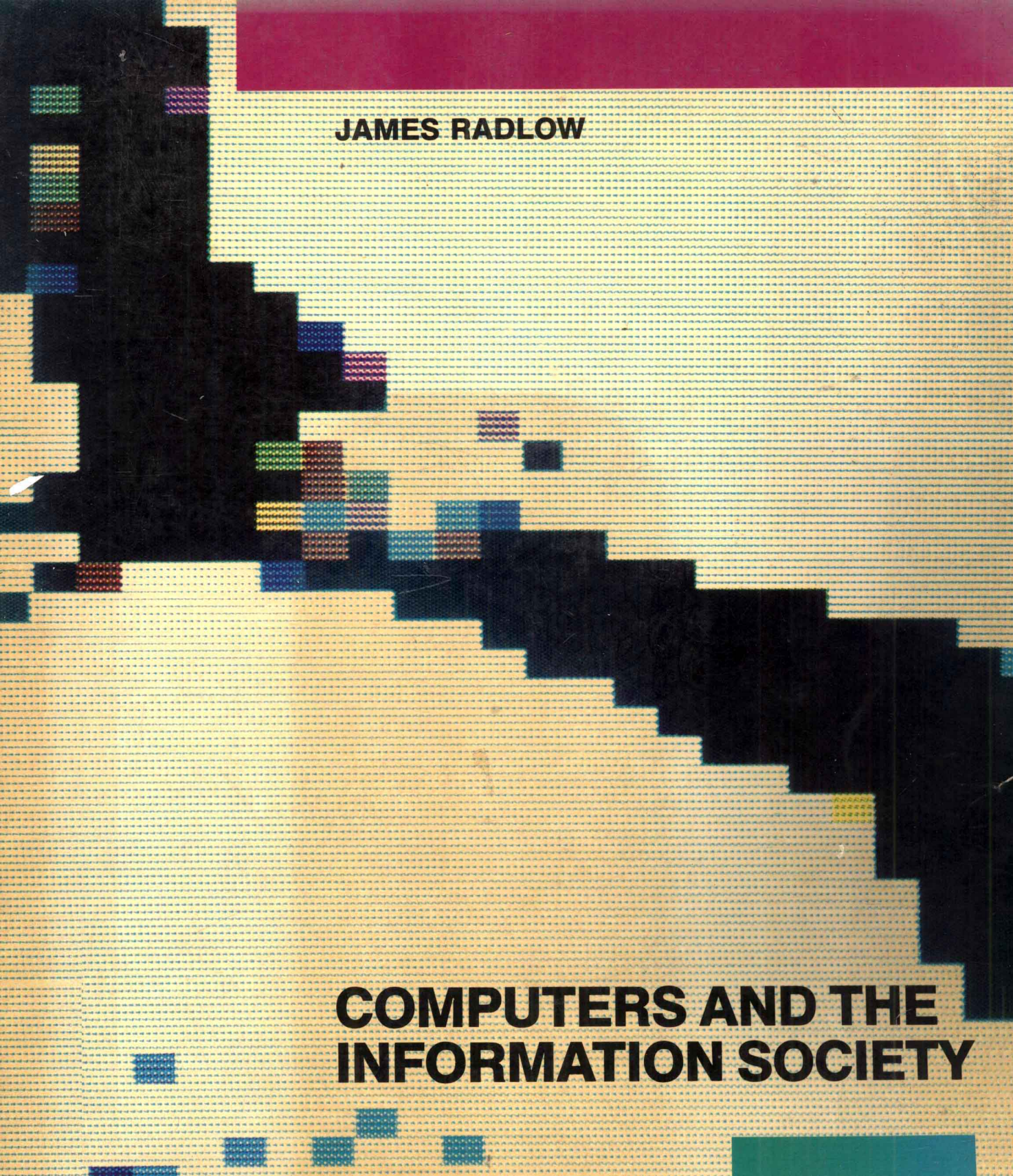

JAMES RADLOW

COMPUTERS AND THE INFORMATION SOCIETY

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James Radlow, a professor at the University of New Hampshire, has been a consultant for four leading computer and telecommunications companies. He is currently involved in research on high-speed computing and is developing software for a major computer manufacturer. In addition to *Computers and the Information Society*, he has published three college texts and many papers in technical journals.

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mindless, uncreative tasks. Of course students in every discipline have greater career opportunities because the computer exists. But the real fascination is in what computers and their applications are becoming—in the new astonishments that will emerge, the new creations, the new effects on our society and on our individual lives. Understanding and appreciating painting or literature or music are traditional routes to life-enriching experience. Understanding and appreciating computing may be another such path.

THE CHAPTERS

There are three groups of chapters: on societal issues (1 and 14), on computer basics (2 to 5), and on applications (6 to 13).

Societal Issues

Chapter 1 describes our age as one in which computer technology has had an impact on every aspect of our society, and on every one of us personally. Each of the societal-impact applications described in Chapter 1 is examined in detail in one or more of the applications chapters. For example, networking is an important topic in Chapter 8 and the main subject of Chapter 11. Chapter 14 completes the societal frame by reexamining the impact of networking and the other applications first mentioned in Chapter 1.

Computer Basics

The first topic in Chapter 2 is the importance of representation. I want students to appreciate that the computer is no more or less than a machine built to represent information—numbers, words, or graphics—through on/off electrical signals. Once the idea of representing information as bits of data is in hand, the student should have no difficulty with the other basic computer ideas—storing data in memory, and fetching it from memory for manipulation by the processor.

Chapter 3 is a history of computing, from the abacus and other forerunners of the computer to the advanced machines and emerging technologies of today. (This chapter uses terms and ideas introduced in Chapter 2, which explains why Chapter 2 precedes it.) Chapter 4 goes into detail about computer hardware. The chapter begins by describing the ''normal'' computer (the microcomputer) and goes on to discuss input, output, storage, and architecture for computers generally. The descriptions and discussions are full but not technical. Chapter 5 completes the unit on computer basics by explaining why programming languages are needed, and what they do. For courses that teach programming, there are sections on pseudocode and program design.

Applications

Chapters 6 and 7 are devoted to artificial intelligence and the closely associated topics of robotics and automation. These are leading-edge applications, but (as I

PREFACE

This book is designed for the introductory course about computers, their applications, and their societal impact. Like the course, it is intended for liberal arts, social science, business, and other students in the general college audience. There are no technical or mathematical prerequisites.

OBJECTIVES

To meet the needs and interests of the nonspecialist student, I've tried to give:

1. clear nontechnical explanations of why the inanimate computer can do useful things that would otherwise require human intelligence
2. a clear understanding that the computer is always under human control
3. an introduction to some applications that are likely to be useful to any educated person, such as word processing, spreadsheets, database programs, and graphics
4. an understanding of leading-edge applications—artificial intelligence, robotics, automation, relational databases, local area networks, CAD/CAM, state-of-the-art graphics, simulation—all influencing our lives right now, and likely to increase their influence greatly in the near future
5. a realistic, unbiased presentation of the key social issues of the computer age—emphasizing that human beings in a democracy will make the ultimate decisions about how computers will be put to use.

Most of all, I've tried to give the nonspecialist student a sense of adventure and privilege. Of course the computer is a machine that relieves human beings of

emphasize) not exotic ones. The student sees that expert systems are well established in medicine and in the business world, and that automation is a key to the success of Japanese industry, and to the long-term survival of American industry.

Chapter 8 discusses large database systems, the most important of current computer applications. The treatment is up-to-date: it features the concept of a database management system, and the relational database model. How can these technical concepts be made clear to a nontechnical audience? This book's answer is: by making use of analogies with the deep and complex ideas that every person in our society is familiar with. Here is an example taken from Chapter 8. I want to explain how passwords, or requests for user identification, function in a table (or relation) belonging to a relational database. Part of the explanation-by-analogy is as follows:

> *Each of these identification requests is at one and the same time a part of the table and a protection for the table, exactly as the toxins in certain plants are a part of the structure of the plant and also a way of protecting the plant against being grazed into extinction.*

Chapters 9 and 10 focus on word and text processing. For courses that introduce BASIC programming, Chapter 9 gives a concise introduction to the features of Microsoft BASIC common to Apple, IBM, and other popular microcomputers. Chapter 9 also demonstrates top-down design, as applied to the programming of a line editor. The editor is usable (it is used to edit a sample text, in the last section of the chapter), and this serves as an introduction to the extended treatment of word and text processing in Chapter 10. For courses that don't introduce BASIC programming, or that prefer a different treatment of the subject, Chapter 9 may be omitted without loss of continuity. With or without the prior treatment of BASIC, the topics in Chapter 10 appear to have special interest for the general college audience.

Chapter 11 is central to this book. It describes the merged computer/communications technology that has created our evolving information society. The topics include office automation, teleprocessing, local area networks (with such examples as AT&T's Olympics network and General Motors' planned robot networks), and computer conferencing. Although the general college audience includes the business/data processing student—who is especially interested in an up-to-date book—introductory data processing books tend to describe the business world as dominated by large computers. This book prepares students for an emerging business environment in which business graduates work less with large computers and more with personal computers and workstations that they control directly.

Chapter 12 discusses ideas and techniques of computer graphics, along with applications in industrial design and manufacturing (CAD/CAM technology), in medicine (rehearsing surgical procedures), in microcomputer graphics, and in state-of-the-art graphics, including special effects in film making.

Chapter 13 describes the systems approach, computer modeling, and computer simulation. As in other chapters, the presentation is nontechnical but it makes use of analogies and similes to take the student quickly into the heart of various topics. These topics include aircraft design, expert systems, a model of negotiation, the Leontief input-output model of the U.S. economy, societal models generally, and

global scenarios. Social science and business students will be especially interested in the closing section, which discusses accounting (the most widely accepted form of simulation in our society), financial simulation generally, and the electronic spreadsheet as a simulation tool and as sophisticated object-oriented software.

ORGANIZATION

The three groups of chapters are independent of one another, to allow for differences in course design. Within the computer basics group, Chapter 3 and the programming examples in Chapter 5 can be omitted without loss of continuity. Within the applications group, Chapter 7 is based on Chapter 6, and Chapters 8, 10, and 11 are closely related.

PROGRAMMING

Chapter 5 begins with a look backward to the covered wagon days of computing, when the computer was rewired for each new program. I think every student of computing should understand the concept of a programming language—that is, of reconfiguring the computer in software rather than in hardware. The rest of Chapter 5 is concerned with basic control structures and structured English, or pseudocode. It gives brief examples of programming in pseudocode.

The sample programs in Chapter 5 give students a look at actual code; they are not meant for teaching any language. For courses designed to include a modest introduction to Microsoft-style BASIC, Chapter 9 carries the student through a useful subset of the language (emphasizing string functions), and shows how to program a line editor. The development of the line editor program is an example of top-down design, or stepwise refinement.

For courses that de-emphasize programming in favor of applications programs, Chapters 10 (for word processing), 8 (for databases), and 5 and 13 (for spreadsheet programs) will be of interest. And some of the supplements described below will be relevant as well.

SUPPLEMENTS

There is a full range of supplements to *Computers and the Information Society,* to enhance the text's effectiveness as both a teaching and a learning tool. These supplements are:

Study Guide. The student Study Guide, written by John Avitabile of Rutgers University, provides extensive review and reinforcement of the information presented in each chapter of *Computers and the Information Society*. Each Study Guide chapter includes a chapter summary, review, and examples to illustrate major points, and 60 to 80 review questions in a variety of formats.

Instructor's Manual. James R. Swanson, Sr. of the University of Florida has written the Instructor's Manual to accompany *Computers and the Information So-*

ciety. For each chapter of the text there is a corresponding Instructor's Manual chapter which includes learning objectives, a lecture outline, suggested activities, readings, and references, and answers to end-of-chapter review questions in the text.

Test Bank. Also written by James R. Swanson, Sr., the Test Bank includes 60 or more questions for each chapter of the text plus two midterms and a final exam, for a total of over 1000 questions. In addition to the Test Bank manual, the Test Bank is available on diskettes for use with IBM, Apple, and TRS microcomputers and on tape for mainframe systems.

BASIC Supplement. For those who teach programming in their courses, this seven-chapter BASIC Supplement has been developed and class tested by Wayne Zage at Purdue University and Ball State University. Each chapter begins with a concise description of a topic and the BASIC commands involved, continues with a variety of examples ranging from single BASIC statements to complete programs, and concludes with review exercises and programming projects.

Overhead Transparencies. A full set of Overhead Transparencies is available to adopters for use as a classroom aid to further explain text concepts.

Slide Package. A package of 100 slides, many of them not found in the text, is available to adopters to illustrate such topics as history, computer graphics, a tour of a computer center, and how a chip is made.

Software. To provide students with their own inexpensive software which they can use in practical, hands-on applications and exercises keyed to the text, McGraw-Hill, in collaboration with Ashton-Tate, is making available a special, limited version of Framework, the popular integrated software package, for use with IBM systems and compatibles. Framework, which includes word processing, spreadsheeting, database management, and graphics, is accompanied by an instruction manual which guides students in its use and provides exercises keyed to the text. For those who want software for the Apple II, McGraw-Hill provides an integrated software program called Groundworks. This program, developed by Tom Goldman and Product Development Guild, Ltd., also provides students with an integrated package of word processing, spreadsheeting, database management, and graphics.

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The design of a textbook can contribute greatly to its usefulness; therefore, I'm grateful to Joan O'Connor for a design that is both functional and strikingly handsome. I've been buoyed up from the beginning by the enthusiastic support of Eric Munson, the book's sponsoring editor, and Christina Mediate, his successor. Susan H. Ryf, as editorial supervisor, wove all the ingredients together. Finally, I'm grateful to Jeremy Radlow and Joanne Turner for help and advice with writing and programs.

James Radlow

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TO THE STUDENT

We're often told we are living in a world the computer made. But that's deceptive, because the computer age was created by human beings, working with computers and other tools. Further developments will also be in the hands of human beings and these will not merely be computer professionals. All of us will use computers directly or indirectly. All of us will participate in making decisions that can lead us away from an Orwellian world and toward one in which there is more human choice than ever before.

What does human choice have to do with computers? As you read this book, I hope you will see more and more clearly that computer applications are flexible and versatile, and give free rein to our individuality. This applies to business people whose entrepreneurial spirit is released and encouraged by their electronic spreadsheets, to writers and editors in every field whose creativity is nourished by word processing, to researchers in economics and the other social sciences whose range is extended by computerized databases.

It applies to visual artists who use computer graphics as a sketchpad or as their primary medium, to city management experts using computerized project analysis to improve the delivery of municipal services and the quality of urban life, to teachers developing computer-based individualized instruction—a patient tutor for every child. Not one of these creative computer applications demands a computer professional—merely a professional in some other field who knows enough to use an existing application, or to ask a computer professional to develop a tailor-made application.

Every computer application I've just described also has its natural place in an information society, by which I mean a society whose primary economic activity

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