nos," and "Maybes." That irked me. For my enterprise I deserved a response ahead of the other letter writers; in fact, you might say I wasn't even a letter writer—I was a *modemer*. I glanced at Eric. He could tell the general direction of the conversation, and he looked just as downcast as I must have. Eric was even hoping—quite unrealistically, I believed—that Clarke might call him at home. "I am starting my own computer software company (R & D)," Eric had said in a preface to his questions, "and I hope to profit in this venture. I am enjoying your book *2001* and want to get *2010*. I am also a novice-class 'Ham.' If you ever need any software or just want to chat, my home and work number is.... I also have interests in ROBOTICS and COMPUTER HARDWARE, and ELECTRONICS (etc.)." I'd reminded Eric that the technology might fail in my quest for answers to his questions; I hadn't been so emphatic in warning that Clarke himself might fail us.

"I'm going to need to test the modem, anyway," Clarke said after a pause, however. He wanted to exchange ideas with an MGM/UA director for the movie sequel to *2001*.

He gave me the number of his telephone with a modem hooked up, and then, several times, I again suffered the vagaries of global phone communications before a line finally opened up and I heard the familiar tone of a modem. I reached for my own modem, a slim blue box, and switched over from "TALK" to "DATA." Then I hit the return key on my Kaypro, firing up the BSTAM program.

My screen flashed word that the connection was in progress, and I was about to slap Eric on the back, but I waited, and quite rightly, for as the seconds wore on, the connection was *still* progressing. Something was amiss. By voice Clarke said my transmission hadn't registered in his computer memory—not even the mere existence of my electronic file.

I called Michael Scott, a technician at Business Computing International, Clarke's New York computer store. He sent a Telex to Clarke. Was Clarke using the normal 300-baud modem speed matching mine? I learned a day or so later that he was. "Well," I asked Michael, "how long has it been since Clarke last communicated with you [the store] through the modem?"

"Months."

"Okay," I said, "maybe he needs a refresher on how to set up the modem program." Patiently, Michael ran through the procedures.

Half an hour later I again was braving surly operators and busy signals to place another call to Sri Lanka.

"What you want to do," I told Clarke, "is type RXN B:ODYCORR.TXT, then a carriage return, then select ANSWER when you see the prompt." Clarke, however, hadn't been doing it that way. We tried again, and for the next ten minutes my screen kept flashing dozens of confirmations of the connection.

Then our computer link broke.

I called Clarke back. Surely at least the start of the electronic file had shown up on the B disk, the one on which he was to store my questions. "No," he said, "I don't see it." Clarke, it seems, had forgotten to put a floppy disk in his B drive. It was a very excusable mistake—this whole modeming procedure was still a novelty to him—and we failed yet another time even with Scott's instructions followed exactly.[86]

So a few days later I settled on another tack: getting Clarke a free Kaypro II.

Why not? Kaypro itself had once suggested that to me. It could do worse than to be able to say that Clarke and an MGM/UA director had used Kaypros to communicate during the creation of the *2010* film. I, in turn, might reach Clarke more easily if he was tapping away on a machine like mine. Besides, he eventually could give his Kaypro to the new Arthur C. Clarke Centre for Modern Technologies. The center was to promote high tech in the Third World, and Joseph Pelton, who was rounding up U.S. backers for the organization, liked the Kaypro idea. So did Clarke. And so did Peter Hyams at MGM/UA.

Hyams wasn't just a well-known director with such credits as *Capricorn One* and *The Star Chamber*. He was the kind of person for whom I was writing this book—he had a problem open to possible solution by computer.

The problem was the need to consult closely with Clarke during the adaptation of the *2010* novel; how to overcome the time difference between Colombo, Sri Lanka, and Culver City, California?

"Some things work brilliantly when read but aren't well suited to the screen," Hyams said, and as a conscientious scriptwriter he didn't want to make arbitrary changes to Clarke's story. "I was interested in finding out what the author was thinking when he wrote certain things. And secondly I thought it was very, very important that Arthur C. Clarke be made to feel an important part of the making of this movie." With rapport might come a greater understanding of the man and his books. Hearing of Hyams's proposal to work together via computer, however, Clarke was skeptical. I could imagine why. Hyams would need a dependable link, not just the capability to exchange occasional messages. It might be 1983, satellites might be old hat by now, but the quality of the phone transmissions didn't belie the fact that Clarke was on an island in the Indian Ocean. Could computers deal *reliably* with the electronic echoes, with the delays from the signal traveling more than 45,000 miles on earth and in space? What about Sri Lanka's primitive phone system?

And yet Clarke's location—some 9,350 miles from Culver City—also helped the struggle seem all the more worthwhile.

"Because he's twelve or thirteen hours away in time, it almost makes normal conversation impossible," Hyams said. "Someone is always going to be speaking at a very inconvenient hour for them. And there are some times when you don't want to talk, and sometimes when you're asking somebody for something, you want to think about something. It requires more than a quick answer." Letters, though, just wouldn't do: "I've gotten mail from him that's almost a month old." Hyams might have used telex or a similar system, but the costs would still be greater than a direct computer-to-computer link. Ideally, he could tap out memos on a computer, then whisk them to Clarke without a secretary taking the time to

type them into another machine. Hyams was already comfortable with a Xerox 860 word processor. Like me, however, he realized that the link had more chance of succeeding with the two ends using the same computer systems—Kaypros in this case. Two hardworking Kaypro employees, Margaret Phanes and Clifford Odendhal, pushed through the project at their company. Within a week or so a Kaypro II was on the way to Clarke, and the company installed another in Hyams's office; at long last, the Great Modeming seemed at hand.

Then, however, rioting broke out in Sri Lanka: fighting between two ethnic groups, the Singhalese and the minority Tamils, who were seeking a separate state. Somehow Clarke's Kaypro reached the airport. But he couldn't pick it up because of the rioting, during which an arsonist burned down the house of one of his technical assistants.

"They're swinging the jawbone again," said an acquaintance of mine, alluding to a scene in *2001* where a man-ape kills another with the high tech of his era. It was not a slur on Sri Lanka—just general disgust over violence of any kind. News stories appeared, then stories about the island trying to censor reporters so there wouldn't be any more stories.

Just when every circumstance seemed to be conspiring against me, I enjoyed a miraculous fluke. Arthur Clarke's neighbor Susan Hayes, the wife of an American official in Colombo, was visiting Washington and would return to Sri Lanka soon; and through a member of the Kaypro writers group, Marcia Tyson, I passed on to her the written questions for Clarke to answer by phone if need be. I wasn't cheating. It was perfectly in line with both the Marco Polo tradition and the spirit of this book; don't ever shy away from paper backups.

I also supplied Clarke a disk of MODEM7, the public-domain program that I used—so that we needn't worry about software differences if my program didn't work with the one that Kaypro gave him.

Kaypro, in fact, did provide Clarke with MODEM7-compatible software—a company program—but it wouldn't run acceptably on Peter Hyams's computer. So both men instead received a commercial program called MITE. There

was a problem, though, as Peter and I prepared for the Great Modeming—I couldn't be Arthur C. Clarke. My MODEM7 could talk to Peter's MITE, but it wasn't really the same. With MODEM7 you couldn't leave your computer unattended and have a machine thousands of miles away call you up and choose from dozens of electronic files on your disk. With MITE you could.[87] And Peter, true to the perfectionism of a top director, wanted his rehearsals to be as realistic as possible. "I'd like to be Arthur Clarke," I told a kindly software dealer, who gave me a review copy. MITE, however, locked up on my machine. On the screen it stubbornly kept saying I was receiving signals from another computer—even before I turned on the modem.

So I visited a hacker I'd heard of. He was a little technobully, who, bare chested in the August heat, worked sullenly on my software, making rude noises whenever I asked a question. MITE seemingly succumbed to his efforts. He berated me for not using the right number of data bits, the right stop bit, the right everything else in computerese. Chastened, I returned home, only to find that the program still wasn't working reliably.

I took my Kaypro and software to a friend, a systems analyst, an intelligent, learned man fond of aphorisms like "Even kings must obey the rules of mathematics." Unfairly, cruelly, MITE still wasn't running after five hours of his toil. My friend played by the rules; he'd based his whole career on following instruction manuals; he was the perfect man to help run the computer system of a hospital or bank. I was just the opposite. When it came to the laws of math or computer manuals, I was willing to turn criminal. In fact, that's how I undeservedly succeeded at last—by flouting MITE's instructions on connecting my computer and modem.

It was the first time in years that I'd used a soldering iron. I didn't own a vise, even, so I placed the RS-232 connectors on an aluminum pie plate on the wooden floor of my apartment and breathed lead-poisoned fumes.

The work was hot. It was also murder on my eyes, hardly the joy I recalled from amateur radio—a task fit for robots, not people. Squinting away, I hoped that beneficent HALs would soon multiply in the world's factories. Then I remembered my

friend Lynn Wilson, a telephone-company retiree who had soldered for decades, who loved it, and who had lost his service job to computers.

With MITE running at last—and with me as a more Clarke-like imitator—I began another series of rehearsals with Peter Hyams. The program was excellent; the instructions were bewildering in places. Peter called a MITE distributor and traded insults. It was outrageous. We were not ordinary end users. Peter was a movie director trying to communicate with a famous novelist-scientist; and I, if an obscurity, was at least around to chronicle whatever abuse Peter suffered.

What would average computer users have done? Without other MITE owners to share their problems, they would have been up the creek. The whole ordeal was a potent argument for user groups; in fact, you might say that Clarke, Peter, and I were a three-member one. Clarke, meanwhile, was reportedly suffering a disk-drive problem. He may have enjoyed sympathy, however, from another user—nearby; an American in Sri Lanka owned a Kaypro. Of course, the ordeal was still another argument for easier-to-master software.

Finally, it happened: the Great Modeming—more than six months after Clarke had first phoned me from Sri Lanka.

Hyams and Clarke started typing messages to each other, and I knew my own Great Modeming would succeed. But a problem lingered even now. Colombo and Culver City couldn't send already-typed material to each other's unattended machines.

So one of Clarke's first messages to the MGM/UA Kaypro wasn't exactly "What hath God wrought?" It was something in the spirit of "Tell **** to fix that software or I'm going to throw the computer in a river. And tell **** that Sri Lanka has many rivers." A furious Hyams and Rothman phoned Odendhal, who promptly contacted the distributor. Contrite, the MITE man apologized and gave Hyams the guidance he needed.

The Clarke-Hyams link was now in place. It hadn't been easy. The two men were each using a $1,595 computer, a modem selling for several hundred dollars, and a communications program listing for more than $175, and Peter's new printer cost several hundred; and those expenses

normally would have been only the beginning. Kaypro had set up the software and offered other consultant-style services; Clarke used his own technician. If Average Company, Inc., had duplicated the computer link on both sides of the Pacific, the project might have exceeded $5,000. And yet clearly the technical hurdles seemed surmountable and the rewards worthwhile. Two weeks into the link Hyams had only one complaint—the difficulty of reaching an international operator at times to place calls. And in future years that problem would lessen as special computer links let Telenet spread into the world's poorer countries. An attachment to make the Sri Lankan phone system compatible would cost the government several thousand dollars. And the expense to Clarke and Hyams would be perhaps $60 an hour—no great barrier, considering that they could transmit 1,000-word computer files in a fraction of that cost using 300-baud modems. With faster modems they might end up spending still less.

More important to Hyams right now, however, was the friendship he was building with Clarke—so important to the success of the film.

"I think we're kind of linked in a strange way," Peter said. "He's written some lovely and sweet things. It's strangely intimate. You're just getting daily mail. It has some really wonderful advantages that letters have over telephone conversations.

"The kinds of questions that I'm asking him and the kinds of things I'm saying are things you don't really say off the top of your head. You know, 'What do you think about so-and-so?' and you sit down and compose the answer and you write it back. Some of the stuff is purely personal. Some of it is not. I want him to experience the making of this movie. There are a lot of logistical details. I've spoken to some people that Arthur's recommended I speak to. There are things to do with everything, from marketing to plans I have, to changes I want to make, to What does he think of certain things? to technical areas of the film that he can be enormous help with."[88]

Clarke, using British spelling, modemed to me that the "connextion" with Peter Hyams was "invaluable. We are on exactly the other side of the clock, so I leave my machine on ANSWER with a file for him when I go to bed, which is about

the time he goes to MGM, and when I get down to breakfast, there's his answer on the disk." If Peter worked late at night, the two men might save their "conversation" on computer disk so "there will be a complete record of our collaboration. It's truly fantastic, like WordStar. I just can't imagine how I ever managed without it. My big worry is that as more and more of my friends get plugged in, I'll never be able to get away from the keyboard."

A few days before Clarke sent his written answers for Eric Meyer and the others, he phoned him just as Eric had hoped. "I wouldn't want to disappoint the boy," Clarke said later. The Clarke-Meyer conversation was brief—words to the effect that Clarke would be in Washington in 1984 and he wished Eric luck in the future—but it served its purpose. "It's the first time I've ever had an international call," Eric said. "My first phone DX!"

My computer DX reached me one Saturday morning at nine, an uneventful occurrence except for a broken telephone connection when I dialed Clarke back to start the modeming. Our two Kaypros clicked the next try. I received a prepared file from Clarke of about one thousand words, and afterwards we tapped out some 250 words:

Q. When will you be coming to Washington so I can tell Eric, who naturally will want to attend your speech?
A. I am afraid it will be a very private affair, as it takes place in the White House! But I expect to be in Washington in late April.[89]
Q. I am planning to call my ergonomics chapter "The Hal Syndrome," and if you've used that phrase before, I'd like to give you credit.
A. I don't recall ever using the term, but it's a good idea, and you're welcome, anyway.

That's part of the conversation with the typos cleaned up—on-line typing isn't for the vain. Clarke was brisk at the keyboard. There wasn't any doubt I was "talking" to a professional author. Hyams was fast, too, reaching maybe eighty or ninety per minute on good days; and yet as Peter pointed out, typing speed didn't matter that much, since you

normally would compose at leisure, then squirt out your prepared file.[90]

The Clarke-Rothman connection ran just fourteen minutes and cost $25.11 on my phone bill—a good case for the economy of global computer communications. I didn't know what Clarke's rates might be. But if I'd given a thousand words to a Telex service in Washington, D.C., a one-way message to Sri Lanka would have totaled some $125. And if I could have afforded my own Telex machine? Well, the connect charges alone still would have exceeded $60. Moreover, my $25.11 charge was for a 300-baud connection, a slowpoke one by some business computer standards. With a 1,200-baud link—a strong possibility since the connection had proved so reliable for Clarke and Hyams at 300 baud—my phone bill might have been well under $15 even on a weekday. And with everything sent already typed, it might have been between $5 and $10. Imagine the thousands of dollars a company could save using micros instead of Telex for regular communications with faraway offices.

In one of the questions sent there Marco Polo fashion, Eric asked if computers someday would replace secretaries who took dictation. Could the machines display the words on their screens and electronically police spelling and grammar? "We will certainly get computers that can take dictation," Clarke replied by modem, "and this may lead to two desirable results—better elocution and rationalisation of spelling."

Yes, yes. Maybe someday American and British computers could even spell alike. Although Eric's question was a very good one, it was passé in many technical circles, as he himself must have known. Articles were already appearing in micro magazines about low-cost computers that could recognize simple commands like SAVE (to preserve material on a disk). One of the big problems with speech recognition was usability with different voices. But I had no doubt that practical machines with a vocabulary fit for the business world would be taking dictation by 2001.

The keyboard would remain, however. Not everyone would want to dictate; I suspected even two decades from now I'd still prefer the pleasure of letting my fingers linger over the

keys. Then again, how did I know? Just a few years ago I could have seen myself at only a *typewriter* keyboard.

As for spelling checkers—well, there again the basic technology was already around. I myself would be proofing this chapter with The WORD Plus, a 45,000-word electronic dictionary that would flag the places where my spellings contradicted it. Not that The WORD Plus would ever replace proofreaders at The *New Yorker*. It would let you use "his" when you meant "this"; it was absolutely incapable of considering spellings in context. Even by 2001 the checkers might lack that capability. But eventually they would respond perfectly to context, as would grammar checkers. That might require artificial intelligence, the ability of computers to reason independently without their humans laying out the machines' tasks in detail. But the day would come.

Of course even the best prophets could err. In his 1945 article entitled "Extra-Terrestrial Relays: Can Rocket Stations Give Worldwide Radio Coverage?" Clarke predicted communications satellites but missed by a mile in another area. "It seems unlikely that we will have to wait as much as twenty years," he said then, "before atomic-powered rockets are developed...." Still, I appreciated Clarke's general philosophy of prediction: Experts are more often wrong in saying something *can't* be done than in saying that it *can*.

"Do you think there will ever be a HAL?" Eric asked Clarke.

"Yes," Clarke said, "HAL will arrive—but not by 2001!"

I agreed. But confusingly, HAL wouldn't necessarily be a pure-bred silicon creation; I could see him as a hybrid of silicon chips and biochips, or maybe just the latter.

Created by an organic process, the biochips might have complexity and power far beyond those of old-fashioned machines with silicon.[91]

What's more, instead of a machine acting like a man, scientists might help join men with machines, with everyone receiving brain implants at birth. Men might turn into Hal before Hal became a man. For years science-fiction writers had been predicting cyborgs, man-machine unions.

In some ways, humans might forever defy emulation. "Even with computers' vast memories, I'm skeptical as to whether a

machine could give judgments based on ethics," said another of the questioners, Jerry terHorst. "How can executives live with this limitation? Might computers have a way of taking the sharp edge off ethical questions? Quite often you can put things in a machine or say things to a machine, but maybe—because of the way it operates—you must conform to its system. You can't very well couch an ethical question for the machine, because I don't think a computer can weigh it ethically. It can certainly weigh it procedurally, but whether it can weigh it ethically is another question. I'm wondering whether computers might get in the way of having to make some of the ethical decisions that businesses are always required to make."

Clarke replied, "It will certainly be some time before computers understand ethics (not too many humans do, for that matter), but *in the long run* it is impossible to rule out any aspect of human activity which cannot be reproduced or at least imitated by computer to any desired degree of precision. Of course, some things will be too complicated to be worth doing." Elsewhere in the response Clarke did say: "I know nothing about corporate or any other form of management, but obviously in principle computers can assist decision making greatly. However—GIGO!" Garbage in, garbage out!

Already electronic decision programs were available for businessmen, helping them consider financial factors—but in most cases, not very much more. Besides, the people who most needed guidance from "ethical" software would be the least likely to use it. Imagine Richard Nixon booting up a disk to ponder if he should cover up Watergate.

All this wasn't an abstraction for terHorst. He himself had resigned as press secretary in a disagreement with Gerald Ford over the Nixon pardon. Now he worked as Washington public-affairs director for another Ford, the car company. It undoubtedly had banks of computers, and like any other automakers', they must be toting up the costs of adding various safety precautions to cars. Critics of the auto industry charged that manufacturers considered only their ledgers—the cost of the precautions versus that of lawsuits. Would software someday weigh the ethical issues along with the numbers, and *should* it? That was hardly a question just for the auto industry.

What about a construction company evaluating building materials of different strengths? Or a book publisher weighing its profitability against the menace to public health that would result from publication of a fad diet book. I was reactionary enough to consider those final decisions forever beyond the realm of even computers as sophisticated as HAL. In the future, though, how many executives would feel that way? Jerry terHorst's ethics question was easily my favorite.

He also asked, "What about the general issue of trust among people communicating by computer? Can people make policy, sign contracts, settle multimillion questions without shaking hands? You can have two people with computers in different locations calling up the same statistics from the same memory bank. Yet isn't it possible that the necessary trust may not occur until the two get together in person?"

"Your point that people must meet to establish trust is one theme of my novel *Imperial Earth*," Clarke replied. "After that, they can work together through telecommunications.

"I had unexpected confirmation of this idea from a visiting reader who happened to be the Russian ambassador-at-large in charge of the Indian Ocean. He said, 'You're quite right. You have to look into the other fellow's eyes before you can negotiate.'"

In *Imperial Earth* a man from a moon of Saturn visits Washington in 2276 to celebrate the U.S. quincentennial and cultivate his family's terrestrial political contacts. Wreckers have razed the original Watergate complex—over the objections of the Democrats, who wanted it saved as a national monument—but in many ways politicians and statesmen are the same as in the darkest twentieth century. They seek personal contact with each other. "Only after that contact, with its inevitable character evaluation, had been made, and the subtle links of mutual understanding and common interest established," writes Clarke, "could one do business by long-distance communication with any degree of confidence."

A booster of telecommuting might nod. He'd insisted that we meet *face-to-face*, and I suspected I could have enjoyed slightly better cooperation from a few other interviewees for this book if we had been in the same rooms. Wires and satellites could never eliminate travel.

Granted, some researchers might say the next year that people tended to use stronger words in computer conferences, perhaps to make up for the lack of body language and other visual clues. Reportedly, the decisions from such conferences tended to be more radical—involving much more risk or not enough—than those made face-to-face.

Just the same, computer "meetings" could greatly reduce travel once the people at the various ends had established the basic trust. Clarke had written two decades ago, "The business lunch of the future could be conducted perfectly well with the two halves of the table ten thousand miles apart; all that would be missing would be the handshakes and exchange of cigars."[92]

That might or not be with television contact. The absence of it, however, wouldn't be the ultimate disaster. In concentrating on the other person's *message*, you might be less vulnerable to misleading clues from facial expression, body movement, or clothing. Clarke himself enjoyed creating different personae for different audiences; once his sarong had shaken up an IBM convention. A Washington reporter described him at another time as "a paunchy fellow" with thinning hair, "math-teacher glasses, discreet hearing aid ... red velvet slippers and unbelted pants" who looked "like some kind of GS-12 from the Bureau of Poultry Audits. And he wants you to see his Kermit the Frog doll."[93] Yet this same man could don dark suits for book jackets and deliver august speeches to statesmen.

Beyond reducing the opportunity for visual distractions, long-distance contact by phone or computer offered another advantage in my opinion. You could reach more people in a given time to confirm their facts; you weren't twiddling your thumbs in cabs and airport lobbies or wearily working the horn locally from a hotel room with a bed fit for a steel-spined dwarf.

That still left the question of what kind of office you would talk to the world from. Margaret Phanes of Kaypro wanted to know. The week Margaret asked about the office of 2001, she said she was in the middle of reading Clarke's novel *Rendezvous with Rama*. In her opinion, Clarke brought about "synchronicity." He himself, in fact, had once told of "preposterous" coincidences in his own life, and he'd peopled

Imperial Earth with characters like "George Washington," a twenty-third-century Virginian who lived on a museum's plantation named Mt. Vernon. If "synchronicity" or other coincidences had worked for Dickens, then why not Clarke and Phanes? Or Rothman? Trying to puzzle out some technical details of my computer-to-computer link with Clarke, I'd run into two noncelebrities who had met him. And what about his neighbor—visiting Washington—through whom I'd passed the questions from Margaret and the others? Coincidence needn't be mystical. I was happy enough for it simply to be useful.

Replying to Margaret's questions about what the office would be like in 2001, Clarke had a problem. For decades he had been working at home. "My 'office,' if you can call it that—it looks like a snake-pit with all the cables on the floor—is just ten feet from my bedroom. I can appreciate your questions are very important, but they're outside my frame of reference."

Clarke may have replied in a limited way to Phanes, however, when he answered a question from Seymour Rubinstein.

He'd asked Clarke about the possibility of briefcase computer tapping into worldwide networks to do complicated processing of information. Just how would that affect people?

Years ago Clarke had said a business eventually wouldn't even need "an address or a central office—only the equivalent of a telephone number. For its files and records will be space rented in the memory units of computers that could be located anywhere on earth. The information stored in them could read off on high-speed printers whenever any of the firm's offices needed it."[94] And now Clarke was predicting little portables capable of using the giant networks and memory banks. "It seems to me that as computers become more and more portable and networks more universal (and systems standardised—a MUST!) there may no longer be any question of 'micros in the office.' The office will be in the micro—and *that* will be in an attaché case." Rubinstein himself already knew that Epson was about to market its little lap-size machine with WordStar built into the read-only memory.

Rob Barnaby, the WordStar programmer, asked a slightly overlapping question covered by the same answer. There was something else for them from Clarke, however—his thanks.

“I am happy to greet the geniuses who made me a born-again writer,” he said. “Having announced my retirement in 1978, I now have six books in the works and two portables—all through WordStar.”[95]

James Watt, the descendant of the Scottish inventor, also figured to an extent in Clarke’s work, in the sense that the Haunted Book Shop sold it. “A computer disk the size of a phonograph record can hold about 54,000 frames of pictures,” Watt observed in his questions, “enough for a large encyclopedia. Does that mean we’ll see the end of going into a bookstore and buying a best-seller? Are we going to lose the printed word as we know it today? Will ‘book’ buying become a computerized activity? Will I call up XYZ computer firm and then peruse disks at my leisure?”

“Nothing will ever replace books,” Clarke reassured him. “They can’t be matched for convenience, random access, nonvolatile memory (unless dropped in the bath), low power consumption, portability, etc.

“But information networks will supplement them and replace whole categories, e.g., encyclopedias and telephone directories (as is being planned in France).”

Clarke was more sanguine about Watts’s fear that computerized shopping might “dehumanize us” and clerks might vanish. He said, “I believe personal service will become more and more important and hopefully more and more available as older occupations disappear. We’ll ‘window-shop’ through home terminals but will still discuss important products with salesmen, even if they’re hundreds of kilometers away!”

The seventh questioner, Lynn Wilson, had worked several decades for the Chesapeake and Potomac Telephone Company, only to see computers do away with the rotary switches he had so lovingly attended.

“They’ve sent all my equipment to the smelter’s to reclaim the metal,” he said. “I don’t know if anyone’s still in the building. Maybe a few times a week someone goes by. The equipment tests itself twenty-four hours a day and flashes a red light for the serviceman next time he’s there.” Just a few boxes had replaced the long rows of devices that connected the dial phones in the area of Alexandria, Virginia.

But Lynn didn't feel any futility. The telephone and teletype themselves had superseded another invention he used—the Morse Code telegraph.

He'd pounded out messages at up to forty words per minute for the Wheeling and Lake Erie Railroad, and he still recalled an old saying reflecting his pride in his craft:

"If a telegram takes more than twenty-four hours to be delivered, it has whiskers."

My friend had a feel for the scraps of history. For years he'd kept a Teletype message announcing the Third Reich's surrender, and I asked about the ARC-5 receiver that he'd given me: could it really have flown over Germany? "Go to the Air and Space Museum in Washington," Lynn said, "and you'll see a cockpit with an ARC-5. I've even seen an ARC-5 with a .50-caliber bullet hole right through it."

Lynn was hardly a foe of every piece of post-ARC-5 technology. In late 1983 he hoped to be among the hams talking on the two-meter wavelength to an astronaut aboard the space shuttle.[96] Just the same, Lynn feared the years ahead—not so much his own fate as other people's.

"Aren't computers turning people into useless objects against their will?" Lynn asked Clarke. Gene Meyer, Eric's father, of course had wanted Eric to ask a somewhat similar question. But it meant more coming from Lynn.

"Computers eliminate people, who take vacations, sick leave, and retirement," he said. "I myself haven't suffered. I took voluntary retirement at full pension at sixty-two. But computers were why I left then instead of sixty-five. I would have had to go to school for three years, and by then I would have been ready for regular retirement. So it didn't make sense for me to stay. But not everyone can retire at full pension when the new technology takes over. What do you do about the people being forced out? What's the answer?"

"Anyone who can be turned into a useless object against his/her will *is* one!" Clarke said. "You obviously weren't."

That was too pat an answer for me. The other day I'd talked to my old state editor, who'd visited Lorain, Ohio, west of Cleveland on Lake Erie. He feared that Lorain might become a husk of a town. A decade ago, when I'd been a reporter there, more than eight thousand had worked at the U.S. Steel mills,

and Dick worried that the company might pull out of Lorain except for a bare-bones plant employing just a few hundred. Downtown, he'd seen dozens of shattered store windows. Oddly, however, the newspaper enjoyed some new subscribers —Dick said some of his friends could afford to do little more than watch television and read. Were Dick's friends to be shrugged off as "useless objects"? In *Imperial Earth* Clarke had told of stringent population control, of an American Midwest replanted with forests, of steel mills neatly preserved as museums; but three centuries earlier, Lorain untidily abounded with angry, idle men. Cheap steel imports were one threat to them. So, perhaps, was the eagerness of many steel-company officers to pour their capital into more profitable industries. But computers and other high tech also had helped deprive Lorain of some steel jobs.

In the future, however, couldn't even a factory technician telecommute—overseeing robots from home and using them to turn out custom-crafted products requiring a human "touch"? Ideally, America in 2001 would be producing something besides "information," Big Macs, and look-alike toasters. And ideally, too, average workers could afford to enjoy the cornucopia. In fact, widespread genetic enhancement of IQs might *eventually* make everyone capable of appreciating high tech at a high level, so that "workers" in the old sense disappeared. Huxley's *Brave New World* hierarchy might never exist, and in the twenty-second century we might all be Alphas smarter than any of today's computer wizards. Robots would be our real Epsilons.

Meanwhile, regardless of the traumas of society at large, some of the most unlikely people could befriend new machines. Jack LaVriha—the cigar-chomping newspaperman in Chapter 8 who dated back almost to the *Front Page* days—had done fine in the Lorain *Journal*'s electronic city room.

Even Rima Meyer, the weaver, had made peace with the family Kaypro. Just a few months ago Eric's mother had given me the impression that she wouldn't use the computer for a long time if at all. But now Gene had nearly finished his Maryland book—freeing up the Kaypro for her to practice on. "I use it for personal correspondence and for the fliers for the weaving classes I teach—anything that requires good, clean

copy," she said. The Meyers, in fact, didn't even have a working typewriter in the house. Well, I thought, so much for all my blather about mandolin players and electric guitars.

To be sure, computerization would rarely be as worry-free and blissful as the advertisements depicted it. There would be computer crime, disk crashes, all the other high-tech woes. Few people would take to computers as naturally as had Charlie Bowie, with his playful, Hawkeye-Pierce attitude toward his little Zenith.

And how many could save their companies $200,000 a year like Alan Scharf? Or experience the exhilaration of Peter Hyams when Arthur Clarke's letters flashed across his green screen? Or the satisfaction that Rob Barnaby received by writing a software classic like WordStar?

But if computer users not only chose their machines and software well but *used* them well, if they formed users groups rather than trust peripatetic sales reps, if they avoided technobullies and hired consultants carefully, if they trained employees in a nonintimidating way, if they computerized humanely as well as efficiently, if they safeguarded their data security, if they prepared for the future through telecommuting when appropriate, if they showed persistence and sense, enough rewards were there, and they'd find the Silicon Jungle to be not only survivable but friendly.

Afterword

It's November 1984 now, and I've sold my Kaypro.

Business computers are production tools, not family heirlooms; when I found that the Kaypro's screen and storage capacity were becoming inadequate for my needs, I unsentimentally ran want ads. The new owner—a church magazine using the Kaypro for lighter-duty work such as letter writing—couldn't be happier.

The Kaypro's replacement was a sleek Victor 9000. I was growing accustomed to it when a writer friend, Stephen Banker, called with news of an auction at a shut-down computer store a few miles from my apartment. A year and one-half ago the store's managers and I had argued about the Kaypro's merits versus the Osborne's. They'd gambled on the wrong machine, the Osborne. Micro sales in general were growing, but this business had perished in the Silicon Jungle.

Now I returned to the store and saw the debris of the micro revolution. Spread out haphazardly on long tables, treated like dead fish, were the computers that I'd seen glamorized on the covers of the micro magazines just months before.

The auction had begun on a Thursday and would last over the Labor Day weekend through Monday. The first day the prices were reduced 30 percent, and they would keep declining, until on Monday you could buy most of the machines for 80 percent off. It was now Friday.

The machine I wanted, a hard-disk version of my Victor 9000, would be $2,400 Sunday—40 percent of the original list price of $6,000.

"Don't buy it Sunday," said Steve. "If God intends you to have a hard disk, He'll let you get it for $1,200 Monday."

There were two hard-disk Victors, one new, one used, both selling for the same. So far only one other person seemed to be showing the amount of interest that I did, a husky, gray-haired man in a T-shirt. He was trying the used machine. I wondered if

he'd seen the new one and was trying to distract me from it. This could be the stuff of nightmares:

A whistle blows that Monday. T-shirt pushes a frail young auction staffer aside and races toward the new Victor. I overtake him, however. Just as I'm about to lay hands on the machine, T-shirt throws a punch toward me. I duck. T-shirt grabs the Victor monitor.

"Listen," I say, "that computer isn't yours unless you get the main part. The monitor won't do."

An auction staffer nods.

I unplug the main machine from an AC extension cord. T-shirt, however, sets the monitor down and moves closer, as if to grab the part with the disk drives and the central processing unit.

"Look," I tell the auction staffer, "it's my machine."

"First come, first serve," he says. "First to the counter gets the computer."

T-shirt flexes his biceps. "You and me got some fighting to do."

"Hell, no," I say. "I already have my computer."

"My *computer," T-shirt growls. I hug the Victor more tightly. My back is aching. T-shirt laughs at my discomfort.* "My *computer," he repeats. "Gimme!" The auction staffer watches calmly. I don't. That's $6,000 worth of machinery we're fighting over. Suppose I drop—*

T-shirt rushes in. The computer's plastic case smacks against the floor and shatters. Simultaneously, one of us brushes against the monitor. It, too, falls; and the CRT makes a horrible sound as the air rushes into the vacuum. The Victor, however well built, isn't a machine to be fought over, barroom-brawl fashion. On the floor I see tiny computer chips and spaghettilike clumps of wire. God knows how, but the hard disk has spilled out of the Victor and is rolling down the aisle of the store.

The auction staffer makes clucking noises. I glare at T-shirt. "You saw it all," I tell the staffer. "He's the one who's going to have to make good."

"Hey, boss," the staffer yells toward the counter, "we got ourselves a little accident here."

The chief auctioneer rushes over and looks over the Victor's remains.

"He smashed it," I say, frowning again at T-shirt.

"But you let it drop," T-shirt snaps.

"The price was only $1,200 on the last day," I remind everyone. A lump is forming in my throat. Inflation notwithstanding, I'll never feel right putting "only" in front of "$1,200."

"Well, it was still worth six thou," says the head auctioneer. "See you both in court."

"Both?" T-shirt and I ask at the same time.

"Both," says the auctioneer, "unless you want to pay now. That'll be $3,000 each. Cash or certified check?"

Hoping that T-shirt wouldn't notice me, I put the new Victor through its paces as much as I could. It wasn't set up to run WordStar, the program I wanted to test it with. I'd be taking a chance. Still, if I bought the Victor for $1,200, I'd have enough money left over for even massive repairs—assuming someone didn't beat me to the machine.

"Maybe I'll buy it myself," said a sales rep, out of either cruelty or a desire to increase my interest still more, assuming that was possible. "Maybe I'll sell it for scrap."

He himself was a good six foot four inches, perhaps three hundred pounds, but some Victor enthusiasts might have thrown a few punches, anyway, at the source of such sacrilege.

The Victor, unlike most of the other micros there, wasn't the computer equivalent of a dead fish.

With the built-in hard disk I could keep every syllable of *The Silicon Jungle* ready for editing without jockeying around the floppies. I silently thanked "Big Blue" IBM for the bargain that might await me. Through its normal marketing muscle, including a massive ad campaign featuring a Charlie Chaplin look-alike, IBM had overwhelmed the competition. People shunned "obscure" brands, especially if they couldn't use IBM PC-DOS IBM software. The Victor didn't have Charlie on its side. Some bozos at the company even *charged* dealers for promotional literature.[97] But what a micro! The Victor was a 16-bit, MS-DOS machine and ran WordStar 3.3 and the CrossTalk communications program, the software I used in my work. The screen was noticeably sharper than the IBM's; the

keyboard was closer to a Selectric's; the light brown plastic cabinet was sleeker, and it didn't take up as much desk space as an IBM PC would. And the floppies could store an amazing 1.2 megabytes of information or three times as much space as the usual IBM disk. How lamentable that IBM rather than Victor had set the standard for the personal computer industry. Victor had gone into chapter 11, but subject to court approval, would be bought by a Swedish company—and even if the sale doesn't go through, there would be 100,000 Victor owners, enough to guarantee a market for replacement-part manufacturers. IBM might have the brand name. But the Victor right now was best for *my* needs.

"When's a safe time to get here before anyone else gets the Victor?" I asked the sales rep.

"We open at nine o'clock," he said.

"Won't do me any good to come several hours earlier?" I asked out of curiosity—I'd show up regardless of the answer.

He shook his head.

That night I called Steve, just to overcome last-minute doubts. The better the bargain, the more suspicious I should be. "You think I should go ahead?"

"Why not? The biggest problem you'll have is selling your present Victor."

I'd paid $1,750 for it new, through the mail. It, too, had been a risk. I'd taken out a maintenance agreement with a local company in case the new arrival turned out to be a lemon. It hadn't been. But could I recover the money selling a supposedly "has-been" machine?

Monday, I arose at five in the morning. If the Victor was still there and if I got to it before anyone else did, I'd save more than $4,000 off the normal price. For four hours of waiting? I'd have to be a regular on all the best-seller lists for my time to be worth $1,000 an hour.

When I pulled into the shopping center, I saw no one else there except for a police car passing through. An old van wheezed into the parking lot a few minutes later. A bearded man and a boy of perhaps ten got out and set up a canvas chair; veteran auction goers? They'd have advice on the best way to fight the crowd and claim my prize.

The man, however, just gestured and grunted. The boy couldn't speak, either. They were apparently deaf mutes. I pulled

out pen and paper and learned they were after Atari-games software.

Maybe an hour later a few others straggled in, one of them a psychologist, with whom I began discussing the great issues of the day.

"You're not interested in the Victor, are you?" I asked.

"I'm looking for Osborne software," said the psychologist.

"What about detachable keyboards and monitors?" I asked, remembering my nightmare over the criteria for laying claim to a machine.

We decided that proper auction etiquette required you to defer to the person who carried away the main part of the computer to the counter; an auctioneer later agreed.

Miraculously, a small, orderly line was forming even now, with fifty people in front of the store by eight. Over the next hour a mob came, some in old jalopies like the van, others in Cadillacs and BMWs. There was both excitement and desperation. Many people, like me, simply would forego buying a new computer if someone else beat them to a suitably priced machine. Should I lose out on the Victor, I'd just spend another year or so juggling floppy disks around. Others, however, might have been hoping to be able to afford a serious business computer, period. No, it wasn't like the Depression, but I couldn't help thinking of the dance marathons of the 1930s where the hardiest carried off the prizes. I was the first in line—of all the hundreds of people—but I certainly didn't boast the strongest back. Just a few feet down the line I saw ... T-shirt.

An auction staffer picked up a bullhorn. He said only fifty people could come into the store at once. I heard sighs. Relatively few people, however, left that line. Maybe, just maybe, the others wouldn't appreciate the merits of the bargain machines that they themselves wanted. I hoped that to most in the crowd the new Victor would be just another dead fish of a micro.

Finally, it was nine. The salespeople—as if at a fire—urged the crowd to stay calm. If the mob lost discipline, the other early comers and I might be crushed against the glass.

As the doors opened, I glanced back at T-shirt. If he was worried about me, he wasn't letting on. At a pace between a jog and a sprint I entered the store; I tried momentarily to excise the image of T-shirt from my mind.

Oh, look! A friendly sales assistant. I'd offered him advice on electronic mail and—

"Do you think you could help me with the Victor?" I asked.

Suppose he couldn't. His job might be at stake if he did even a small favor in this every-man-for-himself struggle.

"Sure," he said. And I'd like to think this was another demonstration of the value of befriending others in The Jungle and sharing knowledge, user to user. With the sales assistant watching guard over the main machine, I picked up the monitor and pushed through the crowd to the counter. I still couldn't believe the Victor would soon be mine. What if the sales assistant had suddenly developed a fondness for Victors and had himself decided to claim the main machine? T-shirt all this time may have been in the other part of the room; perhaps he was a gracious, mannerly fellow who, having seen me first in line, was decent enough to relinquish the new Victor to me. I don't know how T-shirt fared at the auction but hope that his own patience was rewarded through the acquisition of the used Victor.

Within half an hour after taking the new Victor home, I had WordStar running on it. There was some tinkering to do with the software so the computer would start up without my having to stick a floppy disk in it, but otherwise it was a perfect machine, save for a little crack in the front of the case, which I discovered after I peeled away the price tape. For $40 or so I could buy a replacement front. The hard disk, at any rate, has been just as handy as I expected for editing this book.

My old Victor is in the hands of Gabriel Heilig, an aspiring screenwriter, who saw my want ad and bought the machine for $1,750, exactly what I'd paid. Gabe is no dummy; indeed, he used to sell cars—Mercedes—and he insisted that his purchase price include plenty of advice and several hours of instruction in WordStar, my favorite word processor. And then what does Gabe do? He goes out and buys a copy of Word Perfect, a new program that he swears is easier to use. I say, "Great if it helps you do your work." It must. Gabe tells me that the Victor helps him revise five times as fast as he can on his electronic typewriter. "You constantly have a fresh copy in front of you," he says, "whereas if you're using a typewriter, you must retype the whole page even if you change just once sentence." A producer is interested in a proposal for a TV series, and Gabe

says: “I did it in three days—it would have taken two weeks with a typewriter.”

Having sold the old Victor to Gabe for $550 more than the price tag on the hard-disk one, I invested $230 in a 1,200-baud modem. I remain a computer communications junky. A draft of this afterword, in fact, reached my technical editor up in New York via the phone lines.

■ ■ ■

My afterword could cover a number of topics, but I’ll resist. Still, you might be interested to learn that the Great Modeming continues between the United States and Sri Lanka.

Because of problems with the Sri Lankan phone service, the link over the past year hasn’t been 100 percent reliable—monsoons can wreak havoc on cables between Arthur Clarke and the satellite station. But Steve Jongeward, who is now an assistant both to Clarke and Peter Hyams, the *2010* director-writer, reports that the struggles have been worthwhile. The movie will be out in December 1984 (remember: I’m writing this in November 1984), and if a reporter has questions for Clarke in Sri Lanka, Steve will just type them out on the Kaypro in California, and the novelist will typically respond within a day or so. Sometimes the reporters even visit the office with the Kaypro and interview Clarke via modem and get instant replies.

■ ■ ■

The Great Modeming has produced a wonderful outgrowth: an attempt to start an Electronic Peace Corps (EPC) to pipe U.S. technical savvy into the Third World via computers links. (See Backup XIII, “Why Not An Electronic Peace Corps?”)

The idea—in the form of an agency working within or alongside the existing Peace Corps—has won support from people ranging from Clarke to William F. Buckley, Jr., and Chicago *Sun-Times* editorial writers.

Two established foreign-aid groups, Partnership for Productivity and Volunteers in Technical Assistance (VITA), hope to develop an informal EPC-style project with the Sri Lankans.[98] If successful, it could complement an existing VITA plan for an earth satellite to relay electronic mail to and from the

Third World. Ideally, a permanent EPC would develop. Then it could recruit volunteers, help fund projects like the satellite and the Clarke Centre, and otherwise encourage computer communications in vital fields such as public health and agriculture.

—Alexandria, Va.
Nov. 15, 1984

BACKUP:
More Tips and Tales from the Jungle

BACKUP I Twenty-Six Questions to Ask at (and About) the Computer Store

The *very worst* computer stores are like amusement-park arcades. Expect to be clipped. Just aim for the bull's-eye and keep your losses low. Better still, go to the good stores.

Reading my list of twenty-six before-you-buy questions, please remember that the quality of computer stores can vary tremendously. The proportion of lemons to good ones is higher than in the case of ordinary retailers. That's because of the complexity of the product. In fact, there's an old joke about the difference between a car salesman and a computer one: the former knows when he's lying.[99]

One of the main tricks of the crooked computer hustlers is nothing more than the retail-store version of leaving town ahead of the sheriff.

"The average computer salesman has a half-life of two months," said my friend the systems analyst. "Then he loses his credibility with his supposed 'clients' and goes back to selling shoes or automobiles. If you're relying on any salesman for expert knowledge, you might be in for a rude awakening. That's why users groups formed. People got ticked off with this world of hucksterism and created their own little world."

One of the problems is that many good, honest sales reps will soon leave for more lucrative work as consultants or for manufacturers or others.

Of course, the customer himself may be as impossible as some of the sales reps. He might expect a quick, accurate, lucid answer to his question from a rep working for little more than a department-store clerk's earnings. Computer stores can be full of ignorance on both sides of the counter. Moreover, even if the sales rep knows his subject forward and backward, many computer problems just defy easy answers. Imagine the

frustration of a sales rep working on commission. He can ill afford time to educate complete novices. So do your homework or at least make an appointment when the sales rep isn't going to be jammed up with lunchtime traffic. That's the nature of the Silicon Jungle, not simply a series of ripoffs. Cherish the good sales reps.

Perhaps the ultimate bad customer is a middle-aged Missouri man accused of the first-degree murder of a computer-store owner with whom he disputed a $180 bill.

Neither men nor machines "interfaced" well here. Although the customer had bought a printer elsewhere, he was under the impression that no one would charge him for making it compatible with a computer purchased from the store. The owner wouldn't yield. Allegedly—I didn't know the verdict at the time of this writing—the man then fired two .38-caliber slugs.[100]

Short of killing the store owner, how do you protect yourself?

Start by realizing that even at honest stores, your interests and the firms' won't be the same. I know of a Washington store that planned to drop the Kaypro. Despite the computer's generally good technical reputation, the store seems to have been stuck with more than its share of lemons with disk-drive problems. But that wasn't the real reason, apparently.

"We're moving out of the lower-priced equipment into systems where we can make a bigger profit," explained a store employee. "We're not in this for charity. We've got to make a living."

Understandable. But don't count on a store like that to sell you the least expensive machine for your needs.

You can also protect yourself by considering the right questions—*some* of which appear below:

ONE

Do you need a computer? Are you prepared to fire the humans the machine might replace? Remember, a computer can't make coffee or lie about your whereabouts when *you* may face an angry customer. Of course, your business may be expanding so that this isn't an issue.

TWO

Do you have the temperament for the device? A willingness to struggle with mechanical and human frailty—including your own?

THREE

Are you prepared to do your homework? You can't avoid some preparation. It's dangerous to dump the whole chore in the lap of a consultant who, however good, doesn't know your business as well as you do.

Use a consultant if need be. But help him and yourself by knowing what's going on. If you don't have time, at least be certain that a trusted employee does—ideally, someone on whom you can bestow a fat raise if computerization goes smoothly.

FOUR

What magazines and reading material should you buy at the computer store and elsewhere?

The Silicon Jungle is just a start. Neither it nor other books can keep you informed about new products as quickly as a weekly magazine like *InfoWorld* can. I've written for *InfoWorld* and may be prejudiced, but I think it covers the industry well. Some micro magazines, especially those oriented toward specific brands, are namby-pamby in their coverage of the industry or their pet machines.

A good general book is fine for acquiring broad perspective; but now move on to a guide focused on computers for your kind of business. Shop for magazines and books as carefully as you would for the machines. See if the magazines' articles are as up to date as their ads; I know of one that reviewed the Osborne more than a year after its introduction.

Timeliness isn't as important with books if they discuss principles as well as specific products. Whatever you read, make sure it's in English, not gibberish.

FIVE

How do you want to buy your computer and the trimmings? At a store or through the mail?

Unless you have a consultant or otherwise enjoy plenty of technical backup, you should buy your entire system locally, at one store.

Many manufacturers discourage mail-order sales. That's partly because of price cutting but also because they need local stores to guide customers who are new to computers.

But if advice *is* available to you from a consultant or friend? Then mail-order software might be a terrific buy, especially since most computer stores can't supply much software expertise, anyway.

SIX

Do you want an independent store or a chain store?

My own preference is an independent that has been in business several years. Computer sales reps may come and go. The owner, however, should still be in the store and in town when your warranty expires!

If you insist on buying from a chain, well, fine. But learn how long the manager has been around—and how long he intends to stay. He may lie through his teeth. But at least you're trying.

Also, ask the manager how long his predecessors lasted? How fast does the revolving door spin?

SEVEN

Are the sales reps knowledgeable and understandable?

One of the best ways to find out is for them to demonstrate a program of the kind that you want. Ideally, sales reps or consultants won't just know a lot about computers. They'll also know—or learn—something about your business.

Above all, the sales rep should give you accurate information in language you understand. If you're a businessman shopping for a word-processing computer, a good salesman can tell you how many double-spaced pages each of your floppy disks will be able to hold. Of course, ideally, you'll walk into the store knowing the basics of computers.

But there are bound to be gaps in your knowledge somewhere along the line; even writers for computer magazines argue with each other over some supposedly clear-cut technical matters.

EIGHT

Can anyone go with you to the store, especially on the day when you want to firm up the purchase?

You may at least enjoy a psychological advantage over the sales rep if there are two of you asking well-coordinated questions.

Who should accompany you? Perhaps the person in your office who would use the machine the most; what better source of questions for the sales rep? Obviously, too, it's good labor relations. Employees who helped choose a machine will be less likely to complain about screens or keyboards.

NINE

What programs will do the jobs you need done?

Don't just consider costs of the programs; consider their costs versus the cost of *not* owning particular ones.

I don't regret spending $250 for a word-processing program to replace the cumbersome software with which my machine came. With the "free" program it would have taken perhaps 40 percent longer to write this book.

TEN

How easy are the programs to learn? How easy are they to use? Some of the easiest to learn are the hardest to *use*.

ELEVEN

Do the programs include good instruction manuals? You still may want them if they don't—as long as you can buy readable books about them.

TWELVE

What machines will run those programs? And how well will they run them?

Take WordStar. Many machines can run this popular word-processing program; but not all will let you use the cursor keys —the arrowlike ones—to move from place to place on your screen. With some computers you must simultaneously tap on two keys, not just one, to move the arrow. You could have WordStar customized for your machine; but why not instead buy a computer that works well with it from the start?

You also want to consider the operating system that a machine uses. By now, the most widely used operating system is MS-DOS, which has become a de facto standard because of IBM's endorsement of it. It has supplanted CP/M. Rival machines may not run *every* program that the IBM computers can. Some, like the Compaq portable, come close. But if a computer exactly duplicated all the IBM's functions, Big Blue's legal staff would crush the maker.

The widely used Apples have their own operating systems—one for the Apple II series and another for the Macintosh.

There's also UNIX. Ma Bell developed it originally, AT&T Information Systems now supports it, and Microsoft sells a microcomputer version called XENIX. The gurus say UNIX could be the operation system of the future. With it programmers can more easily write software for machines of different brands and sizes and "port" their programs from one computer to another. UNIX may also be good for micros with many people using them at once. The negative is that the nonexperts sometimes have more trouble using UNIX than they do good ole CP/M and MS-DOS.

So much for the mainstream and soon-to-be-mainstream formats. What, however, if the program you need comes only in an oddball one? Think hard. Do you need this software—hence, this computer—immediately? Or can you wait until the wonderful program or an equivalent is available for other machines?

By the way, the word "format" doesn't refer just to the general style like CP/M or MS-DOS. It can also mean specific machines within CP/M and so on. Different makes of CP/M-style computers, for instance, may not read each other's disks because their exact formats are different.

THIRTEEN

Is the machine 8 bits or 16 bits; and how big is the random-access memory? Remember, 8 bits may be fine for word processing and light-duty accounting, but 16 bits might be better for complicated spreadsheets and is a definite advantage in data-base applications.

At the very least in the business world, you want 64K of RAM for word processing and 256K or even more for intimidating calculations.

You may find that a micro just isn't powerful enough to handle a mailing list in the tens of thousands or process the payroll of Exxon. They'd be uses fit for a mainframe or at least a mini.

FOURTEEN

What about **mass storage**—in other words, devices like disk drives? Can they hold enough information for your business?

If you need to juggle around great masses of material in a hurry, you may want a hard disk, which is more expensive than the floppies.

Remember—one character equals one byte and you can squeeze most numbers into one or two bytes. Estimate your needs by calculating how many pages by how many bytes per page, etc., then double your result to allow for growth and the unforeseen.

Don't just consider storage capacity. Think about the ease of making electronic copies of information you squeeze into your computer. A hard disk capable of holding the equivalent of five thousand typewriter pages is nice. But you still must contend with floppies for backup if the hard disk fails. You must either make backup copies as you go along or else, every so often, hold a long, tedious copying session.

Fortunately, the price of hard disks is dropping quickly enough that in the future you might be able to afford a second hard disk to back up the one in the machine. Some micros can back up on a standard videocassette recorder—a good four-

hour tape will hold 100 megabytes. Besides, there'll eventually be cheap, reliable, roomy memories without any moving parts.

Even then, however, you'll still want copies of some kind, especially if failures would zap thousands of pages of hard-won information.

FIFTEEN

Must your computer system accommodate more than one user? Will it work well with people tapping into it from different terminals—those machines with the keyboard and screens but little or no computing power of their own?

Computer makers ballyhoo many micro systems as being "multiuser," but often there are hitches.

These machines may let one person do accounting and the other do word processing at once but might not allow two people to run the accounting program simultaneously. And what about data bases and electronic file cabinets? Can more than one person simultaneously update inventory records, for instance? And will the computer slow down much if too many people use it at once?

Still, properly chosen, a multiuser system is a great way to share information with many people and not have to jockey floppy disks around all the time. Then there's the cost. A multiuser system for twenty or thirty persons may cost less than half of what individual desktop computers *might*.

Instead of a multiuser system, however, you might still go with full-blown computers—but *network* them.

Networking is basically what it sounds: tying together machines to help them share letters, reports, data bases, and other electronic files. (See Chapter 13, "Net Gain$," for a fuller explanation.)

SIXTEEN

Can you expand your computer system without difficulty, adding more storage, for instance, or devices like a modem to help you communicate over the phone lines?

SEVENTEEN

Will the sales rep show you that the computer will work well with the printer or other accessories you have in mind?

He or she might not be able to demonstrate this compatibility, simply because he doesn't have the peripherals in stock; but you should at least obtain a clear written promise saying that everything will work *well* together. Be sure that his obligation to make it work is clear *before* you sign the check.

The same idea naturally applies to software.

EIGHTEEN

How clear is the computer's instruction manual?

In computerese, you want "good documentation"—something that's "user friendly." If the manual doesn't include it, then does a book from an outside publisher? Ideally, the book won't focus just on the machine but also on the software that comes with it.

NINETEEN

How long has the manufacturer been in business? How prosperous is the company?

Buy from a new company if the technology looks far enough ahead of the pack. But be careful. You don't want to buy from a computer maker likely to perish soon in the silicon jungle—not when you'll need spare parts and technical assistance.

TWENTY

Are any users groups around—organizations of people owning the machine?

Ask your dealer or call the manufacturer for the name of the group near you. If there isn't such a group, that's a blow against the machine then and there. You still might buy it, but you'll have less technical advice than you might otherwise get.

Another beauty of good user groups is that they work closely with dealers and manufacturers without compromising their own independence.

With fellow owners just a quick phone call away, you'll be less at the mercy of know-nothing hucksters.

Obviously, too, before buying the machine, you'll find that the user groups can be just the ticket for learning the quirks of the dealers and the machines. Ask discreet questions after the meetings. Which machines and dealers are winners? Which are gobblers?

Don't forget, of course, that the owners would like to think of themselves as having spent their thousands of dollars the right way.

I try to remember that when a computer shopper at a Kaypro meeting asks me about my machine,I say I like it. Then I go out of my way to tick off the Kaypro's flaws so I won't have it on my conscience that I offered a bum steer.

TWENTY-ONE

What about maintenance?

You can solve many of your repair problems ahead of time by buying a computer easy to service.

That's one reason I got the Kaypro rather than the Osborne.

You also want to find out how often the machines break down. Try—whether it's a computer or a printer—to get an MTBF figure. That stands for "mean time between failures."

Failures? That sounds fatalistic. But face it. Neither people nor machines go on forever.

MTBF figures are like political polls and deodorant-commercial statistics—subject to gross manipulation. But they're a start.

Also, consider if you want to pay for regular maintenance, which, in one year, might cost more than a tenth the price of the computer?

Or should you gamble without a maintenance contract?

Here's a rule of thumb. Don't gamble if (a) your system is large and complicated or (b) you'll be up the creek without a paddle if the computer is out of service too long. The second condition is particularly true if one or more of these conditions prevail:

a. If you own just one machine.

b. If it's an oddball machine—not a commodity like an IBM or Kaypro.
c. If your business grinds to a halt without it.

I gambled for a while and seemed to be losing. During the first year I spent perhaps $150 on replacing a printed circuit board in the Kaypro and $300 on printer repairs. Considering the Kaypro's dramatic effect on my output, I won't gripe too loudly. Nevertheless, I appreciated the need for a service contract for even a well-made computer in constant use. And within a few weeks it paid off. A disk drive failed, and the computer shop didn't charge me a cent for several hundred dollars in repairs. The man worked while I waited at the public library down the street. The shop had promised, before I forked over my $250 yearly payment, that it would at least try to fix up my machine within twenty-four hours.

If possible, negotiate for financial penalties if repairmen don't do their job—at your location or theirs—within a certain amount of time.

The contract might be with anyone from a national service organization to a good, honest man operating out of a garage who's been in business a while and has convincing references—and substitutes for the times he's on vacation. (See Chapter 8, "People," for rules to consider in avoiding turkeys.) Count on spending 1–1½ percent per month of the hardware costs if you're dealing with a national service organization.

Of course you *might* be better off without a service contract. Just make sure you can limp along briefly without a computer, which, alas, I can't.

If you do try to wing it without a maintenance contract, you'd better be prepared to know as soon as possible if you've bought a lemon. That's not such a bad idea even *with* a contract.

Theoretically, you should smell the juice within the first few months before the warranty expires. But that's not how it always works—or doesn't work. As a novice, you may not be putting the machine through all its paces. So why not invite a more advanced computer owner or a consultant—someone you trust—to tinker around with the computer in ways that you'll eventually be doing? The sooner the "test drive," the better.

Your tester should do basics like copying disks, transferring electronic files from one disk to another, erasing files, and renaming files. See if there's a program available to test the disk drives and related circuitry. Often those parts are the ones that fail first, since (a) the drives are mechanical as well as electronic and (b) they get some of the heaviest workouts during the computer's operation. As soon as you get your machine, you might leave it running twenty-four hours a day for a week or two. Any component that will fail from heat buildup, for instance, will probably quit then—while your warranty is still fresh. Power consumption is typically no more than a light bulb's.

Whether you have a maintenance contract or not, remember a basic rule:

It isn't the shop's diagnostic tests that count. It's how your newly repaired machine will run *your* programs.

After I took my computer into a shop for disk-drive work, the repairman said the drives just needed a little cleaning and were now testing fine. The computer, however, flubbed when I tried one of my regular programs.

Result: I forced the repairman to install the new disk drive that my machine needed.

Moral: always keep on hand some *good* backup copies of important programs that you can take with you to the repair shop to make certain that the people there have done the job right.

■ ■ ■

Rothman's Law of Computer Trouble-Shooting (Cribbed From an Old Rule for Fliers)

1. If your computer messes up, remember the very last thing you did, whether in hardware or software.
2. See if that isn't the answer to your problem.

■ ■ ■

TWENTY-TWO

When will the new machine be available?

Be especially wary in buying recently introduced computers —even from giants like Xerox.

Maybe you should go ahead because they deliver more value; but don't commit yourself even to a partial payment if you can't pin the store down to a delivery date. Why not negotiate the right to withdraw your money any time you want before you formally accept the computer?

TWENTY-THREE

Will the store deliver your computer system and install it?

For a small portable, obviously, that matters less than it would with a major office system.

Remember, too, that you probably want your software all set to go. Even popular programs like WordStar may be too scary for you to *install* yourself. The word "install" in this case refers to tinkering with software so it runs right on your machine for your use.

TWENTY-FOUR

If the store or other supplier is supplying the equipment over a period of time, can you break the contract into segments?

That way, if the store or systems house doesn't perform in the early stages, you've retained some leverage.

TWENTY-FIVE

What references can the store provide before you purchase a major system?

Buying a computer isn't that different from hiring a consultant or any other professional.

Since you probably can't fully understand the product, you at least have a right to know the reputation of the people offering it.

In at least one case, in fact, a court ruled that the computer dealer in effect was functioning as a consultant and had more

responsibilities to the buyer than he would have had if he had been selling a less complicated product. It's an interesting ruling. And that's it. Don't count on it to protect you.

TWENTY-SIX

Will the store owner himself sign the contract? Remember, your trusty sales rep may be on his way out of town.

■ ■ ■

Rules for Buying a Used Computer

1. Know your prices. Study the want ads of the local papers. There's even a *Computer Classified Bluebook* that rates micros for value in various areas (such as dependability) and offers possible prices. It's available from *Computer Classified*, P.O. Box 3395, Reno, Nevada 89505 ($30 a single copy). Micro prices can change faster than a guide can keep up with them, but the *Computer Classified Bluebook* might be a good start if the local newspaper doesn't carry many want ads for your particular machine. Obviously, too, you'll want to ask around user groups and read the classified sections of their newsletters.
2. Pay attention to the machine's physical condition. A banged-up case—or a chipped one—might suggest that the innards have been roughed around, too.
3. Find out how your pet programs run. If you don't have any available that work on the machine you're considering, see if you can borrow some from a friend and have him or her accompany you. Make sure your friend has backup copies in case the programs are damaged by a sloppy drive in machine you're considering.

   Remember that in the secondhand market the buyer normally doesn't have much recourse if later he finds that the merchandise is defective.
4. As with a car, ask why the seller is selling.
5. Find out what generation of equipment it is. Does it include all the wrinkles of new models advertised.

6. Learn where you stand legally if you're buying software with the used machine. Some companies may require you to register yourself as the new owner; software manuals or accompanying literature may have this information. If you're on good terms with the software company, there's more of a chance its people will answer questions. The company may require you to give the serial number of your disk before it will respond.
7. Call up commercial auctioneers and find out if they're holding any auctions offering the equipment you're interested in.

   Don't buy equipment at an auction unless you've been around the computer for a while or have a friend who can watch out for you. Very possibly you won't get a chance to give a machine a good test. Don't buy unless the price is low enough so you'll still be okay even if you must spend 25 percent of the auction price on repairs.
8. Obviously you'll want to consider a maintenance agreement with a local dealer or repair shop if you need the machine for your work. You may, of course, have to pay for an inspection.

BACKUP II A Few Grouchy Words on Printers

I sold my **daisy wheel**—a printer that prints like a high-priced electric typewriter—and replaced it with a plebeian **dot matrix machine**.

Why? Because all printers, especially my 1975-vintage daisy, are a series of lousy trade-offs.

And one of the trade-offs was about to be my solvency.

The old daisy wheel cost a mere $650 used—quite a bargain for a machine whose latest models go for several thousand dollars—and Anderson Jacobson didn't charge for minor adjustments if I lugged in the bulky printer myself. AJ, however, kept after me to get a $450-a-year service contract.

Then, one day, a printed circuit board conked out, and the replacement board and some other work came to $300.

"You've got to be kidding," I told the crew at Anderson Jacobson. "Three hundred dollars for a printer that cost me $675 originally?"

No, Anderson Jacobson wasn't out to gyp me. Quite honestly, the people there had intended to make their money off me through the service contract; and that would have been fine for a company that needed a heavy-duty, industrial-quality printer to pound away, day after day, around the clock, without stopping. But for a lone free-lance writer? However fast I typed, I could never give them the amount of business for which its makers had designed it.

So like destitute parents searching for the right foster home for their children, I looked for better, more affluent surroundings for my printer.

I asked for, and got, $650 for the printer with a **tractor feed** thrown in for free—it lets you use big stacks of perforated computer paper without stuffing in new sheets when you reach the end of the page. The new owner, a Washington consultant,

understood. He wasn't just buying a printer; he was buying his right to an Anderson Jacobson service contract.

My AJ's successor was the Microprism Model 480, a sleek, plastic-covered machine that took up less space on my tabletop than some typewriters.

In a dot-matrix printer like the 480, little pins hit the ribbon, making impressions on the paper. An "A" is one series of pins, a "B" another, and so on. The quality normally isn't any match for the daisy wheel's, even though the price may be much lower than a daisy going the same speed. "Prints like a daisy, costs like a matrix!" Integral Data Systems touted the Model 480. That was stretching matters.

The letters from my next printer, a Panasonic KX-P1092, could *almost* pass for a typewriter's. It sold discounted at a local store for $489, just a few dollars more than Anderson Jacobson wanted for its one-year maintenance contract.

Here's what else I could have chosen—rightly or not:

1. Another daisy wheel machine. The daisy wheel is plastic or metal and looks vaguely like some flowers, with many strokes radiating from the center. The spokes contain letters and numbers, and your computer tells what spoke the printer should strike—which it does with a little hammer. Run a noisy daisy wheel at one in the morning in a thin-walled apartment with an early-rising neighbor on the other side and you may get a not-so-friendly visit from the police or zoning department.
2. A **laser printer**. Typically, it works a bit like some copying machines, with your computer controlling the printed image rather than a document you put in front of a mirror. This wasn't the choice for me; laser printers at the time went for several thousand dollars up. By now, however, the price may be much lower. Political fund-raisers love the nice quality that lasers can add to slick letters saying how badly they need your money.
3. A **thermal-transfer printer**. This uses patterns of heat to arrange the images on special paper; it's *quiet*. Normally, the paper can be expensive, and the printing quality is poor; so thermal printers were also out of the running for me. Later,

however, IBM introduced its Quietwriter printer, which prints beautifully on ordinary paper.

4. An **ink-jet printer**. This kind literally squirts ink against the paper in patterns forming letters and numbers; and the noise level is low, maybe 50 decibels, compared to 65 or more that a daisy wheel might inflict. What a boon to apartment dwellers and people in already-noisy offices.

While I was shopping for the Anderson Jacobson's replacement, I didn't take ink jets very seriously because of the broken-up letters that came from them. A year later, however, I talked to Richard Sugden, a Wyoming M.D., the owner of a PT-88 ink-jet from Siemens, selling in the $900 range, who may have had a limited solution.

He used the 88 with a special printing program called Fancy Font and high-quality paper that soaked up the ink neatly.

The program slowed his printer down to a fraction of the usual 160 characters per second but greatly improved his print even if it still couldn't pass for a daisy wheel's. You can also team up Fancy Font with some dot-matrix machines, especially those from Epson. Then you can print in a number of sizes and styles, including "olde English." Don't overdo. "Fancy," as its makers joke in a printing sample, "may either kill or cure."

In printer shopping for myself, I used these criteria:

SPEED

Yes, actually I could have afforded a new daisy—one of those $450-$1,000 models.

The problem was that most crept along at less than 20 characters per second. That sounds fast, maybe 200 words a minute; it isn't. You must redo an entire page if you want perfect typing but wish to make one change in material already printed; you can't just white out the wrong word and stick in the correct one as you can with a typewriter. Often, after completing a supposedly final version, I see *many* changes I should have made on-screen. Somehow my editing eyes are sharper with paper.

People less fallible than I can make do with 20 characters per second. They get everything printed right the first time.

Then again, if their printing volume is too high, a snaillike printer still will bog them down.

And if they're using their computer system to store and print notes or records, a faster machine is a must. That's especially true if you're churning out nothing but long rows of numbers. If best impressions don't count, you might consider a high-speed dot matrix capable of more than 150 characters per second—or even 200 or greater.

My Panasonic dot matrix was somewhat of a compromise, with a draft speed advertised at 180 characters per second and a near-letter-quality one of around 33 cps.

WARNING: Please note that advertised speeds may be one-third or more higher than the actual speeds. The advertised speeds may not consider factors such as the time it takes the printer to go from one line to another. This is particularly true the case of **unidirectional** printers, which print only from left to right rather than in both directions, as do **bidirectional** printers.

The only real way to judge a printer speed in your application is to try it with your own sample material.

PRINT QUALITY

Here's the hierarchy of printer quality:

1. **Draft quality.** The letters are too dotty for anything but drafts and correspondence with enemies whose eyes you want to torture.
2. **Correspondence quality.** It'll do for a letter to a forgiving friend or business associate.
3. **Near-letter quality.** You can get away with it for book manuscripts, especially if you already have a contract.
4. **Letter quality.** That's typewriter quality.

A friend described my Microprism's supposed "near-letter quality" as looking like "an upscale grocery store receipt." It was a long way from a daisy wheel.

Still, Judith Axler Turner, a nationally syndicated computer columnist, says dot matrix might actually help her at times; she can print the letters larger than regular typewritten characters. Her manuscripts command more attention.

A Washington lawyer fared worse using a dot-matrix machine without near-letter quality. A judge threw out his brief.

We dot-matrix plebeians, before buying, should test the print quality on a number of people, especially colleagues or clients. Are they happy with the shapes, sizes, and quality of the characters? Do they feel that our dots blend smoothly into each other? Usually, the more pins a dot-matrix printer has, the better will be the printing. Many dot-matrix printers in late 1984 had a matrix of seven-by-nine wires. In 1984 Epson was selling the $1,500 LQ-1500 with twice that density and "letter-quality characters to rival fine office typewriters." I looked one over. The typewriters were still winning.

Sales reps will bill the LQ-1500 and many other dot matrixes as being capable of both (a) lightning speeds with draft-print quality and (b) slower speeds with good quality. Is it "good" enough for you? If not, consider buying a speedy dot matrix or ink jet for routine work and a daisy wheel for the times you want the best impression. The combined cost may be lower than that of a super-duper dot matrix.

If you're doing serious work with graphics, look for a printer capable of reproducing details as well as a good computer monitor does. Daisy wheels won't suffice because of the tremendous number of strikes; doing one dot at a time is incredibly slow, and their preformed characters don't include the variety of patterns that good graphics require. You really need an ink jet, dot matrix, or other alternative.

COST

With printer technology advancing so rapidly, I didn't want to sink much into a machine—hence, the $489 Panasonic. Sometime in the 1980s I'll forsake my cheapie dot matrix for a good ink-jet, thermal-transfer, or laser printer when the price is down.

When pondering costs, don't just look at a printer's price tag. What about ribbons? How many pages will they print? And how much do they sell for? My IDS ribbons listed for around $12 apiece, but luckily I could get around that by (1) buying at a discount place and (2) eventually purchasing a little machine called a MacInker, which, for less than a dime, let me reink a ribbon. It's messy. Don't inflict a MacInker on a Fortune 500 secretary, or *any* secretary, but think about one, maybe, as a way of being frugal at home. The MacInker is available from Computer Friends, 6415 SW Canyon Court, Suite #10, Portland, Oregon 97221. The telephone number is 1-800/547-3303, or 503/297-2321. The gadget as of mid-1984 was selling for around $60 if you included ink and shipping charges.

PRINTING VOLUME

I wanted to be able to churn out a book manuscript in one weekend without overwhelming the printer.

Before you buy a printer, ask the manufacturer if it can handle not only your typical workload but also your peak one.

Cheaper printers may overheat—just when you most need them.

A DECENT REPAIR RECORD

A printer is an electromechanical device. That's a fancy way of saying it may break down a lot.

An electromechanical device, after all, is partly mechanical —which makes it less reliable than the gizmos in your computer system that are purely electronic.

If you can afford backup machines, naturally the repair record won't be as crucial, but no matter what, do compare statistics on the mean time between failures. Remember, they're like EPA ratings for automobiles. They're wrong, frequently, and may not apply to the printer *you* end up with. But don't shrug them off entirely.

QUIET (OR RELATIVE QUIET)

My daisy—with the little hammer pounding away—was too noisy for the late hours. Older dot matrixes also can be offenders; they can almost shriek with high-pitched sounds. Some of the newer ones may be better behaved. Sharing an office-apartment or working from an ordinary office, however, you might buy a sound-muffling box and wrestle with pulling paper in and out of it.

When good, cheap ink jets and laser printers hit the market, these noise hassles will end.

SPECIAL FEATURES

"Will it underline?" I asked. And would it offer **boldface**, the dark, heavy print that books often use for emphasis.

And what about other special features? How about **proportional spacing**, for instance, which prints the "M" wider than a "j"—making the type look more like a book's. That could make the print more readable.

Another question is, "Does the printer offer **justification**?" It's really a software issue. But we'll group it here with the other special features.

Justification evens out the spacing of both the right and left margins, though that's a mixed blessing. Justified margins look more impressive. But **ragged right** margins, the normal typewriter kind, guide the eye more easily and may be better for long reports as opposed to short letters. I did *not* justify this manuscript. But justification is just the ticket for correspondence with the status conscious.

In the case of all these special features, keep remembering to ask:

1. Does the printer offer them no matter what computer or program you use?
2. If not, will your hardware and software let you use the features?
3. For free, will the store modify your computer system to make the features available to you?
4. Will your desired combinations of features work simultaneously? Unfortunately, with my software, anyway,

the Microprism 480 couldn't use boldface and proportional spacing at once.

OVERALL COMPATIBILITY WITH YOUR COMPUTER

1. Can you use a standard cable to connect the printer and the computer?
2. If not, can the store make one up for you? At what cost?

Remember, it isn't enough for the cables to plug in. You also want the right wires going to the right pins and for the computer and printer to be on speaking terms electronically.

To connect up with a printer physically and electronically, a computer uses a **port**—nothing more than (a) a plug or socket and (b) the gizmos that let your machine exchange bits and bytes with the outside world.

"The outside world" may be a **modem**, which connects up with a phone, or it may be simply your printer.

Two common styles of ports are **serial** and **parallel**. Data passes through serial ports a bit at a time; through parallel ports, it passes eight bits or more at once.

Serial ports commonly use an industry standard, the RS-232, which is a kind of socket together with the related electronics. As with "IBM compatibility," this "industry standard" often can be elusive. One brand's RS-232 may differ from another's.

The Kaypro has both a serial and parallel port, and with the Anderson Jacobson, I had to wrestle with plugs whenever I used the modem, since it and the Anderson Jacobson both required the serial port.

In between printing one of the last drafts of this manuscript today, I'm adding another criterion—whether a printer has a **buffer**.

A buffer in this case is just some memory, in the printer, that lets your computer pump a letter or report into the machine in a fairly short time. Then you can return to other computer work while the printer runs. You can of course buy a buffer if your machine lacks one and you're sadistic enough to deprive

your secretary of a good excuse for a coffee break. Wait. Come to think of it, your secretary herself might appreciate a buffer if she's trying to keep a nine to five job nine to five.

You needn't have buffering by way of your printer. Some programs, such as Word Perfect, even let you "schedule" several printing jobs from different documents on your disk while you're still writing.

Big Blue's Quiet One

Do you need a quiet printer that will turn out typewriter-like work but won't cost as much as a laser-style machine?

Then you might consider the IBM Quietwriter printer or the inevitable clones that will follow. It uses a new kind of thermal-transfer process—heating the ink so it goes on the paper without the ribbon actually touching. The Quietwriter doesn't need special paper. Its sound is a polite swish. And its print looks typewriter-sharp.

IBM introduced the Quietwriter at around $1,400—less than half of what the cheapest laser printers were selling for in late 1984 (not that they aren't coming down in price too).

Granted, drawbacks exist The Quietwriter's speed isn't as fast as a laser printer's—effectively a mere 25 characters per second if you use Pica-sized type.

Also, the Quietwriter's ink doesn't sink into the paper as with some typewriters or daisywheels; your work might lack the feel of a *traditionally* typed document. And because the ink is erasable, you shouldn't use a Quietwriter for legal papers. It won't make carbons. Moreover, the technology is unproven—at least to me as I write this. Ask me again when the machine's been out long enough for the lemon-owners to fire off blurred letters of complaint to *InfoWorld*.

Just the same, Quietwriter-style machines are well worth investigating. Hats off to Big Blue on this one.

■ ■ ■

BACKUP III The Lucky 13: What to Look for in Choosing Software

A friend warned me: Don't water down your software advice with "In my opinion"-type phrases and other hedges.

"That's how it seems to me, anyway," he joked.

Well, Rick, I'm sorry. Just as a critic once called *Citizen Kane* "a shallow masterpiece," I'll qualify my enthusiasm for WordStar. I'll be a responsible zealot.

Anyway, I like WordStar enough to use it to help explain the Lucky 13—my general criteria for judging software.

ABSENCE OF BUGS

Programs are like people. "Mature" software is more reliable. It's more like a tried-and-tested salesman or secretary, less risky, say, than a green employee hired off the street.

A complex creation like WordStar, with its thousands of lines of instructions for your computer, won't ever be 100-percent glitchless. But it's close. MicroPro, the company selling it, normally tests its programs well before unleashing them on the market, and WordStar has been around since the late 1970s, giving others the pleasure of suffering bugs before you have a chance. Why should you pay for a software maker's education? Not that you should always buy "mature" programs. Sometimes a newer one looks so promising that you might want to gamble.

GENERAL EASE OF USE

WordStar's easy for many people—not all but many—to learn and use. Arthur Clarke picked up the ABCs of WordStar in days. A public relations woman at MicroPro International says she was doing serious work with WordStar the first day

she used it. I believe her. My friend Michael Canyes explained the basics to me on the phone; but my main training was just hanging around computer stores and trying out Osbornes, which included WordStar as part of the standard package.

WordStar exercise books exist, the computer version of typing ones, but for me they would have been a waste of time. I was too eager to get to work with my new software.

A millionaire swears by WordStar; he has four secretaries deftly running it on Kaypros. A fifteen-year-old I know—smart, though not a prodigy—does his homework on WordStar, and the son of MicroPro's founder learned it at age ten.

Yes, I've heard WordStar horror stories. You're not dim-witted if WordStar doesn't come as easily to you as to me. Oddly, I found Select—ballyhooed as a beginner's word processor—to be more of a puzzle. Oh, well. One person's dream software may be another's kludge.

Keep in mind, however, that you must often suffer trade-offs between easiness, speed, power, and versatility. Although WordStar *might* not give you instant gratification, its speed and power may justify the struggle. Ditto for some of the best spreadsheets and other software categories. The big question is, How much word processing or spreadsheeting, or whatever, do you do? Not much? Then place ease of learning ahead of speed. Ideally, though, a program will give you both. MicroPro has tried especially hard to do this with WordStar 2000, an improvement over WordStar in learnability. Like nearly any powerful program, however, 2000 still takes practice to get up to full speed on.

Whether you're buying a word-processing program or an accounting one, look for software with logical commands.

WordStar, in this way, triumphs. Consider the famous SEXD diamond that you use with the Control key. S is the diamond's leftmost key; it will move your cursor over one space in that direction. E is the uppermost key and indeed moves you up. X, the diamond's lower point, takes you a space down. Rob Barnaby, in short, has done a superb job of letting me get from place to place on the screen.

You may disagree violently. Fine. Software is personal. You're letting a stranger—the writer of the program you use—

influence your working habits.

Ideally, however, the writer's logic and yours will be the same, so that, in the end, the stranger becomes a friend. He might be thousands of miles away. He might even be dead. Or you might loathe him if you meet him in person rather than on your disk. But in running his program, you still get the feeling Holden Caulfield got in *Catcher in the Rye*: you want to call up the author after he's done such a fine job. Holden was talking about novelists. I'm talking about programmers. Ideally, they'll touch your brain the way Holden's literary heroes touched his heart.

GOOD DOCUMENTATION

People say WordStar's manual nowadays is better than the past ones, which *Personal Software* likened to "the Russian-language version of *War and Peace*." Don't memorize even the improved manual, however. Home in on MicroPro's simple list of WordStar commands, a sheet smaller than a restaurant menu with which I learned the basics.

My WordStar version also included a spiral-bound book with exercises similar to a typing guide, but I didn't get lost in them. I was too eager to get on with my *real* work with WordStar.

There's one other resource nowadays—a tutorial disk, which, because it came only in an IBM-style version, I hadn't tried as of this writing. Normally, however, I absorb new wisdom better the old-fashioned way: via bound paper.

More than twenty books on WordStar exist—maybe because of the old manuals' failings—and one of the better guides is Arthur Naiman's *Introduction to WordStar*. Published by Sybex Computer Books, Berkeley, California, it's generally as intelligent and helpful as the program itself.[101]

Remember the basic criteria for evaluating manuals of any kind, factory supplied or not:

1. The general logic of the manual. The author should have written it from your viewpoint, not his—from the viewpoint of what you *do* with the program, not how the programmer

coded it. Ideally, you'll find descriptions of related commands in the same chapter.
2. The quality of the index. I'll charitably assume it's there to begin with. It should list even the most obscure commands—telling on what pages you'll find them.
3. Simplicity of vocabulary and sentence structure. A manual shouldn't impress; it should *teach*.

USEFULNESS TO OLD PROS AND BEGINNERS ALIKE

WordStar adjusts to different levels of skill. You have some **menus** to guide you, to help you decide, say, whether you want to print or see material you've already written. But most of the time you won't need menus during composition. Not after you're experienced, anyway. Some rival word-processing programs have menus that bog everyone down, beginners and old pros. But not WordStar. It has four "Help" levels, including one that keeps messages constantly on the screen to guide you. But you can zap all this once you're a WordStar pro.

WordStar is only as "friendly" to you as you want it to be. It isn't like a puppy leaping up on you and licking your face at the wrong time.

SPEED

WordStar lets you do your job in a hurry. Well, basically. If you're *just* turning out short business letters, for instance, and don't want to store them on your disk, try something else. WordStar makes you electronically save your words there before you can print anything. And that takes time. For swapping words around, however, for additions or deletions, few programs could surpass this one. Were I writing long sales pamphlets or annual reports, WordStar would be my choice.

Now, I'll qualify my "speedy" verdict. WordStar will slow you down when your computer has to reach instructions that the program hasn't already sent on to the RAM—the temporary memory. That means a time-consuming electronic trip to your floppy disk. Also, if you type in a certain amount of material, WordStar will automatically lock some of it on a

disk if the RAM is running out of room. WordStar is a **disk-based** rather than a **RAM-based** word processor.

That has its virtues, however, since, by farming out the runover to a floppy, WordStar lets you work with longer files. Some RAM-based programs may limit each document to only 15 or 20 pages in many computers unless you electronically splice them together.

Altogether, I'd say that WordStar, evaluated as a disk-based, fully featured word processor, is fast. And new wrinkles like hard disks will make it run still faster, even without the speed improvements that very likely will come. MicroPro, in fact, recommends hard disks for users of WordStar 2000, even if it will run with two floppies. Very soon most office micros will contain hard disks.

POWER

WordStar is powerful. You can, for instance, type "@" instead of a long name used commonly in your work. Then, when you're ready, you can plug the name in where the "@" appears. This **search-and-replace** feature is common to every advanced word-processing program; but WordStar implements it better than many rivals.

You can also use it with an accessory program, MailMerge, so you can type a list of names and addresses just once, then automatically plug them into the right spaces in a form letter. Only, it's individually typed, so people needn't know they're getting a form letter.

Of course, "power" isn't a virtue just in word processing. The best electronic filing cabinets, for instance, boast clever wrinkles to make it easier for you to enter new categories of information or to change individual records. Consider this story, which is true, about a reporter whom an editor was on the verge of firing. The severance pay was ready. The editor changed his mind at the last minute, however, and the final check stayed in his desk. Then, not long after, the paper's auditor stormed into the city room. "Why didn't you fire the son of a bitch?" he asked. "Now we'll have to spend all this time straightening out the records." Had the paper had a good,

powerful electronic filing system, the nonfiring would have been a little less traumatic to the auditor.

FEWER CHANCES FOR BOTCH-UPS

WordStar limits the chances for careless errors in the first place.

While you're working on a file, for instance, you can use the **Control-KJ** command to delete everything *but* the document you're in the middle of.

Granted, WordStar isn't perfect. Arthur Clarke, for instance, complains mildly of the underlining procedure. If he turns on the underlining, he'll occasionally forget to turn it off, meaning that, unwittingly, he'll underline everything that follows. WordStar 2000 corrects this problem by showing you true underlines on the screen, not just symbols at the beginning and ends of the underlining.

In record-keeping programs, especially, the anti-botch-up features can be real lifesavers. One technique is to limit the range of numbers entered. An elementary school, for example, might guard against typing errors in new files showing pupils' birth dates. The computer might then flash its skepticism if a clerk said a first grader was born more than six years ago.

THE JEWISH-UNCLE EFFECT

Without bogging you down, WordStar lets you reconsider some drastic actions. Suppose you're about to erase an entire **file**; that is, a whole document that you've worked on: say, a letter or a sales report. If you press the control key and the letters "K" and "J," WordStar won't act immediately. Instead, it will ask, "Name of File to Delete?" You can even get out of most commands before they're executed. It's simple. Just hit the "Control" and "U" buttons, then the "Escape" one. WordStar, in short, is good for the hotheaded. You feel as if Seymour Rubinstein—the MicroPro founder—is watching over you like some kindly, protective Jewish uncle.

A good record-keeping program would react similarly if you were about to erase 8 million names. A payroll program might inquire more than once if you wanted to register the firing of

five hundred people. A spreadsheet program could ask if you really wanted to wipe out dozens of numbers that you'd entered. A graphics package, ideally, would do likewise if you were about to erase an electronic equivalent of the Mona Lisa.

Some programs, in addition to saying you're messing up, will offer you alternative courses of action. The older WordStar isn't as advanced as some other programs in this respect. But normally the error messages are self-explanatory and the corrections obvious.

DAMAGE LIMITATION

WordStar limits the damage if you or your machine goofs in a big way.

It rarely sends you back to the operating system of your computer. What's more frustrating than getting, say, an A> prompt—the computer equivalent of, "Buddy, you're back at square one"? Then you'll have to reenter your work.

WordStar 2000 corrects one feature missing from the original program. Plain old WordStar doesn't let you delete a paragraph, then restore it without zapping other changes you made since you last saved your work on your disk. That is, there's no **yank-back** feature to undo erasures or other recent modifications.

But even the older WordStar makes an electronic equivalent of a carbon copy, a backup file—meaning that you're probably still in business if a glitch destroys the original. Uncle Seymour makes you think twice, literally, before you erase whole files.

The old saw of the computer trade, however, will always apply, no matter what the program:

"Garbage in, garbage out"—"GIGO."

Berenice Hoffman, my literary agent, really rubbed that in. I'm the type whose letters and checks take a little time to adjust to a new year. "For your records, if you keep carbons," Berenice replied to one note, "you might want to change the date to 1983—didn't the computer tell you?" The best programs in the world can't detect such mistakes.

But wait; I just remembered. The fancier computers have electronic clocks that potentially could warn you if the wrong

date appeared when you were working with a correspondence format.

AFTER-THE-GOOF FEEDBACK

WordStar also provides another service—offering error messages telling you what *went* wrong. It isn't perfect. Sometimes you may see combinations of letters and numbers, meaningless to someone without a manual. But normally WordStar is helpful. Say you want to use two markers—one at the start and one at the end—to designate material to be moved to another part of the document. WordStar will tell you if you forget to type out either one.

Ideally, programs not only will offer you a diagnosis after the goof but also a solution. Although WordStar isn't as advanced as some programs in this respect, it's very adequate for the experienced user.

ABILITY TO CUSTOMIZE

I adapted my WordStar to the requirements of a writer. Editors normally don't like hyphenated copy, so now WordStar's "hyphen help," which suggests possible hyphen breaks, is an optional feature instead of a normal one. No longer need I turn it off with special commands. WordStar provides a menu in the installation program that makes it easy for you to change normal **defaults**—the settings that your software will have before you tinker with it. The menu doesn't cover every possibility. But you can vary margins and many other important details, and once you're experienced, you can do a **patch**—a modification in the program—to change other things.

If you're a novice buying from a full-service computer store, ask it to set up your WordStar. Better still, try to dope it out yourself so you make your own changes in the future. You might get guidance from a users' group.

Likewise, you might tinker with a communications program to make it work better with the computers you plan to use and talk to. Or you might set up a record-keeping program to check automatically the accuracy of information fed into it.

ACCESSORY PROGRAMS

WordStar will work with a variety of accessory programs intended especially for it—everything ranging from electronic thesauruses to spelling checkers, word counters, footnoters, and a communications program.

Some word processors, accounting packages, other software, include all the functions you'd need. Others require you to buy the accessory programs. That's not always bad. Why bother to pay for a dictionary if you're a perfect speller? Just make sure—before you buy—that the original software either includes good accessory programs or will work with them.

Some outside companies' accessory programs, by the way, may be superior to those from the main software's manufacturer.

SUPPORT FROM THE MANUFACTURER

There is one plus that I wish I could have included in my praise of WordStar—good support from the manufacturer. Don't count on it. In the area of guidance and troubleshooting from the manufacturer, WordStar on occasion hasn't even been adequate.

Calling as a prospective customer, I couldn't find out if WordStar in a Xerox 820 format would run smoothly on my Kaypro. The company took down my message, then mailed me literature that didn't answer my question.

A California man phoned MicroPro with a problem involving DataStar, a sister program of WordStar that eases record keeping. "We do not have time to correct the programming that results in this quirk," he heard. He complained to *InfoWorld* that MicroPro "has some really elegant program tools but no inkling as to the meaning of customer support." Likewise, the head of a MicroPro users group in New York told the magazine that "fully half of the people who called me to join immediately presented me with a problem they were having."

For a while—I don't know what it'll be like when you're reading this book—MicroPro wasn't even replying to most

customers' questions on the phone; this supposedly was the dealers' job. And while Rubinstein's company indeed sells a Mercedes of a program, some computer stores aren't up to fixing the windshield wipers.

Ideally, software manufacturers like MicroPro will not only offer technical support but also 800 numbers so you won't be on hold for twenty minutes, racking up a formidable long-distance bill.

BACKUP IV On the Evolution of Software (And a "Perfecter and Perfecter" Program)

Mary Matthews, a gifted writer-editor in Chevy Chase, Maryland, favors a WordStar rival called Perfect Writer.

"What a conceited program," I say.

"WordStar's a dinosaur," she shoots back.

In late 1984 we both tried new versions of our pet software (actually WordStar 2000 is more of a successor), and while defending them, we harbor reservations.

First the basics. I myself prefer a program like WordStar Version 3.3, which is in the "get-what-you-see" tradition and shows your copy on screen almost exactly as it will be printed. But Mary makes a good argument for a rival with a different philosophy. WordStar 2000 in fact helps her case. It now has many of the features that her dear Perfect Writer came out with first, including split screens. Interestingly, however, the new Perfect is more useful to the "get-what-you-see" crowd than is the older version, while WordStar 2000 is *less* get what you see in an important way than 3.3 is. At least that's true of the WordStar 2000 previewed to dealers. During a demo, anyhow, a MicroPro employee couldn't coax 2000 into displaying double-spacing conveniently on screen even though we could have double-spaced on paper.

Where does the increasing resemblance between Perfect Writer and the WordStar family fit in the cosmic scheme? I'll recklessly generalize:

The word processors of the world are becoming like refrigerators; all the deluxe models will have the equivalents of automatic defrosters and ice makers and butter warmers and lettuce crispers. More of the new wrinkles will be marginal. And the surviving companies will be the ones that can explain and exploit the differences and support their customers the best.

Not everyone likes butter warmers. As noted before, WordStar 2000 isn't an unalloyed improvement for me, and the "perfecter" Perfect in some ways disappoints Mary.

The older WordStar lets you move to the left of a line with the combination of the Control key and the letters Q and S or **Control-QS**. A touch typist could do this almost instantly. WordStar 2000, on the other hand, uses **Control-CL**. **CL** stands for "cursor left," **CR** for "cursor right," and mnemonic commands like those are indeed easier to keep in your head, especially if you use a program only occasionally. On the other hand, the new strokes are harder for a touch typist—this one, anyway. Likewise, Mary wishes that Perfect Writer's new commands were a bit more logical, especially to old Perfect Writer hands.

Concluding, Mary says Perfect Writer users with 64K machines shouldn't junk them to buy more powerful computers just to run the new version. My thinking is basically the same about WordStar 2000 versus WordStar 3.3. The older program isn't as good as 2000 in some cases; for instance, when you could use built-in memo format to make temporary employees more productive. But 3.3 is still terrific for people *without such needs*, and I'll think long and hard before I myself change.

Mary's impressions and mine are typical of many veteran users of software who can't stomach features added for novices. She's 100 percent right except when we disagree. As "host," I won't rebut her in the places below where we do.

Here's what she sent over the phone via her Kaypro II:

> Somehow, I'm not sure how, I've gotten to be enough of an authority on Perfect Writer—the "old" Perfect Writer, that is, the one released in June 1983—that strangers call me up and say that a computer salesman somewhere told them I was the Sibyl who could answer their questions with a local instead of a long-distance phone call. Luckily, the questions usually run in the "How the heck do you do X?" vein, or I might have to reveal that I'm only a good-hearted writer.
>
> Now the Perfect Writer people have released a brand-new version of their already powerful program, and I think I'm in trouble. The new, revised version of

Perfect incorporates some radical changes—sweeping enough to demand 128K of RAM (and IBM PC DOS) to operate. (Actually, after claiming that the new Perfect can edit documents of up to 100 pages, the manual states that “with 64K of RAM you will be able to edit documents about 5 pages long,” so I assume that the new Perfect takes up about 56K of RAM—not being familiar with the PC’s way of juggling numbers, I can’t tell exactly.) I’m in trouble because I won’t be the reigning Sibyl anymore unless I can figure out how to buy a PC-compatible computer with a decent keyboard (most PC keyboards are horrid) and still do things like pay bills and buy the occasional loaf of bread and jug of wine.

The most radical of the changes is that the new Perfect Writer now uses what it calls “pop-up command menus” during editing. When you hit the Escape key, a small (about one-twelfth of the screen) “top menu” will superimpose itself over your text, as close to your cursor as possible, three characters away to the left or right. It lists your choices for subsidiary menus, which eventually lead you to the command you want.

Nearly every command has been changed, so that those of us who are used to the old Perfect Writer must learn the editing commands all over again. The new manual (haters of the old one will be glad to learn that the index is now at the back where it belongs and those frustrating Roman numerals are gone) explains with a straight face that the pop-up menus exist so that you “don’t have to memorize command sequences.” Of course, if you plan to use Perfect Writer more than once a year or so, you’re going to memorize the commands, anyway; and so, as the manual airily says, the Control key does everything the Escape key does, identically; the only difference is that you “bypass” the top menu—because, it says, you aren’t always going to want to see it. Mind you, if you use the Control key, you’ll see every menu but the top menu, anyway.

Is this enough reason to change all the commands but one—to bypass *one* menu?

To me, this is not an improvement over the old Perfect Writer—not unless you actually *like* added keystrokes. All the old two- and three-keystroke commands are now three-keystroke commands at least, and often four or five. This is progress? The new Perfect Writer has indeed taken pity on us and assigned to the PC's function keys twenty frequently used commands, so that if, for example, you don't feel like keystroking **Escape-DS-Carriage-Return** to save your document and continue working on it (**Control-X-Control-S** in the old PW), you can keystroke **SHIFT-Function Key 9-Carriage Return**. Whoopee.

Let us not carp too much about what strikes me as suspiciously similar to kludge, since the new Perfect Writer is as fast or faster than the old Perfect Writer. We're probably only talking about a few microseconds, mind you, but it still seems to me that the execution of Perfect's new commands is usually close to instantaneous. This is a thing to marvel at when you compare Perfect Writer to WordStar 3.3, where unless you have a specially speeded-up version with specially reassigned command keys and fingers with a lightning-fast touch, it takes forever to execute certain commands (well, ten or twenty seconds) and perceptible time (say, one or two seconds) even if you do have the speed. But I still say the 50, 100, or 200 percent additional keystrokes are a pain in the you know where. The program may be faster, but the human being is now 50, 100, or 200 percent slower.

One improvement in particular is one to run through the streets singing about: Perfect Formatter has been incorporated into Perfect Printer in the main menu (inexplicably renamed "PSI"), and the two of them together are approximately a million times faster than they used to be. Thank you, Perfect Writer!

For a couple of years now, I have been using Perfect for the long, complicated projects, like books, that demand powerful editing capabilities and Perfect's special strengths—such as split-screen editing, automatic footnoting, automatic construction of a table

of contents, etc. For shorter things, like personal letters, I've been using WordStar, for its what-you-see-is-what-you-get screen. The main failing of the old Perfect was whether or not you were using the document design capabilities, you had very little idea of what the final product was going to look like. (The main failing of WordStar, which as far as I'm concerned has been a dinosaur for several years now, is that it can't do half of what Perfect can—and it does it slowly, too.)

Shout "hallelujah," brothers and sisters! The new MS-DOS PW allows you to choose between using its old "@@ commands" and having what-you-see-is-what-you-get. Or you can mix the two of them (not that I know why anyone would want to, since with the PC I'm using, you can't tell when a word's been underlined).

You can now get on-screen justification if you want it; and if you want to underline a sentence, you don't have to worry about your on-screen justification being thrown off 4 or 5 characters—you just position the cursor in front of the material you want to underline, go to the end of it, and tell the machine to underline it. The exact command sequence for underlining a sentence is **Escape-T-B** (begin marking), **Escape-F-S** (go to the end of the sentence), **Escape-A-M-U** (underline the marked area). This looks like a lot of work, especially compared with the old PW's @@ux{}, until you stop and consider what the same thing would be in WordStar. Suppose it's a ten-word sentence you want to underline: you'd go to the start of the sentence and keystroke something like this: **Control-P-S**, **Control-F**, **Control-F**, **Control-F**, **Control-F**, **Control-F**, **Control-F**, **Backspace**, **Backspace**, **Control-P-S**.

I'll break discipline and object to Mary's description of the WordStar underlining procedure. You could underline a sentence just by starting with one **Control-P-S** and ending it with another. What's the big deal, Mary? Your described procedure would apply only to material that you underlined *after* you wrote it. All those **Control-F**s do is make the cursor jump a word ahead. *Grrr!* Then again, maybe I'm

simply a more decisive underliner. I *know* what I want! If nothing else, this little disagreement shows how work habits influence choices in word processors.

Not only does the new Perfect Writer have the old Perfect's strengths—split-screen editing of up to seven documents at a time, a zillion powerful editing commands, still another zillion powerful document structuring options—but it's added a few more just for fun. For example:

- The old Perfect allowed you to delete from wherever the cursor is to the end of whatever sentence you're in; the new one lets you do that, of course, and also lets you cut to the end of whatever paragraph you're in—or an entire paragraph, if you're at its beginning.
- Now you can delete not only the next word ahead of your cursor but also the word behind it—a small thing but amazingly handy.
- You don't have to delete text before you copy it. (However, the process is more complicated than it used to be.)
- You can flush right material on screen—useful for the what-you-see-is-what-you-get feature.
- You can more or less paginate on screen—although this instruction is only good for the what-you-see-etc. editing; it's useless for the document-design mode (@@ commands).
- You can use the "Search" function to search not only the document you're working in now but any and all other document files on your diskette. This strikes me as amazingly handy for editing multiple documents when you can't remember what the name of the other document is or where the reference is you're thinking of. For example, suppose you're writing to Joyce Davenport and you want to add a paragraph from a letter you wrote to James T. Kirk but you can't remember more than that it was about artichokes. You would invoke "search document"; the prompter then asks you what you're searching for, and you say, "Artichokes." Pretty soon you have a list of the

documents the word “artichokes” appears in, and you can then call up the one you want for multiple-document editing.

- Similar to this is something new the main menu offers: you can compare two files, and Perfect Writer will show you their differences—useful for comparing edited and unedited versions of a report.
- If you have a color monitor, you can “paint” the letters and backgrounds of the up-to-seven files you’re working on different colors (eight background and sixteen letter colors), so as to tell them apart. For me, this falls into the “who cares?” category, but some may like it; and I have to admit, you can get some very pretty (though not always easy on the eye) combinations.
- Perfect Writer now has the printing option “End at page X.” Shout hallelujah, brothers and sisters!—the new Perfect at long last has caught up with the dinosaurs like WordStar.
- Some of our old favorite document-design commands have been renamed, usually for the better. And we have one absolutely dandy new command: **@@need**. **@@need** makes sure that there’s enough room left on the page for a chart or similar material. If you’ve just written a 15-line poem that can’t be broken between pages, immediately after the last line of your poem, type in **@@need{15 lines}**; if there isn’t going to be enough room on the page, your poem will automatically be “forced” to the following page. Hot diggety!

All is not completely rosy in Perfect land. The new Perfect has lost some of the old Perfect’s advantages. For example, the old Perfect had an automatic feature that told you where in your document you were—35 percent of the way through, or whatever. Moreover, the old Perfect had a command that let you know how long the document was in terms of both number of lines and number of characters, and where your cursor was in all this. I’ve searched the new Perfect manual and haven’t been able to find any equivalent new command. The closest I’ve been able to

come is a command that lets you know only how many characters there are in the file, not where you are, or anything else; and the command isn't listed in the index, nor is there any equivalent command that I can find. Great work, guys. This is what I call a major frustration. It's maybe bad programming, and it's certainly bad documentation.

The new manual is slightly better organized than the old one, but that's not saying a lot. I've rarely been able to divine the new name for the old command in the new manual, and when I've found it, it's usually been by accident. It would have been an enormous service if the Perfect people had put in some sort of comparison chart for us old-Perfect old pros.

Like the old Perfect, the new Perfect is very cavalier about the number of spaces it leaves after a period or colon; sometimes it's the two you typed in, and sometimes it magically gets transformed into one. The new Perfect goes the old Perfect three better and is randomly cavalier about the number of spaces it leaves behind a period, colon, quotation mark, question mark, and parenthesis—not only deleting spaces where you do want them but also inserting them where you don't want them. Instead of mildly annoying, this quirk is now big-league annoying. May whoever thought it up and liked it so much he/she expanded it spend eternity brushing gnats out of his/her face!

You still can't tell the Search feature to search for something X number of times. For example, if three times you use the word "pishtosh" and want to change it to "nuts," you can't tell the search-and-replace feature to "do this three times"—as with the old Perfect, you have to do it twice with the "Ask me" and then "Cancel" the third time and do it by hand, or do it three times and then have Perfect search wastefully through the rest of the document for something you know is not there.

The new Perfect's printing menu is better than the one the old Perfect came with but not nearly as good as the menu that David Hite developed in 1983 for the old Perfect Writer. The only improvements are the "compare" feature

mentioned earlier and the ability to step outside Perfect for a while into Perfect Calc, Perfect Filer, or a telecommunications program—nothing I'd write home about.

We've lost the "one word" command—a serious blow for those of us who used it to get around Perfect Writer's cavalier treatment of periods and colons. This command caused the characters placed within it to be considered one word, so that Perfect Filer wouldn't split certain words between lines.

Perfect Speller, which is now on the same diskette with Perfect Writer, Perfect Formatter, and Perfect Printer, is much faster than it used to be. Alas, it is just as stupid. Unlike better spelling checkers, Perfect Speller works on the system of prefixes, suffixes, and roots. In other words, if the word "check" is an acceptable root, then "checker" and "recheck" are acceptable. So are "checkment" and "checkation." And like the old Perfect Speller, the new Perfect Speller doesn't recognize its own vocabulary—it queried words like "blankline" and "ux," which are Perfect Writer commands and ought rightly to be ignored. My recommendation is to get The WORD Plus, which can be renamed to be accessed as if it were Perfect Speller and which is far superior.

An interesting—I don't say terrific—addition to the Perfect family is Perfect Thesaurus. You substitute the Perfect Thesaurus diskette for your document diskette in drive B, position the cursor on the word you want to look up, type **Escape-S-T**, and Perfect Thesaurus checks its dictionary. If the word is there, you may substitute any of the synonyms for your original word, type in your own replacement, or say "forget it" and go on to look for another synonym. The hype says that Perfect Thesaurus "holds nearly 50,000 words (entries plus synonyms)."

The parenthetical remark is the key one to home in on. I asked Perfect Thesaurus to look up "transform," and it did; one of the synonyms it offered was "metamorphose." When I asked it to look up "metamorphose," it told me, "Word not found." (Perfect Thesaurus has also never heard of "fanatic," "asinine," "pop," "airy," "bypass,"

"instantaneous," or "shrug," among about fifteen others of the forty-five words I tried.) I'd estimate that the average number of synonyms offered for each word is between five and ten—if we compromise and say seven, that's only 6,000 or so words that Perfect Thesaurus can recognize. Moreover, Perfect Thesaurus can only look up fifteen words before it starts yelling, "No more marks," and refuses to cooperate any further.

In other words, Perfect Thesaurus is a nice toy, but I question its usefulness for serious writers. Having a copy of *The Synonym Finder* by your desk offers you about a million words that you can recognize, and is about as fast to use.

The new Perfect Writer itself still has many of the annoyances of the old Perfect Writer:

- The automatic swapping feature still cuts in at inopportune moments and makes you wait before you can continue typing or execute a command. It's now only one second or so instead of five seconds or so, but it's still annoying.
- There is still no automatic indicator showing where you are in your document or how long it is, a feature of every other word-processing program known to humankind.
- You still can't customize the document-design commands (although it's usually possible to get the look you want if you've used Perfect Writer for many years and know some tricks they don't mention in either the old or the new manuals)—if you want some *real* customization, tough noogies.
- You can still start printing by referencing page and section numbers, but if you want to start with footnote 125, you're in for a major pain.

The new Perfect is more powerful than the old one, but not by as much as its creators fondly think. After spending two days evaluating the new Perfect for this article, I went home and spent several happy hours with the old Perfect. Oh, I admit I thought now and then, I wish I could cut to

the end of the paragraph, or, I wish I could delete the word behind the cursor instead of only the word in front of it—and the old Perfect Writer is indeed slower than the new one (by maybe 5 percent?)—but on the whole I found I preferred two keystrokes to five and three keystrokes to six.

Many of the improvements of the new Perfect Writer fall into the category of kludge: lots of flashing lights and ringing bells and chrome and racing stripes and wow, look at that dashboard! Perfect Writer is still the best word-processing program I've ever run across, but for those of you who don't want to give up your 64K non-IBM PCs, don't worry: you're not missing enough to make spending all that money worthwhile.

BACKUP V "3-D" Versus Mail-Order Software—and How to Shop

How to pick the right disk?

People like Dusty Park know how to improve the odds. Park was at the top of his class at a computer school, worked as a customer support man at MicroPro, then joined a mail-order house called 800 Software in a similar job.[102] I phoned him there when my mail-order copy of WordStar didn't work on my machine. It was a common industry problem, this incompatibility. *Theoretically*—which doesn't mean that much—my Kaypro could read disks in the electronic format of the Xerox 820. Yet my machine in this respect seemed functionally illiterate.

Park told me on the phone that many other Kaypro owners were suffering similar difficulties, that if need be he'd send me another disk set up for my computer. Step by step he went over the WordStar installation procedure with me.

As it happened, I succeeded without him—by having WordStar electronically piped over to the Kaypro from another machine when my micro wouldn't reach the disk. Park had been ready with patience and empathy. I took it for granted that he would suggest buying by mail in many instances; but what advice, based on his MicroPro days and other experiences, did he offer about buying "3-D," as he called it—buying in the flesh from a store, in other words?

"The best place to go if you're buying software retail," he said, "is to someone who's doing a training seminar in the same program you're buying. That way you've got it aced, because the person who's doing the class is going to know the program well.

"You don't have to take the class, but at least you know that there's somebody there who could be asked a question."

Not that a dealer has to know *every* wrinkle of a program to teach it. But you've still got a head start if you do choose a store with classes.

Just be sure that the instructor isn't a circuit rider, so to speak—that he isn't flying out of town to another store as soon as he completes a series of classes. You want him around to answer your questions later on.

This principle would especially hold true when buying software from franchised stores. Some stores may be excellent. Others, however, as Park pointed out, "may be a bunch of small businessmen who used to sell shoes and bought into a franchise at an exorbitant price."

Offering, obviously, a mail-order perspective, Park said that the computer-store managers he knew didn't always know their software lines because there were so many products to keep track of. "It takes too much time," he said. "There's too many things to do in a 3-D store to handle that. Mostly you're showing people hardware."

His opinions rang true. Trying out WordStar with Osbornes, I'd run across sales reps who couldn't show me how to make printouts of the letters on the tiny black-and-white screen. Some sales reps were "terminally" dumb. Others were bright and helpful but too busy selling too many machines to pick up the basics of WordStar and other heavy-duty programs. WordStar wasn't *that* hard to master, however. I wondered how stores could counsel customers if they couldn't even train sales reps.

I asked Park about mail-order software.

croPro," he said, "I told people, 'Don't buy by mail. The dealers are the ones who can answer your questions. You have a real, live, 3-D person.'" MicroPro had instructed Park and five colleagues to try to duck the time-consuming questions from businessmen and others using computers and to refer them back to their dealers. And yet Park and the others had actually ended up spending half their time responding to the pleas of "end users." And many were the customers of mail-order houses.

But now, Park said, some mail-order people were competing not only with low prices but also with technical support; 800 Software had even hired a software guru from the University

of California at Davis to evaluate programs it was going to sell and support. I myself had paid $250 for WordStar, or about half the $495 list price; however, after talking to Park, I felt I was in better hands than I would have been at the typical computer stores I'd visited.

I got everything I paid for; 800 didn't pull any cheap tricks like sending the software without a manual, which, in fact, some mail-order houses may do. This isn't an endorsement of 800 Software. It shows, though, that at times you can successfully bypass the wretched support and high prices that many stores inflict on software shoppers.

"Save by ordering some software by mail," advises *CPA Micro Report*, "but only if the package is easy to install and easy to use. If you'll need training before you can use it or if the package must be configured for a hard disk, buy through your local dealer. Word processors and spreadsheets are examples of software you can safely buy through the mail. General accounting, client write-up systems and communications software should be purchased through a dealer."

It's good advice, basically. Park says few people call him about spreadsheets, that they're easier to unravel than many programs. So what's the most trouble? Data bases, sometimes. "But word processors definitely take the cake.

"You've got to deal a lot with special features on printers, like boldfacing and underlining and whether the software will let them work right," Park says. He suggests the obvious—that before buying new software, you find out how it will run with your printer and computer. Of course, as stated earlier, you'll ideally select your hardware *after* you've chosen your general range of software. Park says most people don't fully "realize the implications" of the software they're ordering "because they haven't thought of it yet." There's the old problem, of course. How do you know you'll like the software until you've tried it at leisure? And then you normally can't get your money back. Before you order by mail, give serious thought to asking someone locally for a "3-D" demonstration.

A very leisurely tryout, in fact, is a good idea no matter how you're buying, mail or "3-D," and ideally you'll have someone

with you—a clerk, a secretary, anyone who'll actually be using the system.

You might even want to bring along your accountant or somebody else working with the information that comes out of your computer system. At the very least, show him the software manual before you buy the program. Don't take the software seller's word that the software will keep the IRS or the SEC happy. Instead, trust the accountant or lawyer you use in your business. If he's uncomfortable with computers, ask him to recommend someone in his profession whom he could work with. You don't have to fire him. Just get him the backup he'll need.

A computerwise accountant, for instance, can tell you if a general ledger package has a good **audit trail**—a way to keep track of what was done on the computer system to make the records come out the way they did. A computer-literate lawyer or accountant can also make certain that the software is reasonably crook-proof.

Follow the same rule as with hardware. Find someone already using the program you want to buy. Is he happy with it?

The nearer his work is to yours, the better. The best authority on accounting software, for instance, isn't a computer guru: it's an accountant. But beware. Some people may have chosen their programs without considering the alternatives, and they might have done better using a different system. Ideally, your fellow accountant, lawyer, doctor, whatever, did plenty of shopping before making up his mind.

Also, remember how subjective software is. Even if someone is in your field, he may think differently and do his job differently.

Of course you might read reviews in computer magazines, but be careful. I recall how glowingly some of them described early versions of Select; how they said it was superb for heavy-duty writing, even though, quite clearly, it was a bona fide kludge.

"How could the reviewers be so wrong?" I asked a computer salesman, a good one, who had sold a number of copies of the Spellbinder program to Kaypro buyers unhappy with the early Select.

He replied, “Advertising. They did a lot of advertising in the magazines. That’s probably why.”

Well, maybe. More likely, however, the reviewers simply were writers unfamiliar with alternatives like WordStar or computer experts unfamiliar with the needs of most writers. Your best bet is to read the magazine reviews, and this book, knowing that the ultimate authority on your software needs is *you*.

BACKUP VI "Easy" Data Bases: Another View (Mensa Member Versus InfoStar)

Charlie Bowie, one of the stars in Chapter 6, "Three Software Stories," breezed through the dBASE II program. But not everyone will find all data bases so easy. Mary Matthews didn't. And you can't call her stupid. She is, after all, a Perfect Writer guru/Sibyl. Also—I'm sneaking this in behind her back—her IQ is high enough for her to belong to the Mensa group for bright people. She's a Smith College alumna, a human dictionary, now working as publications director at a prestigious prep school. I thought that InfoStar—well reviewed in a major micro magazine—would be a cinch for her to learn and use in listing the traits of a good data base.

Well, back comes this essay telling me that she banged her head against InfoStar for a week and almost committed hara-kiri. You can interpret that as a failing either of Mary or of the program. I'll blame the software and documentation.

(Of course she's full of bilge in her Perfect Writer review when she knocks my beloved WordStar.)

Mary, please note, has nice things to say about InfoStar's power; she says it might even be worth the torture. And a consultant can simplify the program for you. Still, if *Mary* is having trouble befriending InfoStar, what about average people who must master powerful data-base software?

They'll succeed only if they have time and buckle down. They mustn't swallow the manufacturers' cant that the programs are "simple"—at least not if the software's like InfoStar. Oh, well, at least they can console themselves that their business competitors may also be suffering.

And once learned, programs like InfoStar (as Mary's essay shows) can indeed make life easier.

Her observations:

There are a number of data-base programs on the market for personal computers, with new entries coming in daily. The MicroPro people—parents of the famous (or infamous) WordStar—have come out with a dandy of their own: InfoStar, which can sit up, roll over, and whistle Dixie.

What does one look for in a data-base program? To a certain extent, of course, it depends on what one wants. Someone who wants to put a Rolodex file on to the computer is going to need a lot less by way of power and versatility than is the owner of a small business who wants to use the data base to keep track of clients, orders, and inventory.

The first thing to think about is how much data the program can handle without going off its nut or slowing down so much that you could walk to Waukeegan and back while your program is processing any entry. Here are some terms and ideas to keep in mind:

- The **data base**, or **data file**, contains all your entries. InfoStar allows any number of data files per diskette; others allow only one. Score one for InfoStar.

- The **data record** covers *all* the information you store for each entry into your data base. How big will your program allow each data record to be? How many data records will your program allow before it seizes up and refuses to accept any more? Will the program warn you that as of X moment its files are full and it won't accept any more records? (I once spent two days trying to figure out why Perfect Filer was giving me back nothing but garbage before I thought to check and see whether my diskette was full.)

  InfoStar will allow you a maximum of 65,535 data records per file. By way of comparison, Perfect Filer will accept as many data records as the diskette will hold—

about a thousand if your diskettes will hold 200K of memory and you've filled up your data entry screen with lots and lots of data fields; probably a skillion if you only have one one-character data field and a lot of disk capacity. The new program dBASE III will allow over a billion records or *two* billion characters in a file—again, up to the limit of your disk space.

□ The **data fields** are the building blocks to your data record. Some obvious attributes a data field may have are that it is alphabetic (letters only); numeric (numbers only); or alphanumeric

(okay, you guessed it). That's about all the simplest data base programs allow—but here's where InfoStar is an absolute champ. Some of the attributes InfoStar will allow:

1. The field may only contain certain numbers and/or letters—for example, if you're typing in a state abbreviation and type "IT" when you mean "IN," InfoStar will stop you and tell you that's not acceptable. (It does this by checking what is called an authority file and comparing the authority's contents with your input. Handy-dandy!)
2. The field will *enter itself* based on your previous entries. For example, you can enter that your customer wants 47 of your code number W889AA (widgets), two entries; and InfoStar can look up the price of widgets, multiply that by 47, look up the sales tax for the state you inputted earlier, multiply your subtotal by the amount of sales tax, and all by itself enter the name of the product, the subtotal, the amount of the sales tax, and the total—zip-zip-zip-zip, four entries, all done by the computer rather than by you and all done in a flash. The first time I tried it, I was startled into yelling, "Wa-hoo!"
3. The field can be a constant. For example, if your data record contains years, you can tell InfoStar to enter "198" automatically, and you only have to enter "4," "5," or whatever.

4. The field can automatically shift cases for you. For example, you can type in “new york, ny,” and InfoStar will insert into the data record “New York, NY.”
5. The field can insist that whatever you type in is identical two times in a row or it won’t save the data record—useful if you deal with complex numbers that *have* to be right.
6. The field can be required—something that you *have* to enter, or InfoStar won’t let you go on.

Oh, and these are only examples! I guess I’m just a simple country girl, but I was amazed and thrilled by all that InfoStar could do with its data fields.

☐ How big are your data fields allowed to be? How many fields are you allowed to have? InfoStar allows you a maximum of 245 fields per record, and a maximum of 255 characters per field—it comes out to a maximum of 62,475 characters per data record. (Perfect Filer, again by way of comparison, theoretically allows 70 fields with a combined total of 1,024 characters. On the other hand, the one time I tried to test this limit with Perfect Filer, the program went comatose on me.) I do wonder whether an InfoStar data record that was 61K in size might mean you would get fewer than 64K data records into your data base. On the other hand, who could imagine a 61K data record on a personal computer? It is, after all, about the same size as a 60-page letter to your Aunt Millie, and how often do you write 60-page letters to your Aunt Millie?

☐ Once you have data in your data base, the **sort keys** determine how you can get the data out again. Do you want to get the information out in alphabetical order by name? Numerical order by ZIP code or phone number? Some combination of the two? (For example, you might, if the information is in your data records, want to sort your friends by who is left-handed, who gave you a Christmas card last year, when their birthdays are, or all of the above.) How many sort keys will the data

base allow? What kinds? How long does it take the program to do a sort?

To take a primitive example, Perfect Filer allows you up to five sort keys (alphabetical order by sister's name, for example; numerical order by ZIP code; both; numeric order by phone number; all three; and so on). Perfect Filer will also generate up to twenty subsets from which to sort. (Left-handed Republicans, female plumbers, all those who owe you more than three dollars—you name it.) And it will also let you have up to 40 list format fields—that is, it will allow you to generate up to 40 different kinds of list (all left-handed female plumbers who live on the West Coast). InfoStar, on the other hand, will allow you 32 sort fields, which is a few more than 5; but it doesn't have any subsets per se and doesn't seem to allow you more than one list format. On the other hand, the range of "logical expressions" it allows is amazing, and provided you understand BASIC (InfoStar's data are written in CBASIC) fairly well, you can attain heights of efficiency Perfect Filer couldn't even dream of (more on this immediately).

□ What kinds of **calculations** will your program do, and when does it do them? Some programs will allow you to add, subtract, multiply, divide, and other even more abstruse calculations, and all at the data entry stage. The best of these allow serial calculations. For example, take A and multiply it by B; then divide the result by C; then add it to D. A program known as DB Master allows calculations for only two fields at a time: A plus B equals C. D plus E equals F. C plus F equals G. Other programs will only allow you to specify that certain relations between data exist, and then only at the report-generating stage. Perfect Filer, for example, will allow you to specify that you only want your report to contain the people whose ZIP codes are between 20815 and 21903—but it won't do any arithmetic at all. InfoStar, on the other hand, can do algebraic and numeric calculations and impose such logical

conditions as “include this record if it meets X criterion”; “do this calculation unless the data field is Y”; “do this if conditions X *and* Y *OR* conditions P *or* Q exist.” Zowie!

□ What sort of “**overhead**” does the program demand? That is, what do you need to be stored on your diskette in addition to your data records? One trade-off might be that the more sort keys, subsets, list formats, and/or logical expressions you have, the less space you have for your data records. Unlike Perfect Filer, InfoStar creates an index file for every data file that you create. An InfoStar index file contains only the field values of your sort key(s) and addresses for each of your data records, but even so, with a lot of sort keys and with a nice, big data base, the index file is not going to be tiny.

Playing with InfoStar—after a week hunched over the keyboard, I still can’t say I’ve learned it—was, in order, daunting, boring, thrilling, mystifying, frustrating, and annoying. The program comes with four (count em, *four*) diskettes and three instructional tomes of a size and heaviness guaranteed to strike fear into the heart of a neophyte. We’re talking half again as big as the compact edition of the Oxford English Dictionary. We’re talking three three-ring binders crammed to capacity with information. Daunting.

The program comes complete with three on-line tutorials—one introductory tutorial that assumes that the person using it has never been near a computer before, one tutorial for data entry, and one tutorial for generating “quick reports.” All three are pretty to look at, slow as molasses to try to go through, and simpleminded in the extreme. The first one, for example, draws you a picture of a computer terminal on its screen just in case you’re suffering from selective blindness and can’t see the terminal you’re running the program on. My advice to those who buy InfoStar and who’ve ever even *seen* a computer before is not to bother with the tutorials—certainly not with the first one! —but to go straight to the training manual and start

plowing your way through. It shouldn't take more than a hundred years.

When I started playing with some of the data bases that InfoStar provides for its customers, I was excited. No, I was *thrilled*. I've never seen anything like some of the things InfoStar can do, and watching six fields fill up all by themselves after Id inputted one number made me chortle with glee.

InfoStar uses most of the same commands that WordStar does, which is convenient if you happen to *like* control commands. I first began to get annoyed when I discovered that InfoStar does not use arrow keys. If you want to move your cursor, it's **CTRL-D**, **CTRL-S**, **CTRL-E**, **CTRL-X**—the same commands WordStar uses and a major-league annoyance. Nor have any Function keys been assigned any values. And every single, solitary time you use InfoStar you have to go through at least four help screens—like it or not. Grrr!

I first ran into trouble when I began trying to define my own data record. Drawing the screen is easy; but what does one do when one is trying to assign attributes and runs up against prompts like, "Field derived? Processing order? Copy attributes of field? Pad field? Batch verify? Range check? Edit mask? Entry/content control character codes?" I'll tell you what I did: I read the training manual. I read the reference manual. I tried native cunning. I tried pounding my fist through the keyboard. I tried crying. InfoStar's hype says, "On-screen menus give you options in plain English ... while a series of help screens guides you through each procedure." Yeah; and I am Marie of Romania.

The same sort of thing happened when I started fiddling with the generation of reports. As promised, InfoStar "enables you to create and print a report in sixty seconds." The report prints all the data in the given file. Here's what the report for the file I'd tried to construct looked like:

```
B:MMPLAY REPORT
B:MMPLAY REPORT
B:MMPLAY REPORT

   10/21/84
   10/21/84
   10/21/84

   FIELD #001 FIELD #002 FIELD #003 FIELD #004
 FIELD #005 FIELD #006
FIELD #007 FIELD #008

    ____ ____ ____ ____ _____ _____ _____ _____
 ____ ____ ____ _____
____ ____ _______ ____
    mwm Mary W. Matthews
4823 Willett Parkway Chevy Chase
MD 20815
      ec Ed Corrigan
Pirmasens American School New York
NY 09189
```

I hope you get the idea. I'm too depressed to go on. So much for the "quick report" that you can create in only sixty seconds.

Next I tried to design a "custom report." The prompts didn't start out to be quite so confusing—"Is the file going to be used for Input or Output?" and "How large should the disk buffer be?" But by the time I got to "Edit mask," "Copy attributes to field," and "Enter algebraic expression," I was thinking seriously about hara-kiri. We are *not* talking quick and easy here. We are talking call in the professionals or resign yourself to a lot of long, hard work. Considering that I don't even get to keep the copy of InfoStar—I only own a 64K CP/M machine, and InfoStar requires a PC DOS and at least 96K of RAM and recommends that you use a hard disk (but will put up with two floppy drives provided that you can get 320K of memory on each disk)—I eventually just threw my hands into the air and gave up. There is no doubt in my mind that InfoStar is a terrifically powerful program that will allow you to do just about anything you want in the world of data bases. The doubt in my mind is whether I'm an ordinarily intelligent person who was thrown by some big-league complexity or whether I'm an absolute moron because I didn't find

the program “simple” and “easy to use.” (Variations of the words “simple” and “easy” appear seventeen times in the InfoStar hype booklet; for example, “InfoStar is ... easy-to-use ... goes well beyond the capabilities of a simple data base system. InfoStar eases the job of managers.... It’s really quite simple. The whole process is really quite simple.... And it’s easy....” All this on one page, mind you.)

To sum it all up in a nutshell, InfoStar offers some *wonderful* features, particularly in the area of making things easy for the clerk typist/secretary who’s doing data entry. And it is, as advertised, lightning fast at calculations and sorting. Its use of WordStar commands is a drawback, and its refusal to allow the arrow keys to function, along with its insistence on making you plod through help screen after help screen that you’re really not interested in, can be infuriating; but I suppose the clerk typist who is forced to use WordStar—at only five years old the dinosaur of word-processing programs—might find it convenient.

But if you, the doctor or lawyer or small business owner, want a custom-designed form or a custom-designed report, you’re not going to be able to delegate the job to a clerk typist/secretary/assistant. You’ll have to either hire a consultant to do it for you or resign yourself to spending days or even weeks mastering ideas and language that, to me, range from the arcane to the dumbfounding.

It’s really quite simple?

BACKUP VII ❑ Graphics Tips

No matter how you're using a graphics program, remember the RDHP—the Rough-Draft Hierarchical Principle. It also may help at times when you word-process memos.

The principle: create the basic pictures or prose yourself. But if pressed for time? Then farm out the details. Just as a secretary might put your memos in the right format on paper, he or she might also smooth your drawings. Or your art department might.

Here are other tips for graphics users:

KNOW YOUR CHARTS AND OTHER BASIC TOOLS

A **line chart**—a graph with the outlines of hills and valleys—is great when broad trends count more than the numbers themselves.

One glance at a good line chart can tell you if wok sales are up or down.

And for even better effect, you might try a **curve chart**, or **area chart**, filling in the area below the curves that the lines make.

"Instead of looking like a wriggly line," explains Carl Herrman,[103] an award-winning graphics expert, "it looks like a mountain. It's much easier to follow."

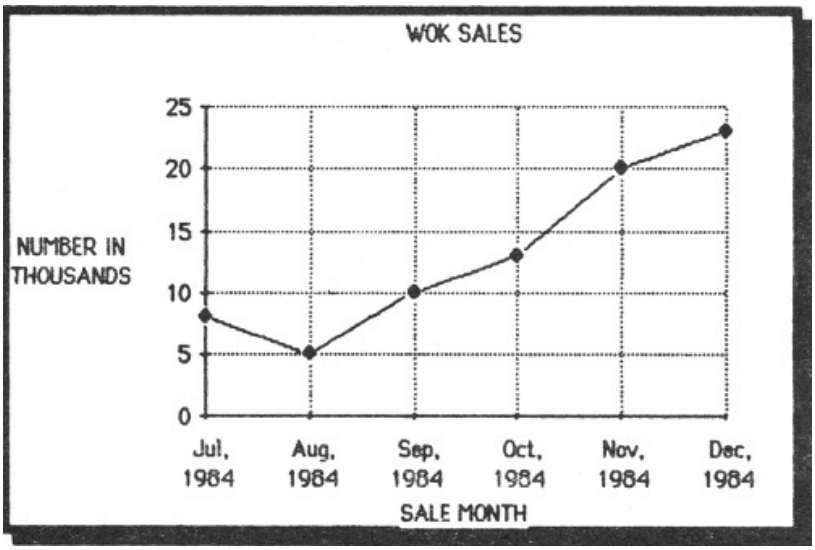
And if you want to show sales trends in three wok categories? Well, you can still use a filled-in chart.

"You might fill in the bottom one solid black," says Herrman. "You might do a **cross-hatch**—parallel intersecting lines—on the middle one. And on the top one, you might have a straight-line effect or a lot of lines running close to each other.

"That way, you can readily see the difference between the three It's more effective than three graph lines on top of each other."

Another tool is a **bar chart**, with bars of different sizes—horizontal or vertical.

NAME THAT CHART With Apple's Macintosh and the Microsoft chart graphics package from Microsoft, you can whip up charts like the ones below. Chart will even pick up numbers from a sister spreadsheet program, Multiplan. My thanks to artist Jo Steele, who works for the Dartmouth College Computer Center and is a partner in Northtronics Associates. Oh, and don't blame Jo for the use of those over-mentioned woks. My mistake. Next time I'll use dishwashers or watermelons.



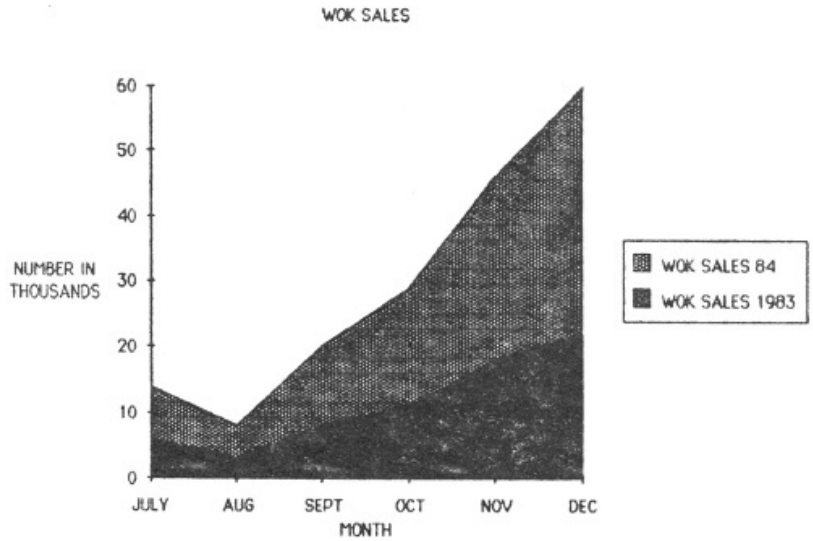
Do broad trends count more than the numbers themselves? Then use a **line chart**, a graph with the outlines of hills and valleys. Amalgamated Wok might decorate each sales rep's office with such a chart, at which a myopic CEO could smile or frown as he walked in.

Use a bar chart to compare sizes or emphasize differences, including those over time. With the bar chart, you might

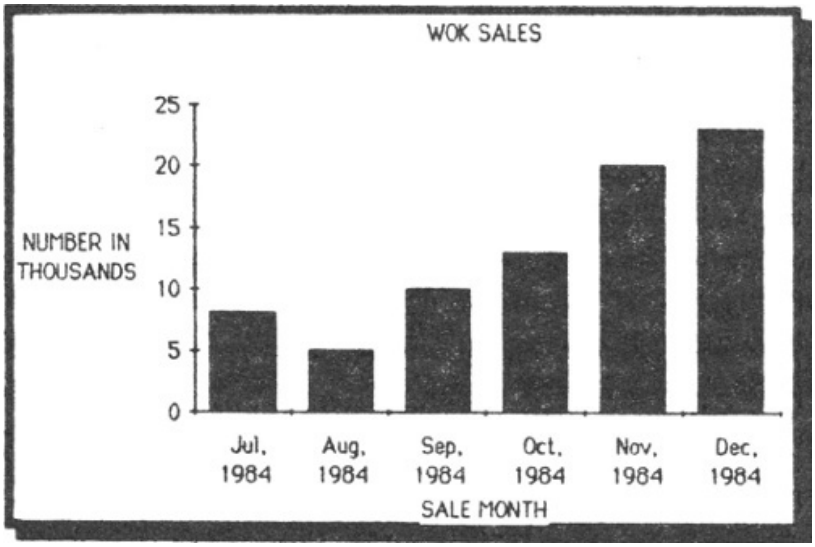
contrast 1979 wok sales with 1984's.

Don't normally use the bar chart, however, to illustrate trends. For that, it's usually back to the old line or curve chart.

Just the same, Mike Slade, a product manager at Microsoft, says: "There are times when you can illustrate trends successfully using overlapping bar charts—with bars of different colors or patterns.



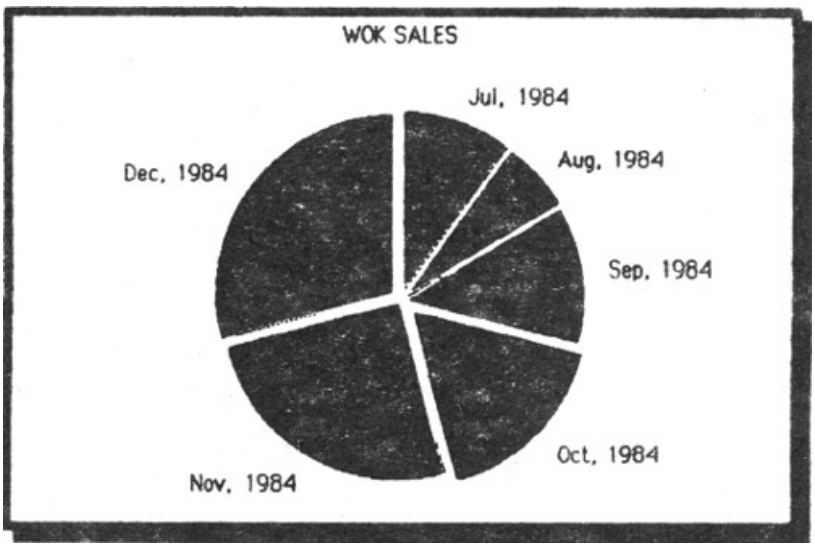
A **curve chart** or **area chart** is just a line chart with the area below the lines filled in. This is a deluxe version with different shadings indicating different years. A no-frills area chart might actually be easier on the CEO's eyes than would a line chart without shading.



Yes, wok sales are increasing and our canny artist used a **vertical bar chart** to emphasize this. Just the ticket for a presentation to a stock analyst studying the prospects of the Amalgamated Wok Corporation. Notice that numbers are easier to take in than those on a line chart.

"You might have a vertical bar for 1979 wok sales slightly overlapping with one for 1979 widget sales and continue these twin bars for the next five years.

"Use overlapping bar charts when you're showing trends for a number of different products or categories."



> Wow! Look at the hefty wok sales in November and December. Someone offer rebates? Actually you'd be better off using a **pie chart** instead to show the percentages of semi-annual sales from different regions. *Regions*, not the 50 states. You can only slice a pie so thin.

Yet another tool, the **pie chart**, just like a pie, with slices, nicely shows relations of complete parts.

Use the pie chart to show the percentage of sales that came from four or five regions.

On the other hand, suppose you have many, many small components in your pie—say, you're interested in the percentages of domestic sales in each of the fifty states. Then a map with percentages on it might be better.

I'll stop here—this is a computer book, not a graphics guide. For more detailed information, Herrman recommends *Designer's Guide to Creating Charts and Diagrams* by Nigel Holmes (from Watson-Guptill, New York).

KEEP IT SIMPLE—WHETHER ITS A CHART OR MEMO

Don't make your charts look like puzzles. "If you clutter up your chart with too many facts, you'll lose the very simplicity that graphics can offer," says Herrman. Home in on your main point. "If need be," he says, "use a short narrative under the chart to back it up.

"In fact, you might be able to say something in words more simply than with a chart. If you're trying to compare the cost of widget imports in the last fifty years and it's doubled each year, then why not just say so in prose?"

Also, avoid other forms of visual clutter. Don't make people's eyes spin with special effects and too many colors.

Grid lines—a series of little squares like those on engineering graph paper—often confuse chart readers. "Don't put them in if you can help it," says Herrman.

"Definitely not," agrees my friend Hard-core bureaucrat.

In memos, don't confuse your readers with a barrage of different typefaces. A little variety is good. But make sure you have a decent excuse, such as special points to stress or different categories of information.

"If you show off your fancy typefaces," says my friend the Hard-Core-Bureaucrat, "it's just a plague that'll make your eyes ache. That's one reason I'm down on fancy graphics for routine stuff. Some Macintosh users are going to produce memos that look like samplers from printing salesmen."

Even on a thousand-word memo, use three of four typefaces at the most. Also, don't stint on white space. Apple's manuals for the Macintosh and its more expensive sister, the Lisa, are models of wise use of white space.

AT THE SAME TIME, KEEP IT LIVELY!

If you can get away with it, why not try a little flair in your graphics and your points will be more memorable.

A good model in many cases is the newspaper *USA Today*, which sports some of the liveliest graphics in the country.

It regularly publishes charts with such sexy facts as amount expected to go for health care in 1990 or the percentage of women who received haircuts and other beauty-shop treatments in 1983.

To jazz up the chart titled "Only Their Hairdressers Know," an artist drew the face of a woman with her hair blowing out. The lengths of the bunched-up strands varied according to the percentages of women receiving different kinds of treatments. "Haircut" (76 percent) was three times longer than "Coloring" (a mere 24 percent). Today the average micro user may not be able to produce such "hairy" graphics, but the future may be different.

Snazzy graphics is like colorful writing. Humanize your work. The "Only Their Hairdressers Know" chart wasn't in the fanciest of color—just black and white and blue—but it was more eye-catching than most eight-color ones might have been.

And if you yourself can't draw too well even with a computer? Well, what a chance to liven up the workday of a

young, talented aide who'd like a break from the typewriter, er, word processor!

Besides, on occasion, you can at least do what an editor may have done with the hairdresser chart—think up the basic idea.

KEEP THOSE CAPTIONS LIVELY, TOO

Imagine you're writing captions for a hybrid of the *New York Times* and *The National Enquirer*.

Try to be accurate, clear, and interesting.

Snare the skimmers! Give them no choice but to read your report.

I'll qualify that. Alas, many report writers, especially the government species, don't *want* to be clear with words or charts.

Maybe they can scrutinize this section to know what to do in reverse.

KNOW YOUR COLORS—WHEN AND HOW TO USE THEM

There *is* life without color.

Just look at the nifty things you can do with high-resolution black and white, with its many different shades.

If your picture offers widely varied shapes and sizes, color just might not help that much.

Think, too, about costs. If Mac had had color, the $2,500 introductory price would have been several times higher. So Apple concentrated instead on resolution. And very likely, some makers of similar machines will do the same. There's a technical trade-off: color capability often comes at the cost of sharpness. Even black-and-white graphics today—at least the affordable kinds—normally are a far cry from the sharpness required in an annual report or the slickest sales brochure.

Still, to a generation weaned on color tv and movies, a 100 percent monochromatic life would be like a monastic life.

And color could be just the ticket for enlivening graphs that visually drone on and on with statistics.

What's more, it can help separate elements of charts. Just don't overuse or abuse the technique. Don't use color to slice a

pie chart too thin.

In working with color, you should know the best combinations. Often you'll want to alternate weak, cool colors with strong, warm, "advancing" ones that leap out from the screen. The strongest colors usually are bright red first, then orange, then perhaps yellow—it depends on your machine and other variables.

"Your weakest colors," says Herrman, "could be blue, green and brown. If you try blue and bright red, your chart will be much more readable than if it has green with blue. You might also use green and orange."

Try, too, to avoid adjacent colors that "vibrate" together in an irksome way. "Red and green is worst," Herrman says. Another loser: red and blue.

Other advice? Match colors to what they stand for. If you're comparing oil and gas production, the oil might be black and the gas a light blue. Oil sometimes *is* black. And gas often bums blue.

Remember, also, that dark colors often can better represent large numbers. Say your company has its biggest, best year ever in sales. And now you're bragging with a multiyear bar chart? Well, you use a dark blue or black bar to represent your recent, gigantic revenues. The leaner years, by comparison, might be a very light color or maybe faint grays or perhaps just white inside gray lines.

Yet another tip is to be consistent if possible. "If you're comparing oil and gas through twenty charts," says Herrman, "stick with oil in black and gas in blue in all the charts."

"But," you say, "how do I choose my graphics programs in the first place?"

Here are the questions you should ask, among others:

1. Does the program help you come up with pies, bars, or whatever kind of chart or drawing will be most useful to *you*?
2. Can it do so as quickly as possible?

   Here programs using a mouse—the pointer on your desk—have a real advantage.
3. Does the program fit in well with your other software?

   That's one advantage of Lisa- and Mac-type systems. You can more easily stick a chart inside a page of text—perhaps

sparing your readers a distracting flip to the back.

Another advantage of a "good fit" is that it may save you hours of typing and drawing. Look for programs that will let you select trends from spreadsheets, then more or less automatically whip up charts based on the numbers. This way, too, you don't have to waste time typing in the numbers from the spreadsheets. Microsoft Chart can do that with the right software for the Mac, Lisa II, and IBM computers. Are you shopping for a program that changes charts automatically along with the numbers? Then see if you can do this without having to clear the chart from your screen and replace it with a special menu.

4. How much memory space does the program—and the electronic files of the resultant drawings—take up?

   You want enough space on your disk for spreadsheets, word processing, and other programs *if* you change your tasks often. But you don't change often? Then don't worry as much about this.

   Frugal use of space, of course, is one advantage of integrated programs combining graphics with word processing and spreadsheets or communications.

   You might also worry about the lengths of the files. One chart can take up the equivalent of page after page in disk space if you're storing the image of the chart rather than the instructions for creating it.

5. What about the program's color capabilities—both on screen and on paper? How many colors offered? And if the program has preset color combinations, do they work well together?
6. Does the program coexist okay with the printer or plotter you own or are about to buy?
7. How easy is the program to learn? What about the other general traits of good software mentioned in Backup III, The Lucky 13?

Whatever your graphics program, don't stint on the hardware. A good, sharp, high-resolution screen is just as important—more so, in fact—as it is in word processing.

BACKUP VIII Consultant Contracts: Some Who-How Questions

Charles Harris, a lawyer who is expert in computer negotiations, ticks off a list of contract questions very similar to the Who-How from the newspaper world.

His list:

1. "Who?" Who from the contracting firm is doing the work? A junior member? If so, you might ask, "Can he perform? Will the consulting firm still bill me the full rate?" Find out the track record not only of the firm but also of the people actually doing the work. Write their names into the contract if you can. Spell out the qualifications of substitutes you'll use if the original people leave the consulting firm before finishing the assignment.
2. "What?" Describe the task as clearly and precisely as possible. And in my opinion you might consolidate the "What?" and the "How?" here. Is there a right way and a wrong way of accomplishing the "What?"? Find out the right way before signing the contract.
3. "When?" Can you negotiate a penalty if the firm misses a deadline? And how about a bonus if it comes in early?
4. "Where?" Will the consultants do the work in your office? Theirs? On your computer? On someone else's?
5. "How much?" Obvious.

In my opinion, you'd also do well to keep asking the "Why?"—to make the consultants justify whatever they have in mind for you. Why not? You're the one spending the money.

Also, at least consider the following:

1. Thinking small. Don't bargain over the Who-How simply for the whole project; break it up into parts. "You say, 'For this much money we expect to at least get a machine in the

door,'" Harris suggests. "'For this much money we expect to get the following diskettes for the following programs.' 'For this much money perhaps we'll talk about customizing software.'" If a consultant flubs an early part of the work or specifies the wrong programs or equipment, then you can more easily send him packing. "But," you worry, "can a rival consultant pick up the pieces?" Well, you simply insist that the original consultant do his work in as standardized a way as possible. See if he can use a program like dBASE II or III —software with which thousands of other consultants are familiar.

2. Making the consultant give you the source code of the new software. That's another pick-up-the-pieces kind of protection.
3. Insisting that any manuals for his software be complete and in plain English. If your consultant can write only computerese, in fact, you might not even want to bother with negotiations.
4. Bargaining if possible for a software warranty. Then, if you discover glitches in the software after it's in use, the consultant won't charge you to correct his own mistakes. You might not succeed here. But try.
5. Possibly requiring the consultant to give you a discount on modifications or expansion of your system.
6. Negotiating for full or part ownership of the software he may develop for you. But don't count on getting rich from the sale of the programs. Adam Green, a software training expert, tells of a computer-store salesmen who, in that way, would appeal to customers' greed. A taxidermist, for instance, might hear this pitch: buy from me, use the right consultant, and you'll make a killing in specialty software for taxidermists. "The consultants would usually intend to finish a job writing this specialty software," Green said, "but it would drag on, and the customers would run out of money, and the things usually didn't get finished." Very likely you *won't* want full ownership, because it would reduce the consultant's interest in perfecting his brainchild.
7. Forbidding the consultant from selling the new software to your competitors. Antitrust complications might arise if you don't bear the financial risks of software development. If you

do, however, you're within your rights to demand exclusivity, just as the consultant is within his rights to charge you more for it. "Trade secret" is a key phrase both here and on the issue of ownership. "I recommend to clients that they go for trade-secret protection because copyright law protects the information only in the way it's presented," says William Wewer, a Washington lawyer who specializes, among other things, in intellectual-property law. In other words, an unscrupulous consultant might bypass the copyright law by using a different programming code to duplicate your new software's functions.

8. Making the consultant pledge that he won't violate any trade-secret laws or copyrights. You don't want to suffer because someone else has plagiarized or pirated software. Be certain you'll own the *master* copies and instruction manuals that the consultant buys. Try to register immediately with the software company as the buyer or user of the disk. You want to know about updates of the product and about debuggings, which you won't find out about with a pirated copy. A shady Massachusetts consultant has resold the same dBASE II program ten or fifteen times. The buyers think he is purchasing it for them and that he's going to supply a version modified for their needs. "But halfway through the work," Green says, "he just walks off."
9. Hammering out a confidentiality agreement, if necessary, to protect company secrets. You don't want an outsider blabbing to competitors.
10. Making the consultant agree in writing that he is working as your independent contractor, not your employee. Protect yourself against unfair Workmen's Compensation claims and in similar ways.
11. Trying to write into the contract your right to a full explanation whenever you want one. Make the consultant justify his recommendation for a certain computer or a certain program; he owes you at least oral explanation and perhaps a written one. How much experience has he himself had with the product? Is he going by someone else's word? Whose? How certain is he that the software-hardware combo that worked for the other person will work for you? Can he

arrange a demonstration of the combo so you can see for yourself how the software runs?

12. Remembering that there's only so much protection the law can give, especially at the micro level. Trade-secret and copyright laws can be vague and expensive to enforce—a major stumbling block to a small business. Your best protection is simply to deal with a reputable consultant whose credentials you have checked.
13. Choosing the right lawyer, if you can afford one, for the contract. He needn't call himself a "computer lawyer." A good contracts lawyer or intellectual-property expert, if conversant with computers, might also work out.

If the job is simple enough, don't negotiate in the same detail that GM does when installing a $10-million mainframe. Again, even with small tasks, do sign a contract or write a letter similar to the sample one on page 114. And if you can afford it and the job's important enough, think about still-another contract—for a second consultant to check up on the first.

BACKUP IX Window Shopping

The ad men and writers have had fun with the inevitable: "Microsoft Does Windows."

You read the headline and envision some programmers with buckets and rags, bravely scaling Manhattan skyscrapers to help executives get a clear view when they're looking up from their computer screens.

Windows, however, actually are *within* computer screens.

You can split your screen into parts: one window showing a chart, for instance, while the other displays the report into which you're inserting it.

Of course you need a screen big and sharp enough to get good views of many windows.

And the software problems could be hairy. Microsoft as of late 1984 was months and months behind in releasing its windows-type product. Other companies were behind on theirs, too. Someone once coined a term for much-talked-about-but-late software—"vaporware"—and it is sure described windows.[104]

Well, now that the miracle windows are theoretically here, are they worth gazing at?

Depends.

Don't buy windows if you're just writing short letters and you needn't blend anything else into them or regularly don't consult other material.

But consider them if, say, you want to look at many spreadsheets quickly while writing reports.

Think what this means to executives with cluttered disks, er, desks. They can stash their material away electronically and not have to print hard copies as often in the future.

"I can imagine people having as many as twenty or thirty windows ready to call up with notes or working papers," says John Butler, a product manager with Microsoft.

Also, windows software may let you switch noticeably faster from one program to another. And with a RAM (temporary computer memory) above 500K, you may even be able to do so instantly.

The plus of this? You won't need to return as often to your computer's operating system and feed the programs one by one into the RAM.

So the machine may seem to impose itself less between you and your work.

When "windows shopping," however, you should ask these questions and more:[105]

1. Is the convenience worth the extra several hundred dollars you'll be paying for the window software alone if it doesn't come with your computer?
2. Up to how many windows can you see on your screen at once?
3. How do the windows look alongside each other? Do they **overlap**, just like papers atop each other? Or do they **tile**? That is, if you select more windows, the existing ones shrink, and you view less from them.
4. How about **data transfer**? If you move information from one electronic file to another, will important details remain? For instance, the way rows and columns coexist with each other on a spreadsheet? Can you cut a graph out of a chart and insert it in the text of a report without it shrinking or ending up distorted? Will it reproduce in as much detail as it would without your reaching it through a window?
5. What kind of graphics—**bit mapped** or **character based**? The bit mapping means sharper images. Your computer keeps track of each little dot, each pixel, on the screen. That hogs memory and may rule out color. **Character-based** systems, though, don't let you make your lines and curves as smooth as bit mapping does. They must work with already-shaped letters, numbers, and other visual forms.
6. Will the window program work with ordinary software or just products written for it? And how many of the windows' special features will do work when you use regular programs?
7. Will the windows at least slightly slow down some programs? A word processor may take longer for you to get

from one part of your report to another.

8. Is the program picky about the computers it'll work with? A window system *may* need over half a million bytes of RAM and a hard-disk drive storing 5 megabytes. Also, as of this writing, windows seemed geared more to the IBM-style MS-DOS computers than to the older but cheaper CP/M ones. Besides, some companies may not sell windows programs directly to ordinary buyers. Microsoft got various micro manufacturers to bundle the program with their products.
9. Does the program require a mouse—the gadget you roll on your disk to move the cursor? How easily can you control the program without a mouse?

BACKUP X Of Mice and Men—and Touch Pads, Touch Screens, Etc.[106]

"If you're a trained, high-volume production typist," asked Seymour Rubinstein, the WordStar developer, "what are you going to do with a mouse except feed it cheese?"[107]

Score one for Rubinstein. He says mice are great—if you have three hands.

Doing graphics? A mouse, maybe. But damned if I'm going to take my hands off the keyboard to push the cursor from one spot on the screen to the next.

It's simply too much wasted motion. I instead just press the cursor keys right above the main keyboard. Or I use WordStar's cursor-moving commands. And even if I hadn't learned touch typing a quarter century ago, I'd still wonder if a mouse for word processing wasn't the Silicon Valley version of *The Emperor's New Clothes*. Next time you're in California, maybe you'll see Apple execs naked in the streets as well as their hot tubs. Well, maybe not. The mouse could be a great marketing tool for sales reps peddling Macs or Apple IIc's to people hoping to do word processing. But experienced typists? Many would probably groan over all the excursions that the mouse forced them to take from the main keyboard.

Some enemies of mice—cats?—also wonder if jockeying the cursor this way couldn't be a little tiring for people writing or typing. Think of the hand-eye coordination required. You're rolling a palm-sized gizmo on your desk to position the cursor on a single letter at times, and that might not wear too well if you're working for hours on end.

Mind you, the rodents have their friends, especially at Apple, where, inconsiderately, the hardware wizards didn't even favor the Macintosh with cursor keys.

Joe Shelton, the Apple products manager mentioned in Chapter 7, says he does most of his writing with a mouse. He

suggests the mouse-equipped Macintosh for "naïve users." Your term, Joe. Now I'll slightly water down my jeremiads. Macintosh-style computers offer nifty graphics and nice offbeat typefaces. So some trendy writers may want one—rodent or not.

And if you're an executive or someone else not doing heavy word processing? Then maybe, just maybe, a mouse is for you. Perhaps you're working with spreadsheets, a number of programs in fact, and you write only a small fraction of the time.

Richard Webb—a partner at Peat, Marwick and Mitchell, the big accounting firm that advised Apple during development of the Macintosh and ordered thousands of them—swears by the mouse for spreadsheets. He says that alone would justify the mouse.

I'm not a spreadsheet artist and will take a pro's word. But at least for heavy-duty writing and typing, the old cursor keys are my best bet.

Graphics is different. There, the cursor keys are more cumbersome.

One artist, however, wanted not a mouse but an electronic "pad and a stylus"; he might be happy with a **digitizing tablet**—also known as a **graphics tablet**—like the well-known KoalaPad. You can write on this surface with a stylus or your finger and the computer will display the lines on its screen.

A **touch-sensitive screen** is still another possibility—for some people—both in word processing and graphics. You point your finger at a spot on the screen. Bingo! You can start moving a paragraph or perform graphics magic. But touch typists may face the same problem as with the mouse—wasted motion—and some people may tire of reaching up to the screen again and again. Also, touch-sensitive screens may not be precise enough for you to pick out just one number or letter.

Hugh Hunt raised an interesting issue.

"What happens if a fly lands on the Hewlett-Packard screen?" he asked someone about a computer with a touch screen.

Well, I hear, the HP 150's screen uses infrared touch sensors that are more than fly length from the glass. "Debugging" the 150, Hewlett-Packard must have thought of *everything*.

Yet other pointing devices are:

- The **joystick**. Moving the stick around, you move the cursor. A neat idea. But it's more fit for video games than word processing and many other business programs—you just can't point exactly.
- The **trackball**. You move the cursor by rotating a ball inside an enclosure. Want the cursor to go faster? Then rotate the ball more energetically. The trackball is found most often in arcade-style systems. It's great for chasing aliens and may have uses in spreadsheets and data-base management, but some people say it's an abomination for word processing.
- The **light pen**, with which you could electronically "draw" on the screen. *Draw?* Okay. *Write?* Well, it's "wasted motion" time again here, as with the other items on this list.

As computers climb the executive ladders—as more nontypists use them—these alternatives may grow in importance. And what about people on the factory floor? They may use such gizmos to make new inventory entries or machine adjustments. Partly the world is learning to type, and partly the computer is learning to understand devices other than the keyboard.

What cursor-control gizmos are ahead? I'll keep reading the *National Enquirer* articles about people moving objects with their minds. Maybe, the hard-core hackers are thinking, the next gimmick will feature some user-friendly ESP.

BACKUP XI The Micro Connection: Some Critical Explanations

When John Fuller hooked up his Heath micro over the phone lines to the Wang at his office, he had a head start on many other do-it-yourself telecommuters.

He wasn't a computer or electronics rookie. For years he had worked around big IBM's and Honeywells, and while telecommuting, he was a computer and management consultant with the navy. He even soldered together his H-89—a kit. And, anyway, he was communicating with another smaller computer, a Wang word processor.

Does that mean you should give up on do-it-yourself telecommuting because of the technical complexities?

No. Not at all. Before hiring a consultant, you might consider two possible sources of free advice: (1) your corporate data-processing department, if you have one, and (2) users groups, whose phone numbers you can get through dealers.

Before approaching anyone, though, learn the basics of the technology. A **modem** converts the *0*s from your computer into one pitch and the *1*s into another, and that whine, you'll recall, goes out over the phone lines. The "mo" in "modem" stands for "modulator"; the "dem," for "demodulator." And a "dem" springs into action at the other end—demodulating the whine back into the *1*s and *0*s.

Modems come in two varieties, **direct connect** and **acoustically coupled**.

The direct-connect modem hooks between the phone line and your phone, or between your phone and the handset. Its whine transmits better over static-ridden lines than do acoustic couplers, but it's normally a little more expensive, and hard to install if your phone lacks **modular plugs**, the tiny plastic ones that unsnap.

Using an acoustic coupler, you cradle your handset in rubber "earmuffs." A small speaker whines into the phone transmitter; a little microphone picks up the sound from the handset's receiver. Acoustic couplers don't need phones with modular plugs, obviously—a boon to traveling executives—but they might not work if the handset is oddly shaped, as it is with some of the new-style phones. Also, loud noises in the room can confuse them.

A direct-connect modem, for that reason and others, would probably be better for your regular office. Also, consider a **full-duplex** modem in most cases.

No, it isn't a modem for two-family houses. "Full duplex" is just jargon for computers jabbering back and forth, both ways, at once. Like two people on the phone. A **half-duplex** modem would allow just one-way communications without switching; it's somewhat comparable to a radio with an unwieldy send-receive control. There are times, however, when half duplex would be best. Normal phone lines, **voice grade** ones in telephone company language, can't handle computers jabbering at too high a speed, and half duplex may work better than full.

Like most modems for personal computers in the early 1980s, Fuller's gizmo transmitted information at 300 baud—equivalent to 300 bits a second, 30 characters per second, or 360 words per minute at 5 letters a word. When telecommuting, however, you may be better off with a modem going 1,200 baud. After all, it can zip material over the phone lines at four times the speed, and that means you're tying up your modem less on long documents. You might not be tying up *yourself* if you run an operating system like Concurrent CP/M, which lets your computer handle electronic mail while you're using it for other purposes; but a 1,200-baud modem is still a good investment if you can afford it. You may well be able to. Soon 1,200-baud modems with auto-answer features will commonly sell for well under $300.

Sent through a modem, the **data bits** are those conveying the information itself. And the **start bits** and **stop bits** keep track of the beginnings and ends of your micros' characters. The most common setting is a **word length** of 8 data bits and 1 stop bit.

Parity bits may help the computers check for errors caused by static and other electronic noise. Parity is said to be "even," "odd," or "none." This **error-checking** method has its drawbacks. It may fail if the mistakes cancel each other out—and it's slow since it checks every character. Some **communications programs** (the ones allowing computers to talk) lack this feature. The most common parity setting is "none"—when you tell your software not to do parity checks.

A few other wrinkles in such programs are:

FILE TRANSFER

That's the ability to send whole files of text or data—including programs, too.

CAPTURE ABILITY

With **capture ability** you can keep a record of each end of a keyboard conversation with both people typing away. You tell your computer to open up a **buffer** in its RAM—the temporary memory. The buffer captures the conversation. And if it fills up, some software will automatically "write" to your floppy disk, then reopen the buffer. Some programs won't write to the disk at the ends of your conversations unless you command them to, meaning that the absentminded will see their bits and bytes vanish.

PROTOCOL FLEXIBILITY

Beyond changing bit numbers, etc., you may want software that can handle different kinds of protocols—sets of rules telling how computers transmit different sets of information.

One possible protocol for you to use—at least in conversations with other micros—would be the **XMODEM Protocol** or **Ward Christensen Protocol**. The receiving computer tallies up the number of bits and bytes transmitted from **blocks**—tiny parts of material—and compares this **check sum** to the number that the originating machine says it sent. And if there's a mismatch? The receiving computer asks for the block again.

You might also use no protocol at all. It's as if you're sending material simply by tapping away on the keyboard without any elaborate rules for the other person's machine. You two should still, however, agree on basics like baud rate, data bits, stop bits, and parity.

Protocols use **handshaking** as part of their bags of tricks. Handshaking, computers swap bits and bytes to verify that they're on speaking terms. A common form is **XON/XOFF**.

Some mainframes use XON/XOFF to talk to micros and vice versa. The receiving computer gives an XOFF signal, telling the transmitting one to pause while the receiving machine "writes" to its disk. XON means, "Okay, my buffer's almost empty. Send more!" Without this **flow control**, you might overwhelm the buffer and lose information.

AUTOMATIC DIALING AND OTHER TRIMMINGS

Some modems will let the communications software dial for you or at least let you feed the number in from your keyboard. Some also have **automatic log-on**. That lets you check onto a network or bulletin-board system without typing out your ID or password. Many **intelligent modems**, by the way, even without special software, can remember and dial phone numbers automatically and spit out log-on sequences and passwords.

VERSATILITY

Want to speak to a number of computers? Then buy software allowing you to set:

- Baud rate (speed of transmission).
- Data bits.
- Stop bits.
- Parity.
- Terminal emulation. It means making the micro imitate popular brands of terminals.
- Half or full duplex. Full is most common in micro communications.

■ The type of handshaking protocol.

Ideally, the software will also:

■ Accommodate a variety of modem types.
■ Designate the host—which computer will manage the **echo back** (which makes the typed conversation appear on both screens).
■ Let you choose different protocols.

All those features, of course, might still not let you communicate easily with your corporate computer. It may not use the **ASCII** code, for instance, which most micros do.

"Since you ASCII'd, anyway," as *PC Magazine* once punned, "those five letters are an acronym for the American Standard Code for Information Interchange." With ASCII, an "A" is one combination of *1*s and *0*s, "B" is another, "," is another, and so on.

When communicating with a mainframe capable of ASCII, it may not matter what brand of micro you're running. So don't reflexively think Big Blue for telecommuting.

The proud IBM mainframes, however, like aloof mandarins of old China, jabber away in a dialect of their own, **EBCDIC**—it's similar to ASCII but different enough to cause serious problems. Now that doesn't mean your home computer won't work with an IBM mainframe. But it may require special programming that will translate from one set of codes to another.

Of course your corporate mainframe may also need a string of **control characters** to open or close an electronic file, and here your word-processing software may matter more than your communications program.

The control characters normally are just letters tapped out in combination with the control key to give commands to your computer. They generally don't print out on paper; they may or may not show on the screen. In this case, controls characters pass the commands on to another machine over the wires. And so you may have to **embed** the control characters in your electronic files. If your word processor won't let you embed

control characters, you may not be able to communicate with some kinds of mainframes. WordStar lets you do this.

An issue more basic than control characters is whether you're using **synchronous** or **asynchronous communications**. The former is a staple among the big mainframes; the latter, among micros.

In synchronous communications, the two computers or modems employ timing signals to separate characters sent in one stream.

Synchronous has a big advantage. You can send at 4,800 baud over regular phone lines; you can't with the asynchronous method, or at least not with late 1984 technology.

But "synch" is more expensive—the needed modems typically cost well over $1,000. Asynchronous, moreover, doesn't require timing signals. It's the simplest form of communications between computers; and more and more data-processing departments have added asynchronous ports for micros to dial up.

John Fuller himself was communicating not with a giant computer but a dedicated word processor in his office, which, like most, talked ASCII asynchronously. He solved other problems on his own. You may need a consultant to do what Fuller did. But take heart. It could well be worth it, what with the time and money your telecommuting may spare you and your employer.

"I'm saving gas, dressing in comfortable grubbies when I write," Fuller said in an article about his experiences, "and with the direct connection I can *prove* that I'm working. I turn out my reports faster. My computer is really paying off. Now," said the self-deprecating Fuller, "if you'll excuse me, I have to repel invaders from space."

BACKUP XII MODEM7: An Almost-Free and Fairly Easy Way to Talk to Other Computers

MODEM7 may be free, but it *works*. With it you can talk to computers thousands of miles away *if* they're running MODEM7 or compatible software. Normally, your only real expense is for the modem and maybe cables; you might spend as little as $100.

Using MODEM7, you can send letters, reports, or programs already on your computer disk. Or you can receive them.

You can also:

1. Communicate teletype-fashion with the other person. You can keep electronic records of what you both type and later print them out using WordStar or another word processor.
2. Call up electronic bulletin-board systems (BBSs) or plug into The Source and many other information utilities. In this case, too, you can store material on your disk and later print it out.
3. Get copies of other programs that altruistic computer buffs have placed in the public domain; you do this after you log on the BBS.

MODEM7 is a good example of free software that fills a niche; experts say it's better than some $150 products. Most free programs are losers for the typical business. They're either (1) games, useless except for training, (2) unreliable lemons with bugs in them, the software kind, (3) programs that might work but don't do anything useful, or (4) fiendishly difficult challenges because the instructions are confusing and no one handy knows how to use them. But wonderful exceptions exist. Never thumb your nose at something just because it's free. In MODEM7's case you'll find more happy, knowledgeable users than you will in the cases of many commercial programs.

MODEM7-style protocols have become an industry standard. Even big businesses and government agencies, including the IRS, have used MODEM7 for some purposes. It's influenced the designs of commercial micro programs, which employ similar techniques to facilitate linkups between different brands of communications software. MODEM7 will also get along beautifully with the popular PC-TALK III "freeware" program for IBM micros and some clones. Freeware is low-cost software distributed in many cases by the users themselves; the author may request a "donation".

Granted, MODEM7 isn't the ultimate. The instructions included on the disk are confusing to the novice—a problem I'll try to overcome here—and ready-to-run versions aren't available for every computer system.

Some commercial communications software, moreover, is easier to run and can help you talk to more machines. And it may also make better use of the "smart" modems and their software so that your computer can dial up others automatically at 11:00 p.m., when the phone rates go down. You can't do this with your cheapie modem and the plain vanilla MODEM7 described here.

But for the average computer user, MODEM7 is a good communications program to start out with. After reading the instructions that follow, you needn't be a micro whiz to use it.

Also, you *may* find that MODEM7 is as convenient as some commercial software for simple tasks, such as quickly checking your electronic mailboxes on The Source or CompuServe.

Don't forget: you shouldn't pay a cent for the basic MODEM7 program itself except for the cost of a copied disk or another token fee. It's public-domain software. So you can legally make copies for all your friends and business contacts who have modems and the same machine that you do.

But how to track down your own copy? Through CP/M user groups, you can locate versions of MODEM7 set up for different computers and disk drives, or you might find an organization of IBM owners, Kaypro fanatics, or others. The better computer stores can steer you to the right people. Incidentally, if you distrust your store, you might not want to say exactly why you're trying to catch up with a user group.

Bear in mind that the computer store isn't going to make a profit off a free program. Some organizations, however, are selling MODEM7 at next to nothing through the mail. For instance, the Public Domain Software Copying Company says it has versions for the IBM PC and clones, all the Kaypro machines, the Morrow micros and Osborne, among others. The cost as of late 1984 was $10. The address is 33 Gold St. cl3, New York, N.Y. 10038; the telephone number, (212) 732-2565. The company also offers separate programs that will adjust stop bits and other settings, eliminating the need for programming. These programs aren't universal. Like MODEM7 itself, they might not work for your particular machine. The Public Domain Software Copying Company also says it offers a low-cost program for the Apple II that lets it communicate with computers using MODEM7.

In addition, you might also investigate PC-TALK III, commonly available through IBM user groups. If they're ethical, they'll encourage you to send a small "donation" to PC-Talk's originator, Andrew Fluegelman, who wanted to save distribution expenses through this "freeware" approach. You needn't feel obligated to pay until you've tried the program. Probably, however, you'll find PC-TALK to be worth the $35 or $45 it may cost; this software is more sophisticated than MODEM7, which I'm focusing on because of its simplicity.

Another excellent MODEM7 alternative—*for experienced computer-users*—is MEX. CP/M versions are available free through users groups and work on many machines, including Kaypros; and NightOwl Software (telephone 800/648-3695 or NITEOWL) expects to sell it for $59.95 in an IBM version. Most of MEX's send-and-receive commands overlap with MODEM7's.

```
MODEM7 as of 12/18/80
Originally Written by Ward Christensen
Revisions by Mark M. Zeiger, Jim Mills

WRT  —Write file to disk (from terminal mode)
DEL  —Erase present file (from terminal mode)
RET  —Return to terminal mode with no loss of data
XPR  —Toggle expert mode (Menu on/off)
DIR  —List directory (may specify drive)
CPM  —Exit to CP/M
S    —Send CP/M file
R    —Receive CP/M file
T    —Terminal mode (optional file name)
E    —Terminal mode with echo

DEFAULT DRIVE:

Command:
```

IBM PC owners, fear not! This Kaypro version of MODEM7 shows the same menu that the IBM version, dated Oct. 15, 1982, does. The only real difference is the IBM adaptation's use of the **DOS** command instead of the **CPM** one to return to the computer's operating system.

Here now is a plain-English guide to MODEM7's version of December 18, 1980, as adapted in 1982 for the Kaypro, IBM, and many other machines.

TO GET READY

MODEM7 has two basic modes for Teletype-like communications, "Terminal" and "Echo." For both parties to see both ends of the conversation, one must be in "terminal" and the other in "echo" if they are communicating directly. Just the "terminal" person will be able to record on his or her disk. The one in echo mode can't save the material electronically.

Beginning, you should read your computer's instructions for information on how many stop bits and data bits your machine normally runs with. And does it use odd, even, or no parity? You might also get this information from your dealer or users group.

Don’t worry right now about knowing about the full meanings of the terms. Just find out what the settings are.

MODEM7 doesn’t provide for changing the settings. If the person at the other end can’t adjust them, either, and if those for his machine are different from yours, you’re out of luck if you don’t know how to fix the program code. You two may have to reach each other through an electronic mail service that mediates between machines. Often, however, micros are set for 1 stop bit, 8 data bits, and no parity, an informal standard. And just about all decent commercial programs for communications let you alter these settings. So does PC-TALK III.

In addition, even though MODEM7 itself won’t change its bit settings, your user group may have some free or low-cost programs that you can load up to do the trick—and then use MODEM7.

There’s one other little worry. Are you and the other person sending at the same speed over the phone lines? The normal speed for cheap micro modems is 300 baud or about 30 characters per second; for the deluxe ones, 1,200 baud. Don’t worry right now about what a baud is. Just make sure you and the other person are both at the same speed. MODEM7 often is set at 300. Some versions may allow for changing the software to accommodate different baud rates, but the command may not work on your particular brand of machine. By the way, remember that you must consider the baud rate not only of the software but of the hardware. Simply adjusting your software to send at 1,200 baud won’t do the trick if your modem can reach only 300 baud. Remember, too, that MODEM7’s speed command won’t necessarily govern your modem’s transmission speed, just your software’s.

You also want to find out how to operate your modem. Some use a physical switch to change from voice to data. Others—smart modems—use commands that you type out while your modem program is in the terminal mode. You can tell a smart modem to dial a number or answer the phone automatically.

TO TRANSMIT AND RECEIVE WITHOUT SAVING ANYTHING ON YOUR DISK

Just think of your computer and the other person's as two Teletype machines connected. When hitting a key on either Teletype, you or the other person can make the two both print, right? Well, it's the same with the computers. Here, however, the "print" is characters on your two screens.

Ready?

1. Start out with the other person's modem set on ORIGINATE and yours on ANSWER (or vice versa) if the modems lack automatic switching.
2. Type **MODEM7** after the A> prompt of CP/M (or PC-DOS).
3. Hit your carriage-return key.

   The menu listing your choices will flash onto your screen.
4. Hit the letter **T**.
5. Tap the return.
6. Assuming you're using a manual modem, flick the switch to "data." With a smart modem, you use the right keystrokes to awaken the gizmo or get it to answer the other computer.

Most smart modems nowadays employ commands similar to those of the Hayes models. With Hayes-style modems, if two people are switching from voice to data, one will type **ATD** and a carriage return (to start getting the modems talking), and the other will type **ATA** (to answer electronically).

If you're talking to another micro or a little terminal hooked up to the phone at the other end, you may need to type **E** (and the return) instead of **T** (and the return).

That's the echo mode, which you'll recall differs from the "terminal" one. **E** lets you see your own typing. Again, normally, one micro user will be in echo, and one will use the straight terminal mode. When communicating with a bulletin board, even on a micro, use the **T** command rather than **E**.

How to switch from the regular terminal mode to the echo mode or the reverse?

You use MODEM7's electronic gear shift. That's **Control-E**; don't confuse it with the **E** used in the echo mode. You tap out this command in other situations, too, whenever you want to return to MODEM7's main menu. A **Control-E**, of course,

consists of holding one finger on the **CNTRL** or control button and then hitting the letter **E**.

Here's a warning: you may need to hit the line feed and/or the carriage return at the end of each line for your words to come out in the right places on the other person's screen.

The terminal mode is worth using even when you and the other person only plan to exchange electronic files. If the terminal mode doesn't work, then the others probably won't, so use the terminal mode first to pave the way for file exchanges. By the way, the terminal mode is just the ticket to communicate with information utilities like The Source or with bulletin boards.

TO RETURN TO THE OPERATING SYSTEM OF YOUR COMPUTER

To return to CP/M—to crank up WordStar or Perfect Writer, for instance—you:

1. Type **Control-E**.
2. Tap out **CPM** from the main menu.
3. Hit your return.

Bingo! You're back with the A>! And from there you go on to WordStar, etc.

If you're using the IBM version of MODEM7, you use the command **DOS** instead of **CPM** (unless your menu says otherwise).

TO TRANSMIT MATERIAL ON YOUR DISK WITHOUT ERROR CHECKING—WITHOUT A MODEM7-STYLE PROGRAM AT THE OTHER END

MODEM7 uses the Ward Christensen Protocol—sometimes called the XMODEM Protocol—to help make sure the material is going from computer to computer okay.

If you don't use error checking in transmitting files, the static on the phone lines may garble some words. Your

computer, after all, is just squirting your file over the phone without bothering to find out if the other machine is receiving it right. You want error checking if you're transmitting or receiving software; just one electronic goof, just a single messed-up "one" or "zero," can throw the whole program out of whack.

But sometimes, when you aren't dealing with programs, you'll want to skip error checking. That way, the transmission will go faster. And it'll be easier for computers with different communications programs to talk to one another.

There's still no guarantee you'll communicate, but with an industry standard like MODEM7 you have a good shot at it.

Here, then, is what you do to send a file to someone without a MODEM7-style program:

1. From MODEM7's main menu, you select **T** and again hit the return a few times.
2. Find out if the other person can read words you type. (Don't worry if you yourself can't read your own words.)
3. Tell him (or her) to set up his computer so that, on paper or on a disk, it'll record what it receives.
4. Once the other person is ready—while you're still in the **T** mode—hit **T** again, but this second time your finger is on the Control key while you're doing so.

   The screen will ask you the name of the file you want sent. Normally, that file will be on your data disk, the one on drive B. B in that case contains the articles, reports, etc., for which you may lack room on the A disk containing your programs. (But if the document to be sent is on A, substitute that letter for **B** in the rest of the steps.)
5. Now you type **B:[name of file]**. Here and elsewhere don't type the brackets surrounding the file name—and please put the file name directly after **B:** without a space in between.
6. Next hit your return. The disk should start spinning, and both you and the person at the other end should see your file flashing across the screens. Following transmission, your computer will say FILE TRANSFER COMPLETED. The other person should now have an electronic copy on his own disk.

TO RECEIVE COPY WITHOUT A MODEM7-STYLE ERROR CHECKING

1. Get the two modems talking, then return to the main menu.
2. Again, select your trusty **T** from the main menu. But don't hit your return immediately.
3. Type a space.
4. Type **B:[the name of the file you're creating on the data disk to receive the other person's file]**. The name on B can be anything you want except a file that's already on the disk.

   In other words, if you want to save the other person's file under the name MAGIC, you type: **T B:MAGIC**.
5. Hit your return once or twice.
6. Then hit the letter **Y** with your finger on the control key (**Control-Y**).

   You'll see some colons on the screen when material starts flashing across it. They won't show up, though, in the file you're creating. They're merely an indication that the computer is saving material—whether it's a file, an item from a computer network, or someone just typing away.
7. Type **Control-E** to return to MODEM7's main menu.
8. Then, to preserve the file, "writing" to your disk, you must type out **WRT**, then hit your return.

   And that's it. You're done!

By the way, if, while receiving material, you decide there's a part you don't need saved, you can leave that out of the file you're creating. Just hit **Control-Y** again. Hit it still another time if you want to return to the "save" mode. On some successors to MODEM7 such as MDM711, a **Control-R** rather than a second **Control-Y** will tell the computer to shut off the save feature.

This save feature, alas, won't work on a computer using the older MODEM7's echo mode (though it will with newer versions of the program). But you can get around the shortcoming. Ask the other person in advance to make a two-way record of your conversation and send it to you! How to receive it? Well, after you've transmitted in the **E** or echo mode, you can shift to **T** with a file name added to save material.

Please also remember that MODEM7's capture buffer—the feature letting it save incoming material to your disk—is small. Often the buffer can't work safely with files bigger than 16K. That's about eight double-spaced pages. If you're using a Ward Christensen Protocol, however, files can normally be as long as disk space allows.

Printing the saved material, you may experience some problems because different word processors aren't absolutely compatible with each other. You may see odd format commands, for instance, like "@"s (noticeable to WordStar buffs reading the files of their not-so-Perfect Writer friends) or ".HE" (a WordStar command that may baffle the Perfect crowd). But once you get the hang of it, you can usually "clean up" such "garbage."

TO TRANSMIT COPY TO SOMEONE WITH A MODEM7-STYLE PROGRAM

1. Get the modems to start jabbering to each other.
2. From MODEM7's main menu, type **S B:[name of the data disk file you want to transmit—either a program or a letter or other document]**. The **B:** shows the file is on the **B** disk. If it isn't, just type **S** and the name of the file—for instance, **S MAGIC**. If **MAGIC** is on **B**, type **S B:MAGIC**.
3. Hit the return.

Soon your computer should start constantly asking the other machine if it's getting your file okay.

If it isn't?

Then your computer will conscientiously try again. But its patience is limited. It'll give up eventually if the two machines and their software aren't on speaking terms.

And if everything does work? Your computer will beep when it's through or at least flash a message letting you know that it's done.

Note: If the other person is using some versions of MODEM7, you may have to ask him to switch on the "check sum" form of error checking. This guide is for the simple old MODEM7, not newer versions. Most of the commands, however, will also work with the updated varieties, and of

course all versions of MODEM7 can communicate with each other, subject to minor adjustments. *Some* versions use the **TCC** command to turn on the check-sum mode.

TO RECEIVE FROM SOMEONE WITH A MODEM7-STYLE PROGRAM

1. Fire up your modem.
2. Type **R B:[new file name]**.
3. Hit your return.

Your computer will tell you when it's through receiving. Remember, the material will show up on your data disk. If you want the material on the other disk, just type **R A:[file name]** instead.

TO FIND OUT IN A HURRY IF YOUR COMPUTER SAVED A FILE SENT BY MODEM (ASSUMING YOU'RE USING AN OPERATING SYSTEM LIKE CP/M OR PC-DOS)

1. Go to the **A**> prompt.
2. Type the word TYPE, then a space, then the name of the file —preceded by a **B:**, of course, if it's on the data disk.
   Immediately after the A> you should have the equivalent of **TYPE B:MAGIC**.
3. Then hit your return.

This is a CP/M and PC-DOS procedure.

TO ERASE A FILE (FROM CP/M)

Do the above, except substitute **ERA** for **TYPE**. Say you want to erase **MAGIC**. Just type **ERA B:MAGIC**.

TO ERASE A FILE (IF YOU'RE USING PC-DOS)

Use **DEL** instead of **ERA**. Type **DEL B:MAGIC**.

TO ERASE A FILE FROM WITHIN THE MODEM7 PROGRAM

Type **DEL B:MAGIC** or whatever the file name is.

TO FIND OUT WHAT'S ON YOUR DISKS WHILE YOU'RE USING MODEM7

1. Type **DIR** from the main MODEM7 menu.
2. Type a space.
3. Type **B:**.
4. Hit your return.

This will show the contents of the **B** drive, normally used for storing data.

To see **A** drive's contents, you merely type **DIR** and hit the return.

TO USE THE DIRECTORY FEATURE WHILE YOU'RE IN THE MIDDLE OF A FILE YOU USE TO SAVE

What if you want to save the other person's message using the **T B:MAGIC** method—but in the middle of the conversation you also want to check the contents of your disk via the **DIR** command?

How do you prevent the **MAGIC** from disappearing except for the name on your file list?

After all, an electronic file is like gas inside a bottle. You must "cap" it with a **WRT** command, or the gas will leak out the top. And you can't reenter your file by typing another **T B:MAGIC**.

But you *can* get back to **T B:MAGIC** by typing **RET** after the **DIR** command.

TO GET THE MENU OFF THE SCREEN ONCE YOU KNOW THE ROPES

From the main menu, type **XPR**. Hit the return.

TO CHANGE THE BAUD RATE

If you're using MODEM7 with a 300-baud modem, you don't worry; the software normally comes set for that speed.

With a 1,200-baud modem, you may be able to accommodate the higher speed this way:

1. Enter the **T** mode of MODEM7 from the main menu.
2. Hit the return several times.
3. Tap **Control-B**.
   You'll then see a request for a new baud rate.
4. Type the right number (300 for 300 baud, 1200 for 1,200; do not use commas—MODEM7 doesn't like them here).
5. Hit your return.

Please note that at least on my Kaypro II the **Control-B** command doesn't work. This may have been due simply to my machine's quirks.

Again, don't forget that MODEM7's successors operate somewhat differently and may use a command such as **SET** or **TIM** to set up the baud selection.

And remember, too, that the old MODEM7's baud command won't control the speed of your modem (although some modems will automatically pick up the baud rate of the one at the other end).

Thanks to Jon Albers, Eric Meyer, Rick Nelson, and Pat Ehresmann for checking the accuracy and clarity of the above instructions. Blame me, however, if anything's wrong.

My instructions are a simplification of:

CP/M MODEM PROGRAM DOCUMENTATION by
Mark M. Zeiger
and James K. Mills 11/04/80

The MODEM7-styles programs have their origins in the work of Ward Christensen, an IBM employee and public-spirited computer hobbyist.

■ ■ ■

A MODEM7 Cheat Sheet

Snip this out! It's a handy summary of commands for the free MODEM7 program.

- *TO MAKE MODEM7 APPEAR ON YOUR COMPUTER SCREEN*: Type MODEM7 from the A> prompt and hit your carriage return. You'll end up in the program's main menu. Or if you're using a new program, you might instead see a screen telling how to reach the menu.
- *TO USE THE TELETYPE-LIKE TERMINAL MODE*: Tap the letter **T** and a carriage return after the main menu appears. You can use this mode with The Source, MCI Mail, and other on-line services.
- *TO USE THE ECHO MODE*: Type **E** and the return. For Teletype-like use when the other machine is in "Terminal."
- *TO GO FROM ONE MODE TO ANOTHER*: Use **Control-E**. This gearshift mode returns you to the main menu.
- *TO SEND MATERIAL ON YOUR DISK WITHOUT THE WARD CHRISTENSEN ERROR-CHECKING PROTOCOL*: Type **Control-T** after you're in the terminal mode. Give the name of the file to transmit. Here, as in other cases, precede the name by **B:** (no space after the :) if the file is on Drive B. Hit your carriage return.
- *TO RECEIVE MATERIAL WITHOUT A PROTOCOL*: After typing the usual **T** in the terminal mode, you skip a space. Then specify the name of the file where you'll collect the received data. Now hit your return several times. Use **Control-Y** to tell your computer to start saving material; also use it to turn off the save feature. (On newer versions of MODEM7, **Control-R** might be the off switch.) *IMPORTANT*: After you've finished talking to the other machine, you must return to the main menu and type **WRT** and return. Otherwise your computer won't save the material on the disk.

- *TO SEND TO SOMEONE WITH A MODEM7-STYLE PROTOCOL*: Type **S**, skip a space, then type the name of the file that you'll send—with the **B:** before it if necessary. Hit the carriage return.
- *TO RECEIVE FROM SOMEONE WITH A MODEM7-STYLE PROTOCOL*: Type **R**. Skip a space. Then type the name of the file where the material will show up, using **B:** if needed. Hit the return.
- *TO RETURN TO THE A> PROMPT*: From MODEM7's main menu, type **CPM** if you're using a CP/M version like the Kaypro one. (The IBM version substitutes **DOS** for **CPM**.) Hit your return.

■ ■ ■

BACKUP XIII Why Not an Electronic Peace Corps?

In a Chicago suburb a $50,000-a-year engineer spends countless hours twiddling with his new IBM PC. The technology engrosses him, but he lacks a sense of purpose. In Southeast Asia, meanwhile, a young man wrestles with calculations needed to build an irrigation dam. He thinks his figures are correct but isn't certain, and thousands of people will die if the dam collapses.

Can the Chicago engineer somehow help his counterpart abroad?

There is a way if politicians for once will appeal to the better instincts of technicians. An Electronic Peace Corps (EPC) could bring these two together and offer the Third World some of the best international technical expertise via computer networks.

Useful computers sell for around a thousand dollars, and much better, cheaper, smaller computers are on the way. What's more, thanks to satellites, international communications prices are falling; and 1,000-word messages anywhere in the world, via special packet-switching networks, could cost just $1 each.

So the EPC needn't threaten the taxpayers with a major burden. By essentially exporting knowledge instead of people, it in fact would increase the impact of economic-aid dollars. The EPC could emphasize basics like public health, agriculture, transportation, construction, manufacturing, and communications.

In carrying out the idea, a government or international agency might keep computer files listing:

- The skills and information required in specific underdeveloped countries.
- People abroad who needed help.

● Those who might be able to offer it.

Most of the corpsmen wouldn't even be computer experts—just people with the right technical knowhow. Some might be ex-Peace Corpsmen. Others might receive special cultural indoctrination similar to traditional Peace Corps training.

Once in the EPC, the corpsmen might regularly correspond via E-Mail at nights and on weekends or on occasion "talk" instantly to Third World counterparts. Of course, not every Third World beneficiary might use a micro. Some might submit written questions that local Peace Corps offices could pass on electronically (one way to mitigate the language problem).

E-Mail, incidentally, needn't be the only form of computer communications available through the EPC. The organization could offer electronic bulletin boards with the names of people either needing or offering information on subjects like biological pest control or solar power. That way, the EPC's beneficiaries would feel as if they had more of a choice.

In addition, there might be ongoing computer conferences on topics of common concern.

Obviously, the EPC wouldn't replace foreign-aid experts in the field, and it wouldn't aid people *directly* at the village level. It wouldn't hand out lap-sized portables to barefoot farmers. Rather, the EPC would help engineers, doctors, scientists, and other people engaged in development in their own countries. Corpsmen in the field would work with local governments to make certain, for instance, that a New Delhi slumlord didn't use the EPC to automate his dunning operation.

Typical EPC beneficiaries might be Indians trying to set up a more efficient grain-storage network, millions of Third World people are starving because the food goes to the wrong places. Sometimes, incidentally, the "wrong places" include the warehouses of thieves, and computerized records could reduce the opportunities for corruption. Many problems are political or economic, of course. The EPC would limit itself to technical issues and try to be as apolitical as possible, just as the international Red Cross focuses on relief rather than ideology.

Another EPC beneficiary might be a communications specialist hoping to install a satellite link; for obvious reasons, better communications might be one of the EPC's first priorities. The EPC might help domestic and foreign groups working toward this goal. Even countries with poor phone lines, of course, can receive some computer messages in the large cities.

Yet other beneficiaries could include:

- Colombian doctors who wanted to fight an epidemic with the latest information sped over the computer lines.
- A civil engineer in Peru working on a road or bridge for isolated villagers who hoped to sell food to cities.
- A rural-assistance administrator in Kenya. Micros could help his staffers keep abreast of the newest, best way to dig a well or treat a dysentery-stricken baby.

The EPC wouldn't just promote the flow of information from countries like the United States to the so-called lesser-developed countries. *Among* them, too, it would speed up the spread of practical solutions to common problems.

Learning of an efficacious home remedy, for example, a rural-assistance group in Ecuador might pass the information on for possible global dissemination. It just might save the life of a child in Peru. By keeping track of the better home remedies in the Third World, in fact, an American drug researcher might discover something that checked out scientifically—as has happened in the past.

Some Third World countries or groups of them might want to start their own EPCs. Rather than preempting these efforts, an American or international EPC could aid them, thereby multiplying the benefits of the original organization and forestalling fears of electronic imperialism.

The EPC could have a domestic version, too. Because of lower communications cost, the Home Corps (a friend's phrase) might take more chances helping nonexperts without credentials. A gifted high school writer on Chicago's South Side might tap out short stories on a school computer, for example, and a famous author across town might zip the files back, with comments easily inserted electronically. The two

might meet a few times in person, then carry on via computer without the hassles and menace of urban travel. Likewise, an Evanston business executive might volunteer help to a businesswoman in a small town many miles away.

The most urgent need for EPC-style assistance, however, is in the Third World, where, because of technical backwardness, so many are starving. The idea isn't so farfetched. In fact the Third World is already enjoying some similar help in a small way.

The CARINET computer network links the United States, the Caribbean, Southeast Asia, and Africa. Long before harvest time a Jamaican farmer can learn how promising a market there'll be for his crop in the United States—or an African potter can find out how to make a ceramic insulator for his local phone company. Jerome Glenn, an official with Partnership for Productivity International, the Washington-based group behind CARINET, says the answers often come in just a day.

"Mail takes too long and Telex is too expensive," notes another Peace Corps alumnus, now heading a nutrition group that works to export U.S. technical savvy through more conventional means.

Many foreign aid and computer experts have similar feelings. The technicians, sure enough, are far ahead of the politicians. One of the most distinguished technicians of them all—Arthur C. Clarke, the father of the communications satellites—describes the EPC proposal as "an excellent idea."

Reaction from Third World countries has been favorable. Naren Chitty, a Sri Lankan diplomat, says the concept is "a positive approach to technology transfer" in "these days when 'electronic imperialism' is a catchword." And a Saudi Arabian communications specialist likewise advocates computer and networks for the Third World. He says: "I had a terrible argument with this Indian man who said, 'My people are starving to death, and you talk about microcomputers.' And I said, 'It's because of food distribution—the food isn't getting there. The reason they're starving is that they don't have the benefits that computers could bring.'"

■ ■ ■

POSTSCRIPT:

Just as I was finishing this book I heard from my friend the Saudi Arabian communications specialist, Omar Alfarouq. Omar says EPC-style efforts are already realities in some places—not just dreams.

Via MCI Mail from California, he told me of "the creation of an Information network throughout Third World, accessible within our own cultural reference.

"It has bloomed under sponsorship Gulf Cooperation Council; data banks for farmers, medical workers in Arabic accessible by personal computer from Oman to Kuwait; anyone can access though it is most often done through local Ministry of Information office; will be tied in with university information systems. It's moving *alhamdullilah* [thanks to God]." Omar says the idea for this net goes back to 1981.

He continues:

"Your Electronic Peace Corps is alive and well and working wonders in Africa at present time, am surprised you are not there doing it. I just returned, am here to regroup, energy burn-out terrible. For example Sahel 84 is a French group 30, lorries w/ food/medicine, one light plane with ground station tied into INMARSAT; satellite shows ground picture where people have sunk down hopeless in endless reaches of Niger, Mali etc., guides convoy to place of need; communication link back to Paris advises of further food/medicine need, diagnostic advice, these helped while other abandonees are being located. That's Sahel 84.

"Mobility 84 is British with land-rover as ground station with a computer, word-processing, works in west central Africa, put together by Alan Benjamin of CAP software in England, Contact him he is doing what you are brooding about.

"Medecines sans Frontreres also has sat-data link to Paris from its camp south Soudan just over border from Ethiopia for Tigre refugees; Tigre people in terrible shape. Data banks can *insha'allah* [if God wills] save Soudan from becoming like Ethiopia—it's getting that way fast. Contact Gordon MacRae, deputy editor of Economist in London for further up-dates, also Jim Grant of UNICEF.

"Congratulations on yr book. But the real point of data exchange is its tremendous humanitarian impact which is so desperately needed in places that will never ever see anything like a telephone. Timely forecasting can prevent Third World suffering. Or even in America. That's your next book. See you in Addis.... *wa salaam* [good-bye], Omar."

Americans invented the transistor, the microchip, personal computers; now if only we'll catch up with the British, French, and Saudis in bringing the technology to the people who most need it!

Thanks!

My Victor 9000 and Panasonic printer ideally could spew out a list of people to thank—starting with those who most deserved it.

As a mere human, however, I don't feel up to ranking anyone other than to mention the big nine:

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Footnotes

1. *Computerworld*, July 23, 1984, is the source of the reports on criminals' use of computers.

2. The Michigan quote comes from a magazine article by Washington writer Joel Makower.

3. Chris Christiansen, with the Yankee Group, a Boston-based marketing research firm, offered the estimate on the number of programs.

4. Kaypro, too, junked Select. Select Information Systems claims that's because Kaypro wanted a cheaper word processor. Kaypro says it was unhappy with Select because it didn't work right with some printers.

5. The examples of the investment adviser and cotton trader come from *New York* magazine.

6. The estimates of the number of business computer buyers come from the Yankee Group's Chris Christiansen.

7. "Gonna die" is from *Popular Computing*. The Osborne statements come from oft-repeated statements to newspapers or from magazines. "Mr. Osborne," an aide said when I revealed that this chapter was on Brand X, "does not want to discuss the Kaypro."

Andy Kay himself did not speak to me in a normal interview. His literary agent-friend, William Gladstone, feared that it might conflict with a project of their own, and Gladstone sought to deny me ownership of quoted material. Normally I would have told him to stuff it, but I needed the right quotes to tell the full story of *my* computer. So Gladstone and I worked out a compromise. After I sent thousands of words of questions via my Kaypro over the phone lines, he obtained Kay's replies on tape. I submitted follow-up queries when Kay's answers did not satisfy me. Gladstone insisted on reading this chapter for accuracy but never tried to censor me;

in fact, he was helpful and pleasant to deal with. He even brought this manuscript to the attention of a publisher he knew (although I placed it through my agents). Gladstone's help, incidentally, didn't influence my perception of the Kaypro II as better than the archrival Osborne. I bought a Kaypro at a time when "William Gladstone" was nothing more to me than the name of a nineteenth-century English statesman; I *already* loved the company's product. Just the same, determined not to write an extended press release, I've consulted with the corporation's critics, and I have run this chapter past a *San Diego Union* reporter named Dan Berger, who exposed some of Kaypro's less admirable management practices. I'm as grateful to Dan as to Bill.

8. The $200-million and $5-billion estimates came to me from Chris Christiansen of the Yankee Group, who said the latter figure might be very conservative. *InfoWorld* quoted another research firm, InfoCorp, as saying that 527,000 portable computers were sold in 1982—and that 5.1 million would be sold by 1987.

9. The *San Diego Magazine* article appeared in May 1983.

10. *San Diego* is the source of the "After we'd been at it eight or nine months" quote.

11. *San Diego* contains the quote on software purchases and royalties.

12. *Business Week* is the source of the facts on Kaypro's disk-drive problems.

13. Kaypro later dropped the Kaypro II and replaced it with the $1,595 Kaypro 2X. It's still a II, though, except for some improvements such as more disk space. The 2X's disks store almost 400K each.

14. "XT" stands for "extended."

15. Kenneth Lim of Dataquest, Inc., the San Jose, California marketing research firm, is the source of the 2.5 percent

estimate quoted in the *Wall Street Journal*, November 14, 1984.

16. Clarke responded by phone in early 1983 to questions I'd mailed about his use of WordStar.

17. *InfoWorld*, April 5, 1982.

18. *InfoWorld*, April 5, 1982.

19. H. Edward Roberts, president of MITS (Micro Instrumentation and Telemetry Systems), a New Mexico company later overwhelmed by the competition, came as close as anyone to being the father of the first successful personal computer. His Altair 8080 made the cover of *Popular Electronics* in January 1975.

20. The November 1982 *PC Magazine* is the source of the quotes on Rubinstein's business plans after IMSAI.

21. "AT" stood for "Advanced Technology."

22. *InfoWorld*, May 14, 1984, is the source of Rubinstein's quotes about the heart attack, not going "on some wild spending spree," and his life not changing.

23. *InfoWorld*, May 14, 1984, is the source of Rubinstein's "bullshit" quote.

24. The $1.5 billion estimate is from Chris Christiansen of the Yankee Group.

25. The account of Select's capital shortage and the metamorphosis into Quadsoft comes from *InfoWorld*, August 13, 1984. The merger information is from *InfoWorld*, October 8, 1984.

26. Dean's *Byte* article appeared December 1983, p. 161.

27. Jerry Pournelle's rebuttal to Dean and others of the "user friendly" school appeared in *Popular Computing*, May 1984, p. 81.

28. The Bricklin quote comes from Steve Ditlea's excellent article in *Popular Computing*, September 1982, page 48, which helped me appreciate VisiCalc's many uses.

29. The car wash, orchard, Yellow Pages, and painting examples come from *USA Today*, May 3, 1984.

30. Ripskis is not the hard-core bureaucrat I mentioned earlier in the chapter. He in fact puts out an underground newsletter regularly exposing his agency.

31. The ex-Bain man's quote is from *Harper's*, November 1982.

32. *Computerworld*, March 28, 1983.

33. *Computerworld*, March 28, 1983.

34. The Colligan quotes are from Joel Makower's useful book *Office Hazards: How Your Job Can Make You Sick*, published 1981 by Tilden Press, Washington, D.C.

35. The material on the Manhattan word processor comes from Barbara Garson's article in *Mother Jones magazine*, July 1981, p. 32.

36. See "Job Decision Latitude, Job Design, and Coronary Heart Disease," by R. A. Karasek, who participated in a 1981 Purdue University conference on job stress. The Karasek findings appeared on pages 48-55 of *Machine Pacing and Occupation Stress*, a book published in 1981 by Taylor & Francis Limited, London. In Karasek's words, "Job-design strategies advocating limited skill usage and decision authority for the majority of the workforce appear to be associated with a host of undesirable, unintended consequences ranging from skill under-utilization (and consequent productivity loss) to increased risk of coronary heart disease."

37. Before Bell adopted the standard touch-phone numbers pad, it did a study showing the superiority of the 1-2-3-4-5-6-7-8-9 arrangement. The study had strong financial motivations.

After all, the more wrong numbers people dialed, the greater would be the cost to the phone company, since Bell at the time probably wasn't charging anyone for wrong numbers.

38. For observations on the merits of various colors, see *Ergonomic Aspects of Visual Display Terminals*, edited by Etienne Grandjean and E. Vigliani and published by Taylor & Francis Limited, London, 1982.

39. If you don't want lines on a CRT to seem to be rolling into each other when you're using a bright background, you should worry about something called a *refresh rate*. That's the number of times the picture "repaints" itself on the screen. Etienne Grandjean, the prominent Swiss expert on VDTs, recommends a rate of at least 80 cycles a second; others say it needn't be so high. The Xerox 860's rate is 70 cycles, according to David Eisen, and that's better than average. Still, I noticed the roll, anyway. In a letter to me in January 1983 Grandjean also recommended a slow phosphor for use with the white background. That means the images would take longer to vanish from the screen than they would otherwise—reducing the perceived flicker.

40. Eisen's advice on VDTs can be found in the booklet *Humanizing the VDT Workplace: A Health Manual for Local Officers and Stewards*, published jointly by the Newspaper Guild and the International Typographical Union (the price is $1.50 from the Guild, at 1125 15th St., N.W., Washington, D.C. 20005).

41. The German requirement for detachable keyboards appears in paragraph 4.3.1 of Standard ZH1/618 of "Safety Regulations for Display Workplaces in the Office Sector," as released by the Trade Cooperative Association, Central Office for Accident Prevention and Industrial Medicine.

42. The McIlvain example comes from *PC Magazine*, May 29, 1984.

43. The advice on keyboard height is from Military Standard 1472C, *Human Engineering Design Criteria for*

Military Systems Equipment and Facilities, published by the army in May 1981 and summarized in the July 1982 *Popular Computing*.

44. The facts of the Renton, Washington case come from Laurie Garrett's National Public Radio interview with Laura Moore, which aired August 12, 1982.

45. The Slesin quotes come from his article in *Columbia Journalism Review*, November 1984. The *Review* correctly says Slesin's newsletter "has taken no sides in the VDT story while keeping up with all relevant developments." It appears monthly. The *Microwave News*'s address is P.O. Box 1799, Grand Central Station, New York, N.Y. 10163. Subscriptions are $200 a year. *VDT News*, a bimonthly, costs $42 a year.

46. The quote from the Cleveland office worker and from the two examples immediately after it come from *Warning: Health Hazards for Office Workers*, published in 1981 by the Working Women Education Fund, 1224 Huron Rd., Cleveland, Ohio 44115.

47. Information on flat-screen displays comes from *InfoWorld*, May 7, 1984, and other micro magazine articles; the *Washington Post* of April 29, 1984; George Weiss, director of computer systems studies with Quantum Science Corp., New York; and Kenneth Bosomworth, president of International Resource Development, Inc., a market-research firm in Norwalk, Conn.

48. The "people will begin using" quote is from a Weiss interview with *USA Today*.

49. For a reminder of the advantages of LCDs in avoiding a dark office, I'm grateful to Bert Vorchheimer, a corporate communications specialist, who, as a sideline, wrote some farsighted articles on office ergonomics.

50. The categories of computer-crime offenses, together with many examples, come from Donn Parker's *Computer Security Management*, published in 1981 by Reston Publishing

Company, Reston, Virginia. Another book for more information is Parker's *Fighting Computer Crime*, published in 1983 by Charles Scribner's Sons, New York, N.Y.

51. The example of the railroad clerk is from a report Parker coauthored for the Justice Department, "Computer Crime: Criminal Justice Resource Manual."

52. All the Ball quotes and paraphrases in this chapter are from *Technology Review*.

53. The H. Michael Snell quotes are from an article he published in *Computerworld*.

54. Presumably VAX-man chose his name with both the VAX minicomputer series and the Pac-Man game in mind.

55. The 414 invaders fortunately didn't alter radiotherapy information. But they reportedly did zap a file used to bill customers a total of $1,500 for computer use.

56. After writing a draft of this chapter, I helped Nye prepare a section of his black box guide.

I find it to be useful, but overly technical for some lay people.

Nye may be reached at Marketing Consultants International, Suite #214, 100 West Washington St., Hagerstown, Md. 21740. Call 301/791-0290 for the latest information about the guide's price and other details.

57. My thanks to J. Michael Nye, for calling my attention to the problems of incomplete erasures. Ed Bigelow, of Adevco, a Pennsylvania company selling networks to link computers in the same office, also was helpful.

58. The Lutus story is from *Popular Computing*.

59. Nilles is in a position to keep track of statistics associated with telecommuting. He has done numerous telecommuting studies as a senior research associate with the Center for Futures Research at the University of Southern

California. Nilles has written an important pioneering work in the field—*The Telecommunications/Transportation Tradeoff: Options for Tomorrow*.

In this chapter I am indebted not only to Nilles but also to work that the Stanford Research Institute did. SRI's three-part study, completed in May 1977 for the National Science Foundation, appeared under the main title *Technology Assessment of Telecommunications/Transportation Interaction*. The first part is *Volume I: Introduction, Scenario Development, and Policy Analysis*, by Richard C. Harkness, available for $17.50 in paper and $4.50 on microfiche as PB-272-694, from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, Virginia 22161. The second is *Volume II: Detailed Impact Analysis* by Harkness; $70 in paper and $4.50 on microfiche, PB-272-695. The third is *Volume III: Contributions of Telecommunications to Improved Transportation System Efficiency* by A. E. Moon and J. M. Johnson, E. P. Meko, H. S. Proctor, and C. D. Feinstein; $14.50 in paper and $4.50 on microfiche, PB-272-696. Needless to say, Alvin Toffler's *Third Wave* (New York: William Morrow, 1980) contributed greatly to popular interest in the subject of telecommuting.

60. The example of the Florida-based telecommuter is from "Rising Trend of Computer Age: Employees Who Work at Home;" *New York Times*, March 12, 1981, p. 1.

61. The South Carolina facts come from "Rising Trend of Computer Age: Employees Who Work at Home," the *New York Times*, March 12, 1981, p. 1; "Computers Turn Dens into Offices," *USA Today*, May 9, 1983, p. 1; and "Home Computer Sweatshops." *The Nation*, April 2, 1983, p. 390. In addition, I talked to Ann Blackwell and her husband, Tim, assistant vice-president of basic and major medical claims at Blue Cross-Blue Shield, in South Carolina.

62. The Nussbaum quotes are from "9 to 5 President Raps Office Automation, Says It Deskills, Devalues Office Jobs," *Computerworld*, May 3, 1982, p. 53.

63. The Seattle example is from *Business Week*, May 3, 1982, p. 66.

64. *USA Today*, March 28, 1984, p. 3B, reported Management Recruiters' telecommuting survey.

65. William Renfro's comments appeared in *The Futurist*, June 1982.

66. The Xerox example comes from correspondence, interviews, and the *Financial Times*, London, July 20, 1982.

67. Thanks to Mike Bell for helping me obtain figures comparing telecommuting costs to alternatives. And the editor has simplified the numbers presented.

68. Nilles may have been the first to envision neighborhood centers for telecommuters.

69. The 1977 Stanford study discusses the neighborhood-center concept in depth and describes a number of possibilities, many of them overlapping with my "munytel" idea. The term "munytel" is mine.

70. Elizabeth Carlson of Continental Illinois said the community college had ended the experiment after buying its own equipment. But the bank feels the arrangement was successful. In fact, it set up a satellite word-processing center in a shopping center near the college.

71. In November 1984 the Labor Department released a rule that allowed people to knit sweaters and hats at home for sale to manufacturers.

72. Nilles's three-quarters of a billion estimate is reported in *InfoWorld*, April 23, 1984.

73. Harkness's remarks are from his speech to the Seminar on Communications, Brasilia, Brazil, June 1982.

74. Frank Schiff, *Washington Post*, Outlook Section, September 2, 1979, p. C1.

75. Some of the material in this chapter originally appeared in an article I did for *USA Today*. I've also made use of facts from the *Wall Street Journal*, March 16, 1984, p. 29.

76. The example of computerized conferencing comes from Participation Systems, Inc., a Winchester, Massachusetts, firm that provided the software for computer conferencing on The Source.

77. Bigelow's company, Adevco, Inc., 2145 Market St., Camp Hill, Pennsylvania, manufactures The WEB equipment under a license from The WEB's designers. That's Centram Systems, Inc., P.O. Box 511, Camp Hill, Pennsylvania, which also sells to manufacturers to add to their computers. A California company, Trantor Systems, likewise makes a network called WEB: this may or may not mean a name change for the Centram technology. At any rate, Adevco itself may abandon the WEB name for other reasons. "We may drop the name and market the product with the same technology in a different version under a number of names," said Bigelow. "If we enhance the product enough, I may want more Adevco identification."

78. Telephone tag occurs when person A returns B's call, but now *B* isn't available. With an E-Mail arrangement, A and B could exchange messages without the other being available at the same time.

79. Bigelow plans a more rugged version of The WEB transmission line in the future to make installation less tricky.

80. Thanks to Ed Bigelow for the children's game metaphor for the ring network. The kids try not to be.

81. PBX stands for private branch exchange.

82. For some of Clarke's own writing on the future, readers might turn to *1984: Spring—A Choice of Futures*, published by

Ballantine Books, New York, 1984.

83. Eric later decided to change the name of his company to EMCo. Computer Consulting.

84. The actual beginnings of the micro age, less romantically, go back to the invention of the microprocessor—a central processing unit on one chip—in 1970. It happened at Intel, an electronics company in Santa Clara, California, and was the idea of a young Stanford University grad named Ted Hoff.

85. Gene's book should appear under the title *Maryland Lost and Found: People and Places from Chesapeake to Appalachia*. The publisher is Johns Hopkins University Press.

86. Clarke's forgetting to insert the disk in the B drive should underscore a truism: *all computer users can commit idiocies*. Once I owned a printer that I couldn't use without unplugging my modem. Things worked the other way around, too—as some people discovered when they tried to communicate with me over the phone but couldn't because I'd forgotten to yank out the printer cable and put in the modem's.

87. MITE's auto-answer feature won't work without an appropriate modem. My own modem was manually activated, meaning that I couldn't take advantage of this wrinkle. I could, however, switch on the modem when Peter called. And for him, that would realistically duplicate the experience of reaching Clarke's computer.

88. A Ballantine paperback titled *The Odyssey File*, records much of the computer dialogue between Clarke and Hyams. Very briefly Clarke also writes of the link in *Ascent to Orbit: The Technical Writings of Arthur C. Clarke*, released by John Wiley & Sons, New York, in 1984.

89. President Reagan's campaign schedule and trip to China forced him to cancel his April 1984 meeting with Clarke.

90. In the postscript of *Ascent to Orbit*, Clarke described himself and Hyams as "lousy typists." They may be in terms of accuracy but not speed—and, of course, with a computer, you can correct mistakes so easily that accuracy becomes secondary to speed.

91. In the early 1960s Clarke himself wrote in *Profiles of the Future* that "the first genuine thinking machines may be *grown* rather than constructed; already some crude but very stimulating experiments have been carried out along these lines. Several artificial organisms have been built that are capable of rewiring themselves to adapt to changing circumstances."

92. Clarke's conjecture about the business lunch of the future appears in *Profiles of the Future*, Harper & Row, New York, 1962, p. 194.

93. The "Bureau of Poultry" description of Clarke comes from Curt Suplee's *Washington Post* article of November 16, 1982. Suplee also saw Clarke in nonbureaucratic attire—the sarong.

94. Clarke's prediction of a business having "only the equivalent of a telephone number" is from *Profiles of the Future*, p. 194.

95. Discussing WordStar, Clarke was careful to point out that he had "never used or even seen any other word-processing system" and had "no frame of reference," but found "only a few small nits to pick with my version. (Release 3 of 1981, WU644275C)." Among other things he repeated a complaint I myself have against WordStar 3.0. "I do wish one could see the printed instructions actually operating on the screen text," Clarke said, "so it wasn't messed up by those ugly control characters. That would also have the enormous benefit of preventing the sort of boob I made for the first few weeks—not closing the print instruction, with horrid results, e.g., underlining to the end of the manuscript!!"

96. Alas, Lynn tried but did not successfully make radio contact with the space shuttle.

97. A former Victor employee tells me that charging dealers for promotional material isn't that uncommon a practice. I realize that some dealers may waste literature, but I still think the practice is dumb.

98. Kaypro has donated five machines for the project and expects to send five more. Special thanks here to David Kay and Tom Peifer, a Kaypro staffer in charge of the company's Third World donations program.

99. The salesman joke is from *InfoWorld*, October 22, 1984, p. 27.

100. *InfoWorld*, June 20, 1983, p. 1, reported the shooting incident.

101. Ironically, Naiman wrote *Introduction to WordStar* with another program, WRITE, the creation of a friend of his, and WordStar itself is far from his favorite word processor. He compares it to a big Cadillac or camper loaded with too many features. My thinking is different; I *want* to have many to choose from; I'll gladly ignore the others.

102. Since writing this section, I've learned that Park has left 800 Software for another company.

103. Carl Herrman is communications director at MITRE Corporation, a nonprofit research and consulting firm in McLean, Virginia. His address there is W 160, 1820 Dolley Madison Blvd., McLean, Virginia 22102.

104. I asked John Butler, a Microsoft products manager, why windows would hit the market months late. "We don't like to announce products too far ahead of time when they're not fully developed" he said, "but with Windows we had to tell other software companies about its existence early on—so they could write programs taking full advantage of ours."

105. I'm basing the "windows-shopping" questions on points raised by various micro publications, especially *Popular Computing*, May 1984, p. 96.

106. For background in researching this appendix—but not for the opinions, strictly mine—I'm grateful to Forrest M. Mims's excellent article "A Few Quick Pointers." It appeared in May 1984 *Computers and Electronics*.

107. Rubinstein's "cheese" quote is from *InfoWorld*, May 14, 1984, p. 57.

Transcriber's Note

Errors deemed most likely to be the printer's have been corrected, and are noted here. Where the intent of the author is ambiguous, a suggested re-reading is provided here, and the text itself is merely annotated. The references are to the page and line in the original. Entries with three numbers refer to the page, the footnote (as resequenced), and the line within the footnote. The following issues should be noted, along with the resolutions.

ii.3	Published in the Uni[t]ed States	Added,
12.24	Two San Francis[c]o-area authors,	Added.
24.8	[“]The “B” drive is my **data disk**	Removed.
24.24	floppy disk[s] drives	Removed.
30.35	the very same writer who had le[a]d the cheering	Removed.
31.2	was no match for some more expensive machines[’].	Removed.
50.20	wanted to do.[”]	Added.
50.21	and others unfamiliar with computer arcan[i]a.	Removed.
52.13	Then again, your boss may ba[l/w]l you out	Replaced.
52.27	m[e/o]re programmers are	Replaced.

	writing	
53.44	WordStar as a programming aid[e] to write WordStar.	Removed.
56.31	to have a manual. [”]	Added.
70.42	[“]The user needs to know	Added.
71.25.1	account of Sele[k/c]t’s capital shortage	Replaced.
88.31	have to go through unwield[l]y computer rigamarole	Removed.
89.33	Symphony, for instance[,] lets you flush out formulas	Added.
90.12	and it did [“]all the basic search and sorting	Removed.
94.1	Turn onto Cary Avenue. Follow [M/C]ary	Replaced.
101.39	the data base grew too unwield[l]y	Removed.
104.9	was as badly botched as its hardware[.]	Added.
117.8	said Bill Scrivo[,] an ex-managing editor.	Added.
120.24	have microprocessors in them.[”]	Added.
136.36	How much more can they push	Replaced.

	them[./?]	
138.20	and the same breaks [e]very hour for workers	Added.
148.40	Angle between upper and low[er] arms:	Added.
150.8	particularly effective on a num[b]er of newspapers.	Added.
161.22	A second failing of electroluminescent screen[s]	Added.
166.16	mainframes are sending electronic copies to [a]micros	Removed.
170.13	why not zap [a]way the barriers	Added.
176.4	but it helps.[”]	Added.
177.12	Steve Wozniak, the Apple cofounde[e]r	Removed.
188.20	Your dial-up computer [should] send its name until	*sic*: should not
194.38	You can’t afford to have your material stored just [in on] your chip.	*sic*
204.60.2	“Rising Trend of Computer Age: Employees Who Work at Home;[”] *New York Times*	Added.
206.36	articles sent over the phone lines[?/.]	Replaced.
210.16	the regular workers cost a[t] least	Added.

	$50.52 a day	
215.1	A COMPARIS[I]ON OF OFFICE EXPENSES PER WORKER	Removed.
217.25	establish munytels in poorer neighbor[hood]s>.	Added.
220.72.1	Nilles's[;] three-quarters of a billion	Removed.
222.6	a vivid contrast to be[ ]suited, tied scientists	
222.38	The Source and a rival network, CompuServe[,] each boast	Added.
223.12	"You may even want to type 'Chuckle,'["] Trudy says,	Added.
225.32	packet-switching techniques[,] can also increase	Removed.
233.25	electronic mail can go from [person] to another	*sic*: one person
241.10	instead of saying you[r] wanted to reach	Removed.
245.31	the computers don't['] mind being "it"	Removed.
253.9	"Hey, don't worry[,/.] You'll learn it much faster than I did,"	Replaced.

257.15	to work together via[by] computer	Redundant.
266.92.1	Clarke[’s] conjecture about	Added.
267.95.8	with horrid results, e.g., underlin[in]g to the end of the manuscript!!	Added.
272.9	from an AC ex[t]ension cord.	Added.
283.2	Are you pre[p]ared to do your homework?	Added.
259.24	I hoped that benefic[i]ent HALs	Removed.
267.22	*that* will be in an attaché case.[’]”	Removed.
290.27	will pro[b]ably quit then	Added.
292.29	are damaged by [a sloppy drive in machine]	*sic*: a floppy drive in the machine (?)
295.19	so thermal printers were also out of the run[n]ing for me.	Added.
347.5	the mouse-equipped Macintosh for “na[i/ï]ve users.”	Replaced.
348.6	is found most often in arcade-style [styles].	*sic*
350.20	transmitted information at 300 baud[s]	Removed.

353.14	An issue more basic than control characters i[n/s] whether	Replaced.
353.19	You can send at 4,800 baud[s]	Removed.
379.1	Perfect Fil[l]er, 324-27	Added.

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