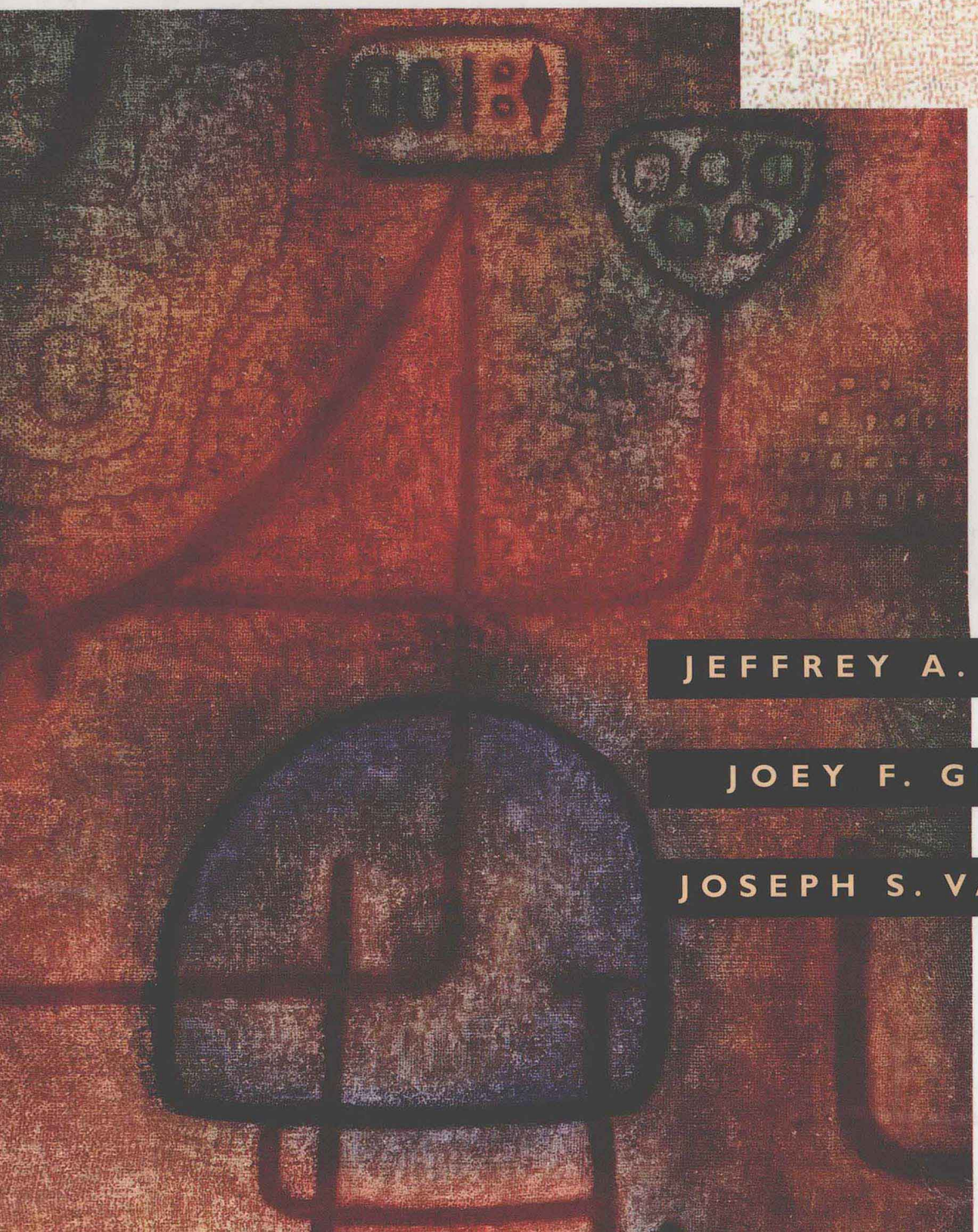
# Modern Systems Analysis and Design



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# MODERN SYSTEMS ANALYSIS AND DESIGN

**Jeffrey A. Hoffer • Joey F. George • Joseph S. Valacich**

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*To Patty, Missi, and Carrie, who are my heroes*
*and sources of energy and joy in life.*
*—Jeff*

*To Karen, Evan, and Caitlin, without whose support*
*and trust this book could never have been completed.*
*—Joey*

*To Jackie, Jordan, James and the rest of my family,*
*your love and support are my greatest inspiration.*
*—Joe*

# Preface

## DESCRIPTION

This book covers the concepts, skills, methodologies, techniques, tools, and perspectives essential for systems analysts to successfully develop information systems. The primary target audience is upper division undergraduates in a computer information systems curriculum; a secondary target audience is MIS majors in MBA and M.S. programs. Although not explicitly written for the junior college and professional development markets, this book can also be used for these programs.

The book is written assuming that students have taken an introductory course on computer systems and have experience designing programs in several third and/or fourth generation languages. We review basic system principles for those students who have not been exposed to the material on which systems development methods are based. We also assume that students have a solid background in computing literacy and a general understanding of the core elements of a business, including basic terms associated with the production, marketing, finance, and accounting functions.

This book is characterized by the following themes:

1. *Systems development is firmly rooted in an organizational context.* The successful systems analyst requires a broad understanding of organizations, organizational culture, and operation.

2. *Systems development is a practical field.* A coverage of current practices as well as accepted concepts and principles are essential in a textbook.

3. *Systems analysis is a profession.* Standards of practice, a sense of continuing personal development, ethics, and a respect for and collaboration with the work of others are general themes in the textbook.

4. *Systems development has significantly changed with the explosive growth in databases and data-driven architectures for systems.* Systems development and database management can be and possibly should be taught in a highly coordinated fashion; this means that this textbook and the McFadden and Hoffer database text, *Modern Database Management,* fourth edition, also published by Benjamin/Cummings, should be compatible. In fact, the proper linking of these two textbooks is a strategic opportunity to meet the needs of the IS academic field.

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5. *Success in systems analysis and design requires not only skills in methodologies and techniques but also in the management of projects: time, resources, and risks.* Thus, learning systems analysis and design requires a thorough understanding of the *process* as well as the techniques and deliverables of the profession.

6. *Systems development is increasingly becoming both automated and more strategic.* Students must understand the capabilities and limitations of such technologies as computer-aided software engineering (CASE) as well as know how systems relate to IS planning, business process re-engineering, and systems integration initiatives.

Given these themes, this textbook emphasizes the following:

- A business rather than a technology perspective.
- The role, responsibilities, and mindset of the systems analyst as well as the systems project manager rather than those of the programmer or business manager.
- The methods and principles of systems development rather than the specific tools or tool-related skills of the field.

## OUTSTANDING FEATURES

The following are some of the distinctive features of *Modern Systems Analysis and Design:*

1. This book is organized in parallel to the McFadden and Hoffer *Modern Database Management* text, which will facilitate consistency of frameworks, definitions, methods, examples, and notations to better support SA&D and database courses adopting both texts. Even with the strategic compatibilities between this text and *Modern Database Management,* each of these books is designed to stand alone as a market leader using the standard chapters found in each book.

2. Extensive coverage of oral and written communication skills including systems documentation (one thorough chapter on documentation, training, and support is included), project management, team management, and a variety of systems development and acquisition strategies (e.g., life cycle, prototyping, rapid application development, joint application development, participatory design, and systems re-engineering).

3. A clear linkage of all dimensions of systems description and modeling—process, decision and temporal logic, and data modeling—into a comprehensive and compatible set of systems analysis and design approaches. Such a broad coverage is necessary for students in order to understand the advanced capabilities of many systems development methodologies and tools that are automatically generating a large percentage of code from design specifications.

4. The grounding of systems development in the typical architecture for systems in modern organizations, including database management and distributed and client/server systems.

5. Coverage of rules and principles of systems design, including decoupling, cohesion, modularity, and audits and controls.

6. Consideration of standards for the methodologies of systems analysis and the platforms on which systems are designed.
7. Discussion of systems development and implementation within the context of management of change, conversion strategies, and organizational factors in systems acceptance.
8. Careful attention to human factors in systems design that emphasize usability in both character-based and graphical user interface situations.
9. CASE technology is used throughout the text to illustrate typical systems analysis and design documents and CASE-based systems development is discussed; however, no specific CASE tool is assumed. A wide variety of CASE products are illustrated and the current limitations of CASE technologies are highlighted.
10. In Chapter 3, survey results highlight the talents that good systems analysts have (and previews the main themes of the text) and helps students identify important material throughout the text.
11. The text includes a separate chapter on systems maintenance. Given the type of job many graduates first accept and the large installed base of systems, this chapter covers an important and often neglected topic in SA&D texts.

## PEDAGOGY

Several elements in the design and implementation of the text and its supplements make it readable and practical, holding the readers' attention, and assisting the instructor in delivering a better course.

1. Chapter 2 presents a scenario, Pine Valley Furniture (PVF) depicting how a systems analysis and design project is conducted by illustrating the critical success factors and deliverables of such projects. This provides the students with a target or goal for the course and a concrete example in which to better see how each specific topic is applied.
2. Sixteen of the twenty-one chapters include a running case study, Broadway Entertainment Company. This hypothetical, high-technology company provides a rich arena for bringing the concepts, skills, techniques, and tools explained in the chapter to life. Discussion questions for the case are provided in the *Instructor's Manual.*
3. Videotapes are available that will show practicing systems professionals engaged in meetings, interviews, and other tasks during the development of information systems. This series of four videotapes also includes discussions by systems professionals on the critical success factors for systems developers and for the management of systems projects.
4. In addition to PVF in Chapter 2, there are three case situations used throughout the book (several of these match cases used in the McFadden and Hoffer *Modern Database Management* text) to illustrate methods, notations, and design techniques.
5. End-of-chapter review questions and problems and exercises test students' knowledge of the material. An innovative addition is a set of field exercises

that give students an opportunity to explore the practice of SA&D in organizations.

6. Chapter objectives introduce each chapter to help the student identify the main topics within each chapter.
7. A comprehensive *Instructor's Manual* provides answers to all the review questions and problems and exercises from the text, plus teaching suggestions and selected questions and problems which may be used in tests or as supplemental exercises.
8. A case/project companion book is available that contains several projects and extended exercises; these follow the framework for systems development outlined in the text.
9. A comprehensive test bank of over 1,600 objective and short answer questions.
10. Transparency masters for the figures and tables in the book.

## USING THIS TEXT

As stated earlier, the book is intended for mainstream SA&D courses. It may be used in a one-semester course on SA&D or over two quarters (first in a systems analysis and then in a systems design course). Because of the consistency with *Modern Database Management,* chapters from this book and from *Modern Database Management* can be used in various sequences suitable for your curriculum. The book will be adopted typically in business schools or departments, not in computer science programs. Applied computer science or computer technology programs may adopt the book.

The typical faculty member who will find this book most interesting is someone

- with a practical, rather than technical or theoretical, orientation
- with an understanding of databases and systems that use databases
- who uses practical projects and exercises in the course.

More specifically, academic programs that are trying to better relate their SA&D and database courses as part of a comprehensive understanding of systems development will be most attracted to this book.

The outline of the book generally follows the systems development life cycle, which allows for a logical progression of topics. However, the book emphasizes that various approaches (e.g., prototyping and iterative development) are also used, so what appears to be a logical progression often is a more cyclic process. Part I of the book provides an overview of systems development, previews the remainder of the book, and shows the student what the process of developing systems is like. Part II covers those skills and concepts that are applied throughout systems development, including systems concepts, project management, and CASE technologies. The remaining five sections provide thorough coverage of the seven phases of a generic systems development life cycle, interspersing coverage of alternatives to the SDLC as appropriate.

Four appendices provide background or extensions to topics covered in the chapters. Appendix A reviews the types of information systems for which systems development projects are conducted. Appendix B overviews rapid application development. Appendix C presents advanced data modeling principles, which extends

Chapter 11. And Appendix D addresses object-oriented systems analysis and design methods, which are of great interest to developers of interactive and real-time systems.

Some chapters may be skipped depending on the orientation of the instructor or the students' background. For example, Chapters 1 (environment of SA&D) and 3 (critical success factors for SA&D) cover topics that are emphasized in some introductory MIS courses. Chapter 6 (project identification and selection) can be skipped if the instructor wants to emphasize systems development once projects are identified or if there are fewer than 15 weeks available for the course. Chapters 11 (conceptual data modeling), 15 (logical data modeling), and 16 (physical database design) can be skipped or quickly scanned (as a refresher) if students have already had a thorough coverage of these topics in a previous database or data structures course. Finally, Chapter 21 (maintenance and re-engineering) can be skipped if these topics are beyond the scope of your course.

Because the material is presented within the flow of a systems development project, it is not recommended that you attempt to use the chapters out of sequence, with a few exceptions: Chapters 9 (process modeling), 10 (logic modeling), and 11 (conceptual data modeling) can be taught in any sequence; and Chapter 15 (logical data modeling) can be taught before Chapters 13 (output design) and 14 (interface design), but Chapters 13 and 14 should be taught in sequence.

## SUPPLEMENTS

**Instructor's Manual on Disk**
*by Jeffrey A. Hoffer, Joey F. George, and Joseph S. Valacich*
Formatted in Acrobat, the Instructor's Manual accompanying **Modern Systems Analysis and Design** provides answers to all text review questions, problems, and exercises; plus teaching suggestions and transparency masters.

**Test Bank on Disk**
*by Lisa Miller, University of Central Oklahoma*
Includes 40–60 multiple choice, 15 matching, and 5 essay questions per chapter. Available for IBM and Macintosh.

**Computerized Test Bank**
Formatted in Acrobat, the computerized test bank includes the same questions as the printed version in a format that lets you edit questions and generate multiple tests. Available for the IBM PC and the Macintosh.

**Electronic Transparencies**
Formatted in Acrobat, include art from the text that you can manipulate, print as handouts, make into transparencies, or display directly from a computer in lectures. Available for the IBM PC.

**Projects and Cases Workbooks**
*by George Easton and Annette Easton, San Diego State University*
This companion workbook contains 10 cases and extended study questions.

**HyperAnalysis Toolkit (HAT)**
This CASE (computer-assisted software engineering) tool program gives students the opportunity to view and use the kinds of technologies illustrated in the text. Available bundled with the book.

**EDS Video Series**
*by Electronic Data Systems Corporation (EDS)*
This video series, prepared by EDS specifically to accompany **Modern Systems Analysis and Design,** consists of four video segments each approximately 15 minutes in length, that focus on systems analysis and design. Each includes an introduction and prologue from Professors Hoffer, George, and Valacich.

## ACKNOWLEDGMENTS

The authors have been blessed by considerable assistance from many people on all aspects of preparation of this text and its supplements. We are, of course, responsible for what eventually appears between the covers, but the insights, corrections, contributions, and proddings of others have greatly improved our manuscript. The people we recognize here all have a strong commitment to students, to the IS field, and to excellence. Their contributions have stimulated us, and frequently rejuvenated us during periods of waning energy for this project.

We would like to recognize the efforts of the many faculty and practicing systems analysts who have been reviewers of the several drafts of our manuscript. We have tried to deal with each reviewer comment, and although we did not always agree with specific points (within the approach we wanted to take in this book), all reviewers made us stop and think carefully about what and how we were writing. The reviewers were: Susan Athey (Colorado State University), Penny Brunner (University of North Carolina, Asheville), Donald Chand (Bentley College), Barry Frew (Naval Post-Graduate School), Jim Gifford (University of Wisconsin), Dale Gust (Central Michigan University), Ellen Hoadley (Loyola College—Baltimore), Robert Jackson (Brigham Young University), Len Jessup (Indiana University), Robert Keim (Arizona State University), Mat Klempa (California State University at Los Angeles), Nancy Martin (USA Group, Indianapolis, Indiana), Mary Prescott (University of South Florida), Terence Ryan (Southern Illinois University), Eugene Stafford (Iona College), Bob Tucker (Antares Alliance, Plano, Texas), Connie Wells (Nicholls State University), Chris Westland (University of Southern California), Charles Winton (University of North Florida), and Terry Zuechow (EDS Corporation, Plano, Texas). All of the reviewers provided honest and helpful comments. We want to especially recognize the in-depth comments from Robert Jackson (Brigham Young University), who always provided constructive comments and challenged us to state our ideas clearly and to say only what needed to be said.

We are very indebted to Len Jessup (Indiana University) for the preparation of the case studies which open each part of the text. Len not only wrote each case study but also identified most of the organizations on which the cases are based. Len and the authors would like to acknowledge the assistance of these organizations and their representatives who helped by being interviewed and editing the cases: Ken Chambless (Atkinson Construction, San Bruno, California), Peg Dawson (EDS Corporation, Indianapolis, Indiana), James Herrett (Atkinson Construction, San Bruno, California), Nancy Martin (USA Group, Indianapolis, Indiana), Craig Olsen (Albertson's, Inc., Boise, Idaho), Carl Pohrte (McHenry County, Illinois), Dori Pelz-Sherman (IVI Publishing, Minneapolis, Minnesota), Pat Steele (Albertson's, Inc., Boise, Idaho), Clay Tyler (Consensys Group, San Diego, California), Hadley Wagner (Albertson's, Inc., Boise, Idaho).

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material between chapters and appendices and we modified and added to our requests for his assistance. We have all come to appreciate Len's keen sense for quality teaching, the clarity of his thinking, and his friendship.

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We have also called upon several companies to supply examples of their CASE tools. We thank Antares Alliance, Sterling Software, Texas Instruments, and Visible Systems for their assistance in identifying and supplying various figures for the text.

One unique supplement to this text is a series of four video tapes which illustrate common activities and situations encountered by systems analysts. We are very excited about the pedagogical value of these tapes, and complement EDS Corporation for the sizable commitment of human and financial resources to develop and produce these tapes for exclusive use with our book. Specifically we thank Stu Bailey, Michael Cummings, Vern Olsen, Chris Ryan, and Terry Zuechow of EDS, Bob Tucker of Antares Alliance, and Bill Satterwhite of Whitecap Productions for all of their work on this project.

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Jeffrey A. Hoffer (Dayton, Ohio)
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