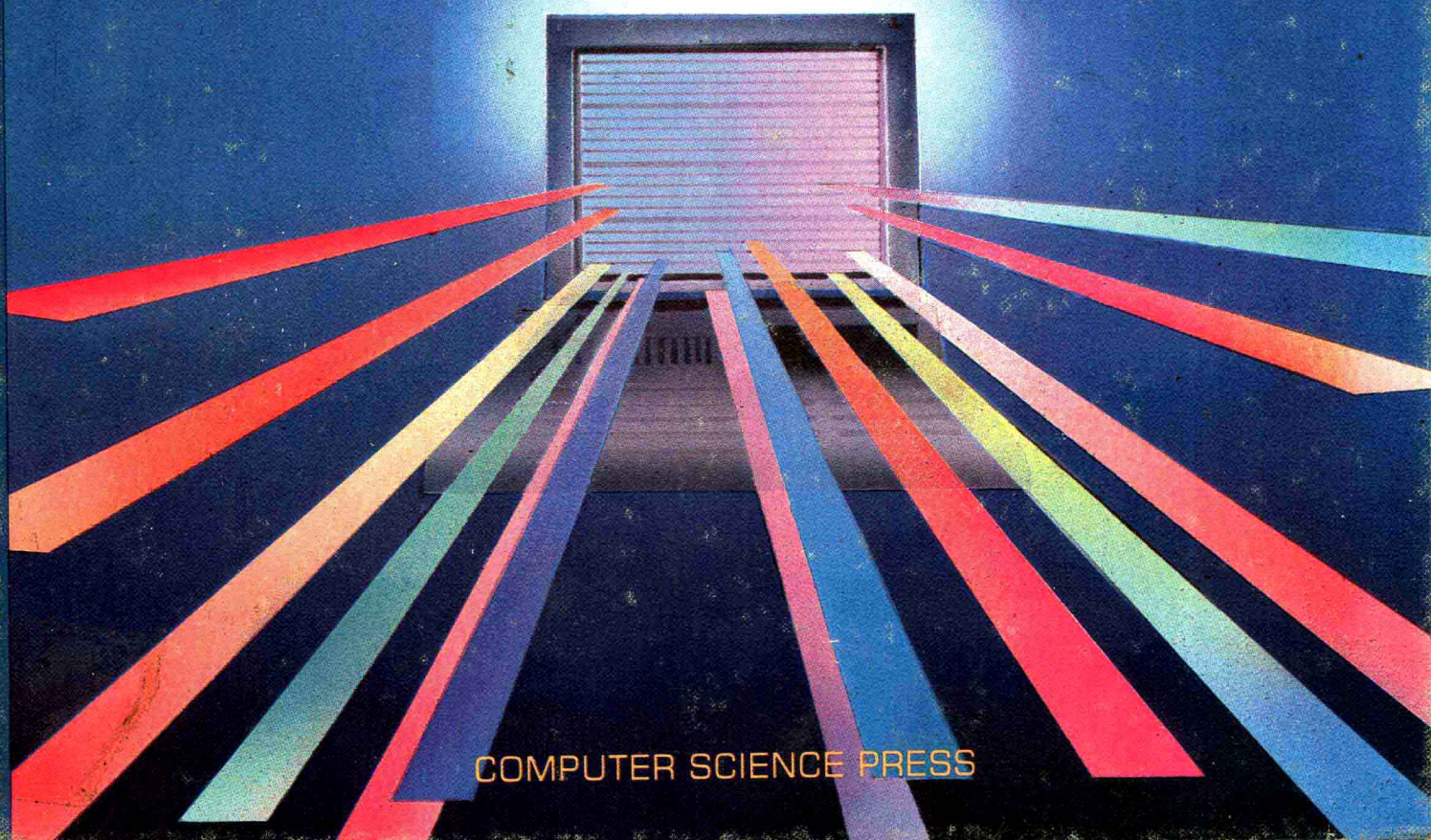
TOM LOGSDON

COMPUTERS TODAY AND TOMORROW

The Microcomputer Explosion



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PREFACE

Have you ever wondered what it would have been like to live in a special place during a special period of history? Along the Left Bank during the French Revolution? Or within sight of the Crystal Palace in Victorian England? Would you be willing to climb inside a time machine to explore the richest corners of our cultural heritage? To sail into the bustling harbor in pre-Christian Rhodes, or to amble along the Golden Horn during the flowering of Constantinople? Would you like to have been a guest in the New World 20 centuries later, when a ragged bank of Minutemen held firm against England's disciplined "Lobsterback" army?

These experiences would surely fill your spirit with delicious excitement. Fortunately, you need not wait for a clever genius to invent a time machine to gain a close-up view of the inner workings of a revolution. Why not? Because you are already, at this moment, living through one of the most important revolutions in the history of the world. It is called "the microcomputer revolution," and it is rapidly changing everything about the way we live.

The microcomputer revolution has swept over us so quickly that even talented experts have difficulty trying to fathom its probable outcome. Predictions are quickly overrun by events. In the late 1940s, for instance, when a reporter questioned one of the pioneers of the data processing revolution about the number of computers our country would ultimately require, he contended—in all seriousness--that we would never have a need for more than about 10 or 15. Today's computer industry produces and sells 15 new computers every 90 seconds. Such a production rate would have been incomprehensible a few decades ago. Yet many observers are convinced that the microcomputer revolution has barely begun. One of them even predicts that Americans will own and operate a billion computers by the year 2001.

Most introductory computer science courses treat their topic in a relatively placid way. There is much to recommend this fundamental approach. However, classroom trials have demonstrated that, if we focus on some of the more controversial issues, as is done in this treatment, we can trigger much more enthusiastic classroom response. My students at the University of Southern California have engaged in many lively discussions of today's controversial issues, and I would like to take this opportunity to thank them for their helpful contributions toward modifying and restructuring this book.

Sincere thanks should also go to a number of other individuals who helped in the preparation of the final manuscript. In particular, I would like to thank my friend Elda Stramel who has done all my typing for many years. I would also like to express my gratitude for the efforts of Ernie Gisondi and Ed Roman who provided the many excellent drawings that accompany the text. Much of the lettering was supplied by a perky craftsperson, Sheila Hernandez.

Finally, I would like to thank my editor Dr. Ellis Horowitz, who made helpful suggestions, and my daughter, Donna, who has become a talented wordsmith in her own right.

Tom Logsdon
Seal Beach, California

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If the efficiency and cheapness of the car had improved at the same rate as the computer's over the last two decades, a Rolls Royce would cost about $3.00, would get three million miles to the gallon, and would deliver enough power to drive the Queen Elizabeth II.

—Christopher Evans, *The Micro Millennium* [1]

One Friday morning in June 1983, a data processing specialist at the Sloan-Kettering Cancer Center on Manhattan Island realized that the hospital's VAX-11/780 computer—which was being used to monitor the patients' radiation treatments—had gone berserk at some time during the night. Pouring over the computer's printouts for clues, he noticed that five secret passwords had been issued to unauthorized users. The mystery deepened when he discovered that someone, somewhere, had reprogrammed the computer to behave in a curious way. Whenever a legitimate user gained access to the machine by typing in a secret password, a copy of that password was immediately sent over telephone lines to the intruder who had tampered with the computer.

Later the FBI traced the outgoing calls to Milwaukee, where they eventually discovered a gang of seven young computer "hackers" (untrained enthusiasts) who called themselves "The 414"—after the area code in their city. A subsequent investigation revealed that the gang members, who ranged from 15 to 22 years of age, had used a TRS-80 microcomputer to break into 60 large data processing systems in all parts of the country. One was located at the Los Alamos National Laboratory in Nevada; another was in the Los Angeles Security Pacific National Bank. The TRS-80 computer the gang used in their caper was owned by the father of their ringleader, 17-year-old Neal Patrick, a brash and enthusiastic high school senior with a B+ average.

The exploits of "414" were reminiscent of similar, but much more dramatic events in *Wargames*, a popular Hollywood movie that traced the exploits of a precocious teenager who tapped into a military computer system and accidentally lured it into playing "thermonuclear war."

At first the public assumed that the Milwaukee gang members got their inspiration by seeing the

film, but actually their bizzare adventure started several months before the movie had been released.

Wargames and the 414 incident received wide-ranging coverage in the popular press. Consequently, one of the networks began broadcasting a fictionalized copy called "Whiz Kids," a playful account of the exploits of four youngsters led by Richie, a skillful hacker who uses his expertise to penetrate computers at the Central Intelligence Agency, the FBI, and the major television networks. "Whiz Kids," an action-packed weekly series, is designed to appeal to the young people in the audience. It manages to show the kids off to advantage while the adult characters tend to be fumbling and ineffectual.

In retrospect the exploits of Neal Patrick and his real-life "Whiz Kids" may seem relatively benign. But those who manage large computer networks are worried about more serious incidents of a similar nature. Each year the American banking system moves more than $120,000 billion from computer to computer. Even smaller percentage thefts could have serious repercussions because these generous heaps of electronic "money" represent 30 times our current gross national product!

Hundreds of costly computer crimes have already been reported in the popular press. In one widely publicized incident, computer expert Mark Rifkin clipped the Los Angeles Security Pacific Bank for $10.2 million in one pulse-pounding orgy of electronic embezzlement. His adventure started when he caught a glimpse of a Fed Wire password on a visit to a bank where he had once worked. Part of the money bought a pouchful of diamonds from a dealer in Switzerland. Fortunately, they were valued at more than $10.2 million by the time bank officials managed their recovery.

So far electronic embezzlement is a manageable, if annoying, irritant for our country's financial institutions. But now that millions of microcomputers are in the hands of ordinary private citizens, crime by computer will likely become a much more troublesome phenomenon. Here is how Michael Crichton characterizes the magnitude of the computer revolution that has swept over us so relentlessly during the past few decades:

> The proliferation of computers in recent years has been truly phenomenal. In 1978, there were about 5,000 desk-top computers in the United States. In 1982 there were 5 million. . . . By 1990 it is estimated there will be 80 million. . . . By then, if you count microprocessors in weapon systems and home appliances, there will be a *billion* computers in use throughout the world.[2]

Today teenagers by the millions program computers as easily as previous generations fixed their bikes or repaired their automobiles. In a remarkably short interval, microcomputers have been adapted to a variety of tasks, most of which would be considerably less efficient and much less interesting without computers.

MICROCOMPUTERS FOR EVERYONE

Jack Adinolfi, who owns and operates a dry cleaning establishment in the Bronx, is representative of those who are participating in the microcomputer revolution. Nearly every afternoon when he arrives home from work he flips on his Apple II and vaporizes a few Klingon starships or plays a hand or two of blackjack before switching to his "checkbook" program and balancing his accounts. Before he turns the unit off, he might invite his wife and daughters to join him in scaling down one of their favorite recipes or playing a few quick games of electronic Ping Pong.

Jack and his family use their machine for business, pleasure, education, and household tasks. He also prepares his company payroll on the Apple using a program he coded himself after only a few hours of studying the manuals—which he found a bit confusing. He types in pay rates, hours worked, and number of dependents for each of his employ-

ees. The machine then uses its built-in tax-rate tables, computes Social Security deductions, and displays the results on the color TV screen. If he chose to fork over a few hundred dollars for an optional printer, Jack could print the resulting paychecks automatically, but for now he fills out the checks by hand.

Jack and his family program some routines in BASIC but they also use inexpensive preprogrammed software they have obtained from specialty houses and other hobbyists. For instance, Jack bought a General Ledger Disk for $24.95 to enable him to keep track of financial trends in his business. He feeds in vehicle expenses, rents, supply costs, etc., whereupon the computer spews out totals, comparisons, and trends to help him make profitable business decisions. This approach turns out to be much easier (and more precise) than his old method of scanning 14 columns on ledger sheets and spending hours pounding on an adding machine.

When he is not using it for business or entertainment, the Apple II supports Jack's avocation. He is a member of a local aquarium society and he uses his Apple to gain the upper hand in fish-breeding competitions. Among other things, the computer "remembers" the date he purchased each fish, its price, its age, when it spawns, the number of eggs it lays, the number that hatch, and the number that survive after 30 days. This information is held in permanent storage on a small magnetic disk.

Other microcomputer users are equally enterprising. One gambler, who makes his living betting on dog races, uses his machine to check track odds against his own best judgment. A young doctor uses his to cross-index the articles he reads in medical journals. Still another has put his unit to work keeping track of all the people he reaches on his shortwave radio; it also translates incoming Morse code into typewritten messages.

A microcomputer equipped with special switches and sensors can handle a variety of household chores. These include electronic thermostats to operate furnaces more efficiently, devices that switch on appliances or dim lights, and units that monitor seepage and moisture on basement walls.

Future applications could be considerably more useful. Someday you may have body monitors capable of checking your vital signs: heartbeat, pulse rate, blood pressure, respiration, temperature. If your measurements ever fall outside preprogrammed norms, the computer will sound an alarm or transmit a warning to paramedics by telephone—or communication satellite!

Computers of the future may also monitor the news service, selecting stories of interest and automatically making you a printed copy. Would you like to own an intelligent phone-answering machine? Leave a prerecorded message for a special friend, then, if she calls, your computer will automatically check her voiceprint before divulging what the message says.

Over 100 companies are currently marketing microcomputers or their key component parts. Figure 1.1 presents examples of some of the more popular models. In the next section, we will compare one of them with the finest full-sized model of 40 years ago.

THE ENIAC VERSUS THE APPLE II

The time is 1946. The place is the Moore School of Engineering in Philadelphia, Pennsylvania. The atmosphere is tingling with excitement. Persistent rumors have been circulating for several days. Most of them concern the capabilities and the fate of a revolutionary new machine soon to be unveiled by two unassuming professors: Dr. J. Presper Eckert and Dr. John W. Mauchly. The official name of their brainchild is the ENIAC*, but newspaper reporters quickly nickname it the "giant brain." When it works properly, the ENIAC can add 5,000 pairs of eight-digit numbers in one sec-

*ENIAC = Electronic Numerical Integrator and Calculator.

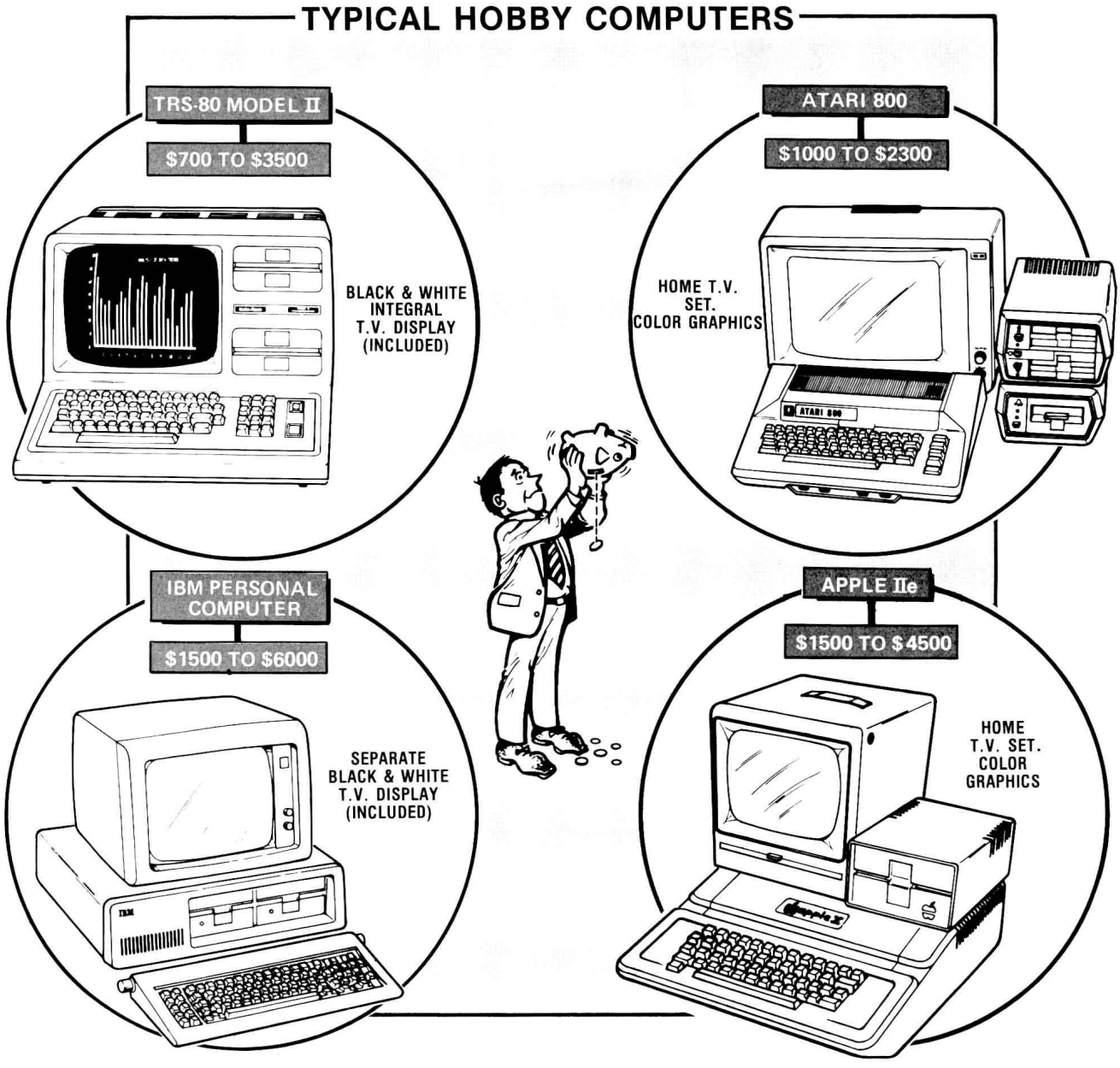

Figure 1.1: Today's hobby microcomputers are remarkably powerful and versatile machines. The four versions shown in this figure, which in some models cost as little as a few hundred dollars each, can be programmed in simple languages such as BASIC to solve business and scientific problems. They also accept preprogrammed software routines including word processing and video games. In the past few years millions have been sold to hobbyists, students, and small and large companies.[3]