

Computer Confluence

Third Edition

www.computerconfluence.com

EXPLORING

TOMORROW'S

TECHNOLOGY



George Beekman

TP3 / B393 = 3

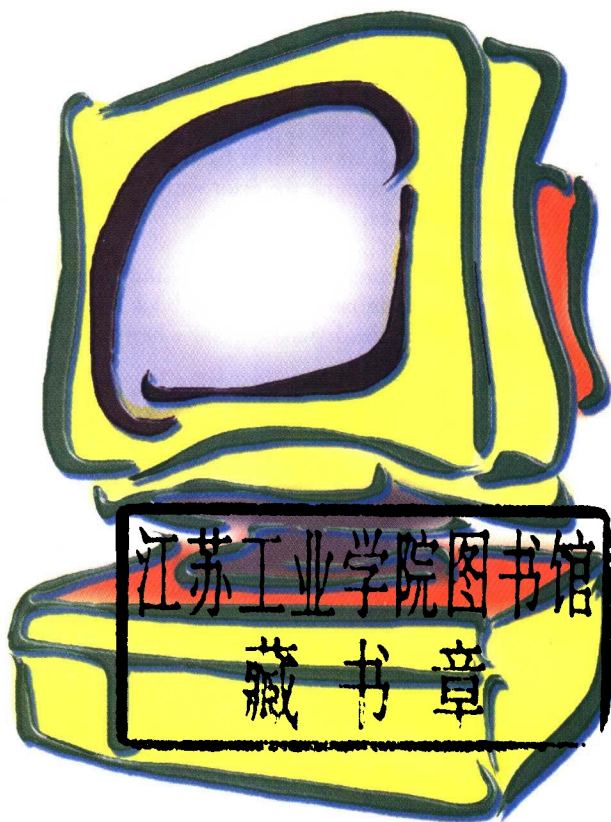
Third Edition

Computer Confluence

EXPLORING

TOMORROW'S

TECHNOLOGY



George Beekman

An imprint of Addison Wesley Longman, Inc.

Reading, Massachusetts • Menlo Park, California • New York • Harlow, England
Don Mills, Ontario • Sydney • Mexico City • Madrid • Amsterdam

Acquisitions Editor	Anita Devine
Assistant Editor	Kerry Connor
Editorial Assistant	Holly Rioux
Senior Production Supervisor	Juliet Silveri
Production Services	Jean Lake
Composition, Illustration, and Packaging Services	Lachina Publishing Services
Photo Researcher	Billie Porter
Cover and Text Designer	Regina Hagen
Print Buyer	Sheila Spinney
Senior Marketing Manager	Tom Ziolkowski
Senior Marketing Coordinator	Deanna Storey
Film, Printing/Binding	World Color-Versailles

Copyright ©1999 by Addison Wesley Longman, Inc.

All rights reserved. No part of this publication may be produced, or stored in a database or retrieval system, distributed, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher. Printed in the United States of America.

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this book, and Addison Wesley Longman was aware of a trademark claim, the designations have been printed in initial caps or all caps.

The credits section for this book begins on page 463 and is considered an extension of the copyrights page.

Library of Congress, Cataloging-in-Publication Data

Beekman, George.

Computer confluence : exploring tomorrow's technology / George Beekman. — 3rd ed., annotated instructor's ed.

p. cm.

Includes bibliographical references and index.

ISBN 0-201-35213-3 (pbk.). — ISBN 0-201-42880-6 (pbk. : instructor)

1. Computers. 2. Information technology I. Title.

QA76.5.B3652 1999

004—dc21

98-34363

CIP

1 2 3 4 5 6 7 8 9 10—RNV—02 01 00 99 98

To Sue, Ben, and Johanna

**My inspiration . . .
yesterday, today, and tomorrow.**



Computer Confluence

Third Edition

INSTRUCTIONAL SUPPORT SYSTEM

CD-ROM Included free with every new copy of the book, this digital companion offers eye-popping interactive animation, thought-provoking video clips, interactive tutorials, self-assessment quizzes that can be printed out with text references pages, and demonstration versions of popular software applications. The contents of the CD-ROM is tightly integrated with the book, expanding on and illustrating key concepts using state-of-the-art multimedia.

World Wide Web Site (<http://www.computerconfluence.com>) This comprehensive on-line supplement offers a wealth of integrated material to expand on the contents of the text. The regularly updated Web Site includes late-breaking news, hundreds of annotated links to related pages, and forums for both students and professors. New to the Web site are course management tools, on-line testing facilities, and chat rooms. The *Computer Confluence* CD-ROM and Web Site work together with the text to make a highly-integrated learning package.

Annotated Instructor's Edition This special edition, with annotations by Jerry Reed, is provided free to instructors. It contains annotations for lecture preparation and includes information not found in the Instructor's Manual. The annotations include *Perspective Notes* to share with the students, *Technical Notes* to help elaborate on more complex issues, *Teaching Tips* on how to present material in a "new" way, and *Quotes* that are pertinent to the material at hand. Test Bank and PowerPoint presentation references are also included.

Instructor's Resource CD-ROM for Windows 95/98 and Macintosh. The Instructor's Resource CD-ROM contains the tools you need whether you do full-blown multimedia presentations and post self-assessment quizzes on the Web or teach with an overhead projector and test using paper-and-pencil quizzes. The CD-ROM includes:

- The complete Instructor's Manual and tests from the printed test bank, both in a Microsoft Word and Adobe Acrobat format. (Instructor's Manual description follows)
- A Computerized Test Bank to create printed tests, network tests, and self-tests for the Internet. The Computerized Test Bank allows you to view and edit test bank questions, create multiple versions of tests, easily search and arrange questions in the order you prefer, add or modify test bank questions, administer tests on a network, or convert your tests to HTML to post to the Web. This edition's test bank contains 75% new questions, level of difficulty for professor use, and page references where the answers to questions can be found.
- An HTML Reference help file, which includes all the commands in HTML 4.0, with examples of their use, and which runs in your Web browser. This can be used as a supplement to *Compact Guide: Web Page Creation and Design*, packaged free with the student text.

- Helper Applications: PowerPoint 97 and Word 97 Viewers, Word 98 and PowerPoint 98 Converters, and Adobe Acrobat 3.0 Readers which can all be installed from the IRD.

Instructor's Manual with Printed Test Bank, written by George Beekman and Bill Daley. The Instructor's Manual extends the information in the Annotated Instructor's Edition of the text with behavioral objectives, chapter overviews, key terms, and class outlines. The printed test bank includes all of the test questions from the computerized test bank, including multiple choice true/false, matching, completion, and situation essay questions. Each question is labeled with a level of difficulty and references the text page where the answer to the question can be found. 75% of the test questions are new to the third edition.

Lecture-Launcher Videotapes Qualified adopters can receive our all-new videotapes. We have taken the best clips from many commercially available videotapes and put them together in 10-minute segments that relate to chapters in *Computer Confluence*. These tapes are ideal for adding information and interest to your lectures. Your Addison Wesley Longman sales representative has details about this offer.

The Latest Software Your school may qualify for full-version software licenses. Addison Wesley Longman is committed to partnering with your school to provide you with the latest software and best teaching materials available. Ask your Addison Wesley Longman sales representative for more information.

The Computer Confluence TechSuite Edition

Build a custom edition of *Computer Confluence*, Second Edition, for your lab course by combining the text with one or more selections from our SELECT Lab Series. The SELECT Lab Series offers dozens of proven and class-tested material, from Windows and DOS software applications textbooks to Internet activities, multimedia, CD-ROMs, and computer-based training. Your customized choice of textbooks will be sent to the bookstore, combined in a TechSuite, allowing students to purchase all books in one convenient package. Students gain a wide range of hands-on computer experiences, including the Internet, World Wide Web, word processing, spreadsheets, databases, programming, presentation graphics, and integrated packages. Instructors can add their own class notes or syllabi to create a unique learning package that has been tailored to match their individual course objectives.

Instructors choose what they want, and we customize the TechSuite to fit their needs. All materials from the SELECT Lab Series are also available separately.

Your Addison Wesley Longman representative will be happy to work with you and your bookstore manager to provide the most current "menu" of SELECT Lab Series offerings, outline the ordering process, and provide pricing, ISBNs, and delivery information. Or, visit our Web site at hepg.awl.com

Preface

Confluence **1:** a coming or flowing together, meeting, or gathering at one point (a happy confluence of weather and scenery) **2a:** the flowing together of two or more streams **b:** the place of meeting of two streams **c:** the combined stream formed by conjunction

—Merriam Webster's Collegiate Dictionary,
Electronic Edition

When powerful forces come together, change is inevitable. As the 20th century comes to a close, we're standing at the confluence of three powerful technological forces: computers, telecommunications, and electronic entertainment. The computer's digital technology is showing up in everything from telephones to televisions, and the lines that separate these machines are eroding. This digital convergence is rapidly—and radically—altering the world's economic landscape. Startup companies and industries are emerging to ride the waves of change, while older organizations reorganize, regroup, and redefine themselves to keep from being washed away.

Smaller computers, faster processors, smarter software, larger networks, new communication media—in the world of information technology, it seems like change is the only constant. In less than a human lifetime, this technological cascade has transformed virtually every facet of our society—and the transformation is just beginning. As old technologies merge and new technologies emerge, far-fetched predictions routinely come true. This headlong rush into the high-tech future poses a formidable challenge for all of us: How can we extract the knowledge we need from the deluge of information? What must we understand about information technology to successfully navigate the waters of change that carry us into the future? *Computer Confluence: Exploring Tomorrow's Technology* is designed to aid travelers on their journey into that future.

What Is Computer Confluence?

Computer Confluence is more than a textbook; it's the confluence of three information sources: an illustrated textbook, a multimedia CD-ROM, and a timely World Wide Web site on the Internet. This integrated learning package takes advantage of the unique strengths of three media types:

- *Computer Confluence*, the text. In spite of the talk about a paperless future, a book's user interface still has many advantages: You can read it under a tree or on the subway, you can bend the corners and scribble in the margins, you can study the words and pictures for hours without suffering from eyestrain or backache. A well-written text can serve as a learning tool, a reference work, a study guide, and even a source of motivation and inspiration. A textbook is no

substitute for a good teacher, but a good textbook can almost always make a good teacher better. This book, which started out as *Computer Currents* in 1994, has served as an information-age guidebook for thousands of students through its first two editions.

- *Computer Confluence*, the CD-ROM. A CD-ROM may not be as warm and friendly as a good book, but it can deliver video, audio, animation, and other dynamic media that can't be printed on paper. A well-designed CD-ROM can encourage exploration through interactivity. The *Computer Confluence* CD-ROM supplements and reinforces the material in the book with state-of-the-art 3-D animation, audio, and video. It also includes a software sampler for hands-on experimentation and interactive study materials that provide immediate student feedback.
- *Computer Confluence*, the Web site (<http://www.computerconfluence.com>). The information in computer books and CD-ROMs has a short shelf life. The Internet makes it possible to publish up-to-the-minute news and information regularly and link that information to other sources around the world. The Internet can also serve as a communication conduit for on-line discussion and research. An extensive collection of timely, media-rich Web pages keeps the information in *Computer Confluence* current. The pages include late-breaking news, multimedia tidbits, and links to the most important computer and information technology sites, all organized by chapter and topic. The Web site also includes discussion areas where students, instructors, and authors can meet on-line. Students can also visit the Web site to take practice quizzes and submit answers to on-line exercises.

Computer Confluence presents computers and information technology on three levels:

- Explanations: *Computer Confluence* clearly explains what a computer is and what it can (and can't) do; it explains the basics of information technology clearly and concisely.
- Applications: *Computer Confluence* clearly illustrates how computers and networks can be used as practical tools to accomplish a wide variety of tasks and solve a wide variety of problems.
- Implications: *Computer Confluence* puts computers in a human context, illustrating how information technology affects our lives, our world, and our future.

Who Is Computer Confluence For?

Computer Confluence: Exploring Tomorrow's Technology is designed especially for the introductory computer class for both nonmajors and majors. *Computer Confluence* is also appropriate for introductory computer science classes, discipline-specific computer courses offered through other departments, high school courses, and adult education courses. *Computer Confluence* can also serve as a self-study guide for anyone who's motivated to understand the changing technological landscape.

Most introductory computer courses are divided into lecture and lab sections. In some courses the labs cover computer applications like Microsoft Office; in other courses the labs cover Internet tools like electronic mail and the World Wide Web; a few courses include programming with languages like BASIC, C, and Java. Since this book focuses on concepts rather than keystrokes, it can be used in courses that teach any combination of lab applications and tools. The SELECT Lab Series and the Tim Duffy Lab Series offer specially designed hands-on labs covering the most

popular software applications and programming languages. There are dozens of books that can be used for the lab segment of this course.

How Is Computer Confluence Organized?

The book consists of 16 chapters organized into five broad sections:

1. *Approaching Computers: Hardware and Software Fundamentals*
2. *Using Computers: Essential Applications*
3. *Exploring with Computers: Networks and Gateways*
4. *Mastering Computers: Issues, Algorithms, and Intelligence*
5. *Living with Computers: Information Age Implications*

Part 1 provides the basics: a brief historical perspective, a nontechnical discussion of computer and Internet basics, and an overview of hardware and software options. These chapters quickly introduce key concepts that recur throughout the book, putting the student on solid ground for understanding future chapters. Part 2 covers the most important and widely used computer applications, including word processing, spreadsheets, graphics, multimedia tools, and databases. These applications, like those in Parts 3 and 4, are presented in terms of concepts and trends rather than keystrokes. Part 3 explores the world of networks, from simple interoffice LANs to the massive global infrastructure that's evolving from the Internet. Part 4 begins with a discussion of information technology risks and related ethical issues; it then explores the process and the problems of creating software, including the curious field of computer science known as artificial intelligence. Part 5 explores the far-reaching impact of computers on our work, our schools, our homes, our society, and our future.

Throughout the five parts, the book's focus gradually flows from the concrete to the controversial and from the present to the future. Individual chapters have a similarly expanding focus. After a brief introduction, each chapter flows from concrete concepts that provide grounding for beginners toward abstract, future-oriented questions and ideas.

Each chapter includes instructional aids to help students master the material quickly. Key terms are highlighted in boldface type for quick reference; secondary terms are italicized. Terms are defined in context, in a glossary at the end of the text, and in the CD-ROM's hypertext glossary. Each chapter begins with a list of objectives and ends with a chapter summary; a list of key terms; collections of review questions, discussion questions, and projects; and an annotated list of sources and resources for students who want more information or intellectual stimulation.

Throughout Computer Confluence special focus boxes complement the text:

Charles Babbage, Ada Lovelace, and the Computer That Never Was

The Analytical Engine has no pretensions whatever to originate anything. It can do whatever we know how to order it to perform.




—Countess Ada Lovelace

The Analytical Engine Ada Lovelace referred to was the first computer, conceived by Charles Babbage, a nineteenth-century mathematics professor at Cambridge University. Babbage was an eccentric genius known by the public for his war with street musicians. He calculated that they sapped him of 25 percent of his working power, and strove to have them outlawed. But Babbage was more than a crank; his many inventions included the skeleton key, the locomotive cow catcher, the speedometer, and . . . the computer.

Babbage's computer vision grew out of frustration with the tedious and error-prone process of creating mathematical tables. In 1823 he asked for and received a grant from the British government to develop a difference engine—a mechanical device for performing repeated additions. Two decades earlier Joseph-Marie Charles Jacquard, a French textile maker, had developed a loom that could automatically reproduce woven patterns by reading information encoded in patterns of holes punched in stiff paper cards. After learning of Jacquard's programmable loom, Babbage abandoned the difference engine for a more ambitious enterprise: an Analytical Engine that could be programmed with punched cards to carry out any calculation to twenty digits of accuracy. Babbage's design included the four basic components found in every modern computer—components for performing the basic functions of input, output, processing, and storage.

Ada Lovelace, the mathematically gifted daughter of poet Lord Byron, visited Babbage and became fascinated by the Analytical Engine. Lovelace corresponded regularly with Babbage and published a paper on the Analytical Engine that included the first computer program. She became Babbage's partner, expanding on his vision and correcting errors in his work.

Babbage and Lovelace became obsessed with completing the Analytical Engine. Eventually the government withdrew financial support; there simply wasn't enough public demand to justify the ever-increasing cost. Babbage and Lovelace gambled on horses and pawned jewels to raise money for the project, but to no avail. The technology of the time was not sufficient to turn their ideas into reality. The world wasn't ready for computers, and it wouldn't be for another 100 years.



Human Connection

boxes at the beginning of all chapters feature stories of personalities who made an impact on the world of computing, and in some cases, people whose lives were transformed by computers and information technology.

Creating Presentation Graphics



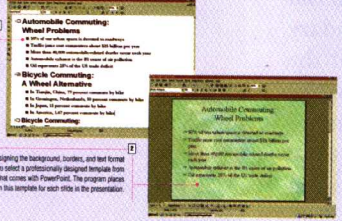
Software: Microsoft PowerPoint.
The goal: To create visual aids for a talk you're giving for a class. You'll use PowerPoint, a presentation graphics package that's especially designed for this kind of task.

1 You start by creating an outline of the main points of your talk, arranging headings and subpoints in the appropriate order. (You could just as easily do this step in a word processor with outlining capability.)

2 Rather than designing the background, borders, and text format yourself, you select a professionally designed template from the collection that comes with PowerPoint. The program places your text on this template for each slide in the presentation.

3 PowerPoint has a few basic drawing tools and the ability to import charts, graphs, drawings, and scanned images created with other applications. But for this slide you simply add an image of a slide from a clip art collection that comes with the program.

4 You can print overhead transparencies or have slides made from your disk file. But since much a big-screen computer system in the lecture room, you decide to create an interactive "slide show" with animated visual transitions between slides.



The User's View

boxes show the reader, through screens and text, what it's like to work with computer applications without getting bogged down in the details of button pushing. Featured applications are available on both Windows and Macintosh platforms.



Throughout the book, icons indicate links to supplementary material on the CD-ROM and the World Wide Web.

CURRENTS

Computer Doomsday

Robert J. Samuelson

Many people are already planning big parties to ring in the year 2000. But the wee hours of January 1, 2000, won't be a time of celebration for many people who work with aging computer systems. This article, published in a longer form in the May 6, 1998 edition of the *Wall Street Journal*, describes how Y2K bugs might wreak havoc on all kinds of systems we depend on every day. The clock is ticking—what will happen when the alarm goes off?

I plead guilty to journalistic incompetence for ignoring what may be one of the decade's big stories: the Year 2000 problem. Among technical types, it's shorthand for the Y2K problem (K stands for thousand) and refers to the dangers of computers that can't recognize the new century. Economist Edward Yardeni of Deutsche Morgan Grenfell, who has studied the problem, rates the odds that it will trigger a deep recession at 60 percent. He fears something ranking with the 1974-75 slump, the second worst since World War II. In 1975 unemployment averaged 8.5 percent.

Even this doesn't cover the everyday disruptions that could conceivably fray society's fabric. In our computer-dependent world, here are some possibilities: failed telephone systems; power brownouts; a hobbled air traffic control system; uncheckable credit cards; faulty billing systems; delayed tax refunds. No one knows whether these and other bad things will happen; but no one knows that they won't, either.

President Clinton and Vice President Gore project themselves as cyber boasters: they love plot-rips with satellites at computers. But they've virtually neglected the Y2K problem. As a result, many agencies lag badly in converting their computers. The Federal Aviation Administration's air traffic control system has 230 computer systems, using 30 computer languages with about 23 million lines of software code. It didn't begin taking the Y2K problem seriously until mid-1997. By early 1998, less than half the system was converted. The FAA claims it will be fully ready by mid-1999; the General Accounting Office is skeptical.

The House subcommittee on government management, information and technology, chaired by Rep. Stephen Horn (R-Calif.), estimates that the federal government has almost 8,000 "mission critical" computer systems and that only 35 percent are now prepared for the year 2000. At the present rate, the committee projects that only 63 percent will make it. Most disturbing is the estimate that only about a quarter of the Defense Department's 2,900 systems are now ready. Among private companies, readiness also seems spotty. The head of General Motors' information systems recently told *Fortune* magazine that the company is working feverishly to fix "catastrophic problems" at its plants.

Inattention to the Y2K problem may partly reflect the PC myth: the belief that personal computers and their "servers"—which can supposedly read all dates—have assumed most computing tasks. Not so. Larger computers are still used for (among other things) personnel files, airline reservations, banking, money transfers, medical records and telephone systems. These are society's arteries. In the 1960s and 1970s, software programs used only two digits to signify a date—way 67 for 1967. Programmers (it's said) never expected the software to survive until 2000. But much of it did; new computers simply enable it to run much faster.

When the year hits 2000, the date becomes "00." Consider the potential havoc. A computer subtracts 98 (1998) from 99 (1999) and gets 1. On a loan, that's a year's worth of interest. Now the computer tries to subtract 99 (1999) from 00 (2000). Perhaps it won't compute—or perhaps it gets 99 years. On a loan, that's 99 years of interest. The FAA reports that its radar has a date mechanism to regulate a critical coolant. If the software isn't fixed, "the cooling system will not turn on at the correct time . . . and the [radar] could overheat and shut down."

Potential glitches like this abound. No one knows how many there are. Millions of lines of software have to be scanned and, if wrong, rewritten. Computers must then be tested. New software can create new bugs that have to be corrected. Interconnected systems are especially vulnerable. Even if one system is okay, it may be harmed by bad data from another. Little testing has been done. It's complex and time-consuming. Often, systems can be tested only on weekends when not in use.

Our vulnerability is plain. In 1990, a few bad lines of bad software caused AT&T's long-distance system to crash for nine hours; recently, an AT&T data system crashed, disrupting automatic teller machines, airline reservations and e-mail. We depend on the smooth flow of information. Interruptions will harm the economy. If fixed quickly, they will be mere inconveniences. If not, they will sow uncertainty, destroy confidence and sap society's sense of control. We can deny the possibilities and pray they don't materialize. Or we can pay attention and hope to minimize them. Either way, the year 2000 won't wait.

Discussion Questions

1. The author suggests there are generally two polar positions to take in this debate: reassuring complacency and hysterical alarmism. Do you identify with either of these positions?
2. Can you think of several ways the Y2K bug might have an impact on your life on January 1, 2000?
3. Before you read this article, were you aware of the potential magnitude of the Y2K problem?



Ergonomics and Health

Along with the benefits of computer technology comes the potential for unwelcome side effects. For people who work long hours with computers, the side effects include risks to health and safety due to radiation emissions, repetitive-stress injuries, or other computer-related health problems. Inconclusive evidence suggests that low-level radiation emitted by video display terminals (VDTs) and other equipment might cause health problems, including miscarriages in pregnant women and leukemia. The scientific jury is still out, but the mixed research results so far have led many computer users and manufacturers to err on the side of caution.

More concrete evidence relates keyboarding to occurrences of repetitive-stress injuries such as carpal tunnel syndrome, a painful affliction of the wrist and hand that results from repeating the same movements over long periods. Prolonged computer use also increases the likelihood of headaches, eyestrain, fatigue, and other symptoms of "technostress."

Ergonomics (sometimes called human engineering) is the science of designing work environments that allow people and things to interact efficiently and safely. Ergonomic studies suggest preventive measures you can take to protect your health as you work with computers.

Choose equipment that's ergonomically designed. When you're buying computer equipment, look beyond functionality. Use magazine reviews, manufacturer's information, and personal research to check on health-related factors, such as monitor radiation and glare, disk-drive noise levels, and keyboard layout. A growing number of computer products, such as split,

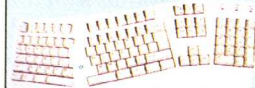
angled keyboards, are specifically designed to reduce the risk of equipment-related injuries.

- **Create a healthy workspace.** Keep the paper copy of your work as close to the same height as your screen. Position your monitor and lights to minimize glare. Sit at arm's length from your monitor to minimize radiation risks.
- **Build flexibility into your work environment.** Whenever possible work with an adjustable chair, an adjustable table, an adjustable monitor, and a removable keyboard. Change your work position frequently.



- **Rest your eyes.** Look up from the screen periodically and focus on a far-away object or scene. Blink frequently. Take a 15-minute break from using a VDT every two hours.
- **Stretch.** While you're taking your rest break, do some simple stretches to loosen tight muscles. Occasional stretching of the muscles in your arms, hands, wrists, back, shoulders, and lower body can make hours of computer work more comfortable and less harmful.
- **Listen to your body.** If you feel uncomfortable, your body is telling you to change something or take a break. Don't ignore it.

Ergonomic keyboards like this one allow computer users to hold their hands and arms in more natural positions while typing to reduce the risk of repetitive-stress injuries.



Currents

boxes at the end of each chapter provide thought-provoking, timely, and sometimes controversial essays and interviews with writers, analysts, and industry insiders. How is this technology changing our lives? What have we given up in return for a high-tech future? Who stands to gain the most, and who stands to lose the most, as we move into an information-based economy? Do PCs make us more productive, or have we been suckered by clever marketing tactics? How will future generations experience our digital works of art and literature? These and other questions are raised—and wrestled with—in Currents boxes.

Rules of Thumb

boxes provide practical, nontechnical tips for avoiding the pitfalls and problems created by computer technology. How can you use graphics effectively and tastefully in a computer document? How can you minimize the health hazards of extended computer use? How can you protect your data from viruses and other software risks? What's the best way to communicate effectively with electronic mail? These are the types of questions that are answered in Rules of Thumb boxes.

How It Works

boxes are designed to provide additional technical material for courses and students who need it. How does the CPU execute a program? Why does a color image look different on the screen than on a printout? How does compression make files smaller? How can messages be encrypted? Students will find answers to these kinds of questions in the How It Works boxes. For classes where this kind of technical detail isn't necessary, students can safely skip these boxes without missing any critical information. How It Works boxes are numbered to make it easy for instructors to create customized reading assignments by specifying which are required and which are optional.

A Word to Instructors

Even if you're on the right track, you'll get run over if you just sit on it.

—Pat Koppman

When *Computer Currents* was published in 1994, most introductory computer classes were taught using command-line software on hardware that couldn't support any form of multimedia. Few introductory books even mentioned the Internet, few students used email, and the World Wide Web was a well-kept secret. Today's computer user takes the graphical user interface for granted, most new software is delivered on CD-ROMs, and multimedia computers are commonplace. The Internet has become fashionable, email is taught and used in hundreds of introductory classes, and World Wide Web URLs are commonplace on business cards and in television commercials.

This kind of change threatens to make even the most successful introductory computer classes irrelevant. How do we provide timely information on a subject about which last year's news seems remarkably old? How can we be sure that a freshman-level Introduction to Computers class won't seem like a History of Computers class by the time those freshmen graduate? How do we design courses that provide students with practical, expansive, lasting knowledge about computers and information technology?

It's no longer enough to teach students the fundamentals of programming and call them "computer literate." Nor can we assume that students who know word processor and spreadsheet keystrokes are adequately equipped to survive and prosper in the information age. Even today's email programs and World Wide Web browsers will probably look like antiques in a few short years. In fact, any hands-on experience is likely to have a short useful life unless it's accompanied by material that provides a broader context.

Computer Confluence 3e is designed to provide that context. Like the first two editions, the book emphasizes big ideas, broad trends, and the human aspects of technology—the critical concepts that tend to remain constant even while hardware and software change. But even big ideas and broad trends change over time. For example, the past few years have seen the Internet and interactive multimedia move from the fringe to the center of our collective computer consciousness. *Computer Confluence* has been rewritten to reflect those changes. The Internet and the World Wide Web are introduced in the first chapter and covered extensively throughout the book; Chapter 10 provides a chapter-long, in-depth look at the Internet and related technologies. Chapter 7 has been revised and expanded to provide more clear, comprehensive, and current coverage of hypermedia and interactive multimedia. This edition includes new *User's View* boxes on searching the Web, editing photographic images, drawing with illustration software, and designing a Web site.

But *Computer Confluence* doesn't just talk about the Internet and multimedia—it uses these technologies to deliver information that is more expansive, more interactive, and more current than what can be provided by a book alone.

The *Computer Confluence* CD-ROM includes supplementary text, animated illustrations, interactive exercises, and audio and video clips for anyone with access to a multimedia-ready computer. The completely revised CD-ROM has a wealth of new material, including more interactive explorations, more video clips, more practice quizzes, more demonstration software, and new printing capability that make it easier for you to monitor student progress. Students find that it's easy and fun to explore the CD-ROM using its innovative, streamlined 3-D user interface. The CD-ROM runs on Windows and Macintosh machines, so students can use it on their

own computers, even computers that aren't the same kind you use in your labs. It runs without installing any files on the local hard disk, requiring only QuickTime for animations, so it can be used even in the most tightly controlled public labs.

The *Computer Confluence* Web site provides students with timely updates and links to hundreds of valuable Internet resources. New interactive study questions, practice quizzes, on-line testing, and discussion forums add value for students and faculty alike.

Students don't need to have access to CD-ROM drives and the World Wide Web to benefit from *Computer Confluence*; they can easily master the material in the book without using other media. But the additional material on the CD-ROM and the Web can make their learning experiences more interesting, exciting, and timely.

The *Computer Confluence* book, CD-ROM, and Web site, when combined with your guidance and instruction, can provide students with unprecedented resources for understanding the technologies that are shaping their future. Hopefully, many of those students will use their knowledge to take an active part in shaping that future.

A Word to the Student

If you're like most students, you aren't taking this course to read about computers—you want to use them. That's sensible. You can't really understand computers without some hands-on experience, and you'll be able to apply your computer skills to a wide variety of future projects.

But it's a mistake to think that you're computer savvy just because you can use a PC to write term papers and surf the Internet. It's important to understand how people use and abuse computer technology, because that technology has a powerful and growing impact on your life. (If you can't imagine how your life would be different without computers, read the vignette called "Living without Computers" in Chapter 1.) Even if you have lots of computer experience, future trends are almost certain to make much of that experience obsolete—probably sooner than you think. In the next few years, computers are likely to take on entirely new forms and roles because of breakthroughs in artificial intelligence, voice recognition, virtual reality, interactive multimedia, networking, and cross-breeding with telephone and home entertainment technologies. If your knowledge of computers stops with a handful of PC and Internet applications, you may be standing still while the world changes around you.

When you're cascading through white water, you need to be able to use a paddle, but it's also important to know how to read a map, a compass, and the river. *Computer Confluence: Exploring Tomorrow's Technology* is designed to serve as a map, compass, and book of river lore to help you ride the information waves into the future.

Computer Confluence will help you understand the important trends that will change the way you work with computers and the way computers work for you. This book discusses the promise and the problems of computer technology without overwhelming you with technobabble.

Computer Confluence is intentionally nontechnical and down to earth. Occasional mini-stories bring concepts and speculations to life. Illustrations and photos make abstract concepts concrete. Quotes add thought-provoking and humorous seasoning.

Whether you're a hard-core hacker or a confirmed computerphobe, there's something for you in *Computer Confluence*. Dive in!

Acknowledgments

Writing a book requires countless hours of working alone, but it isn't just solo work. This book is a team effort. I'm deeply grateful to all of the people who've helped bring *Computer Confluence* together. Their names may not be on the cover, but their high-quality work shows in every detail of this project.

I'll start by saying thanks again to the marvelous Benjamin/Cummings team that worked with me to put together the first edition. If it hadn't been for the vision, talent, and hard work of these folks, the original *Computer Currents* wouldn't have been such a big success, and there wouldn't be second or third editions. I was doubly fortunate to have many of those same people back to help me turn *Computer Currents* into *Computer Confluence*.

When it moved east from Benjamin/Cummings California headquarters to the main Addison Wesley campus in Massachusetts, *Computer Confluence* inherited a new family. Personnel changes and deadlines made for some difficult adjustments. But the new team is together now, and it's been a pleasure for me to get to know and work with them.

I'm delighted that Anita Devine has joined the *Computer Confluence* team as Acquisitions Editor; she brings a wealth of experience and a proven ability to the difficult job of managing this and other related projects. Anita has been ably assisted by Holly Rioux, who became an invaluable member of the team the day she came on board.

Kerry Connor has been amazing throughout this project. Her duties shifted several times as personnel changed; she served as an anchor during the most difficult transition periods. She's done an outstanding job on both editorial and production fronts, and she's a joy to work with.

Patty Mahtani was instrumental in getting the project moving on the production front and providing support and assistance to the rest of the team. Juliet Silveri worked tirelessly on all aspects of production, helping assure that the project could make all those nearly impossible deadlines. And Jean Lake, who was responsible for production of the first two editions, helped coordinate a myriad of production details and communications this time around. All of these people did marvelous jobs, and the quality of the finished book is a testament to their work.

The *Computer Confluence* CD-ROM and Web Site were produced by a team of Oregon wizards headed by Mark Dinsmore and Dave Trenkel, two former students who morphed into multimedia professionals. Mark's technical expertise, design talent, problem-solving skills, insatiable curiosity, and endless energy made him indispensable. Dave's crystal-clear tutorials, imaginative 3-D animations, and intelligent electronic music rival the best in the business. Graphic designer Delores Dinsmore and Web researcher Ben Beekman each brought a unique set of talents to the team and the project. Back in Reading, Massachusetts, the details of the CD-ROM and the Web site were coordinated by Jennifer Pelland, whose knowledge, creativity, resourcefulness, and attention to detail amazed and inspired all of us.

Many others brought their considerable talents to *Computer Confluence*. Gina Hagen is the person most responsible for the beautiful design of the book. Gary Brent and Paul Thurrot contributed most of the original material for the *How It Works* boxes and served as valued consultants and technical advisors. Billie Porter's research uncovered many of the excellent photos in these pages. Robert Rose and Ben Beekman captured most of the screens in the *User's View* boxes.

Lionel Browne's sharp eyes edited copy. Lorne Franklin and the staff at Lachina Publishing Services produced the final book from all of the raw materials supplied by the others listed here.

All of this effort would be wasted if *Computer Confluence* didn't reach its intended audience. Thankfully, Michelle Hudson and Deanna Storey have done a wonderful job of marketing *Computer Confluence*. Michelle recently left the team to face new challenges, and I wish her all the best.

There are others who contributed to *Computer Confluence* in all kinds of ways, including critiquing chapters, answering technical questions, tracking down obscure references, guiding me through difficult decisions, and being there when I needed support. There's no room here to detail their contributions, but I want to thank the people who gave time, energy, talent, and support during the years that this book was under development, including Peter Harris, Jan Dymond, Sherry Clark, Mike Johnson, Mike Quinn, Walter Rudd, Cherie Pancake, Bruce D'Ambrosio, Bernie Feyerham, Rajeev Pandey, Dave Stuve, Clay Cowgill, Keith Vertanen, Megan Slothover, Claudette Hastie-Baehrs, Shjoobedebop, Sujita, Wonderlust, SMILE, Breitenbush, Oregon Public Broadcasting, and KLCC. Thanks also to all the hardware and software companies whose cooperation made my work easier. And most of all, thanks to Susan, Ben, and Johanna, whose patience, support, love, and sacrifice inspired me every day through all these years.

Reviewers

Thanks to all of the dedicated educators who reviewed the manuscript at various stages of development; *Computer Confluence* is a significantly more valuable educational tool as a result of your ideas, suggestions, and constructive criticism. William Allen, University of Central Florida; Warren Boe, University of Iowa; Frederick Bounds, DeKalb College; David Bozak, SUNY Oswego; Gary Brent, Scottsdale Community College; Judy Cameron, Spokane Community College; Mark Ciampa, Volunteer State Community College; Daniel Combellick, Scottsdale Community College; Nancy Cosgrove, University of Central Florida; Allen Dooley, Pasadena City College; H. E. Dunsmore, Purdue University; Joseph Fahs, Elmira College; Pat Fenton, West Valley College; David Fickbohm, Golden Gate University; Blaine Garfalo, San Francisco State University; Dwight Graham, Prairie State College; Wade Graves, Grayson County College; Margaret Guertin, Boston University; Ananda Gunawardena, University of Houston - Downtown; Dale Gust, Central Michigan University; Lynne Hanrahan, Salem State College; Michael Hansen, Midlands Technical College; Sally Ann Hanson, Mercer County Community College; Shelly Hawkins, Trevor Jones, Duquesne University; Edward Kaplan, Bentley College; Linda Kieffer, Eastern Washington University; Fred Klappenberger, Anne Arundel City College; Robert Kuhn, Muskingum Area Technical College; Larry Lagerstrom, University of California, Berkeley; Doug MacDormand, Red Deer College; Brenda Mathews, University College of the Cariboo; Pat Mattsen, St. Cloud University; Vicki McCullough, Palomar College; J. Michael McGrew, Ball State University; Doris McPherson, Schoolcraft College; Linda Wise Miller, University of Idaho; William Moates, Indiana State University; Virginia Phillips, Youngstown State University; Gerhard Plenert, Brigham Young University; Loreto Porte, Hostos City College; Mike Quinn, Oregon State University; Paul Ryburn, University of Memphis; Jennifer Sedelmeyer, Broome City College; Raoul Smith, Northeastern University; Randy Stolze, Marist College; Susan Switzer, Central Michigan University; Tim Sylvester, Maricopa City College; John Tellpro, Salem State College; Dale Underwood, Lexington Community College; Dwight Watt, Athens Area Technical Institute; Patricia Wermers, North Shore City College; Alan Whitehurst, Brigham Young University; Melissa Wiggins, Mississippi College; Floyd Jay Winters, Manatee City College; Rich Yankosky, Frederick City College.




Navigating Computer Confluence (Read Me First!)

Here are a few pointers to aid you on your journey through *Computer Confluence*:

- **Know your boxes.** Text chapters include several types of boxes, each of which is designed to be read in a particular way.



The User's View boxes show you what it's like to be in the driver's seat with some of the most powerful and popular software on the market today. Even if you have experience with the software, take a little time to look over these boxes. Some key concepts are introduced in the User's View boxes. A UV symbol like this  in the main text means "This is a good time to look over the User's View box."



Rules of Thumb boxes provide practical tips on everything from designing a publication to protecting your personal privacy. They bring computer concepts down to earth with useful suggestions and concrete facts that can save you time, money, and peace of mind.



How It Works boxes are for those readers who want—or need—to know more about what's going on under the hood. These boxes use words and pictures to take you a little deeper into the inner workings of the machinery without getting bogged down in technical detail. The CD-ROM includes multimedia versions of many of these boxes as well as some bonus *How It Works* features that aren't in the text. If your course objectives or personal curiosity don't motivate you to learn *How It Works* material, that's OK; you can skip every *How It Works* box and still understand the rest of the material in *Computer Confluence*.

CURRENTS

Currents boxes, new in this edition, showcase timely, diverse, and often controversial points of view on information technology and its impact on our lives. These short essays and interviews, which close each chapter, offer thoughtful perspectives from some of the most important writers and thinkers on information technology today.

- **Watch for media roadsigns.** You don't need a CD-ROM drive and an Internet connection to explore *Computer Confluence*—you don't even need a computer. But these tools can make your journey more interesting. As you're reading the text, look for icons pointing you toward other media:



This icon means that the CD-ROM contains information related to this section of the book. It may be an animated illustration, a video clip, a software demonstration, or an interactive exercise. Use the CD-ROM's Multimedia Study Guide to find the chapter and section. The study guide is organized through a table of contents that matches the text; you can explore any subject by clicking on its name. If you're

feeling more adventurous than hurried, you can explore the CD-ROM by navigating your way through a 3-D Virtual Computing Center.



This icon means that there's material in the *Computer Confluence* World Wide Web site (<http://www.computerconfluence.com>) related to this section of the book. The *Computer Confluence* Web site includes in-depth discussions and essays on relevant topics, updates to time-sensitive material, multimedia illustrations or examples, and links to dozens of other interesting and useful Web sites. If you're in a hurry, you'll need to exercise some self-discipline; it's easy to spend hours following your curiosity around the Web.

- **Read it and read it again.** If possible, read each chapter twice: once for the big ideas and the second time for more detailed understanding. You may also find it helpful to survey each chapter's outline in the table of contents before reading the chapter for the first time.
- **Don't get stuck.** If a concept seems unclear on the first reading, make a note and move on. Sometimes ideas make more sense after you've seen the bigger picture. If you still don't understand a concept the second time through, check the CD-ROM and the Web site for further clarification. When in doubt, ask questions.
- **Remember that there's more than one way to learn.** Some of us learn best by reading, others learn best by exploring interactive examples, still others learn best by discussing ideas with others, on line or in person. *Computer Confluence* offers you the opportunity to learn in all of these ways. Use the learning tools that work best for you.
- **Don't try to memorize every term the first time through.** Computer jargon can be overwhelming if you tackle it all at once. Throughout the text, key terms are introduced in boldface, and secondary terms are italicized. Use the Key Terms list at the end of each chapter to review and the glossary to recall any forgotten terms. The CD-ROM contains an interactive cross-referenced version of the glossary so that you can quickly find any term without searching through the book.
- **Don't overanalyze examples.** *Computer Confluence* is designed to help you understand concepts, not memorize keystrokes. You can learn the nuts and bolts of working with computers in labs. The text examples may not match the applications in your lab, but the concepts are similar.
- **Get your hands dirty.** If possible, try the applications while you're reading about them. When you read about word processing in *Computer Confluence*, get some word processing experience. Your reading and lab work will reinforce each other and help solidify your knowledge. The CD-ROM contains demonstration versions of many popular applications.
- **Study together.** There's plenty to discuss here, and discussion is a great way to learn.
- **In a hurry? Turn the page.** The next few pages will give you a quick start—just enough information so you can start using the CD-ROM, the Web site, and related computer applications right away.