Information Retrieval Design

Principles and Options for Information Description, Organization, Display, and Access in Information Retrieval Databases, Digital Libraries, Catalogs, and Indexes

by

James D. Anderson
and
José Pérez-Carballo

Ometeca Institute

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Part I. Chapter 1. Introduction and Background Issues : 7

Assumptions and steps required before design begins; terminology; standards and codes of practice, types of databases.

Part II: Design Decisions : 43

Chapter 2. Subject Scope and Domain : 47

Defining the kinds of questions an information retrieval (IR) database will answer, with respect to subject or topical areas and also the operational and cultural domains of potential users; role of subject scope and domain as guide for database producers in the selection of messages and the creation of document descriptions and indexes; role as guide for potential users in the selection and navigation of appropriate IR databases.

Chapter 3. Documentary Scope : 73

Kinds of messages, texts and documents appropriate for fulfilling subject scope and user preferences; definition of searchable documentary features.

Chapter 4. Documentary Domain : 87

Domain (territory) covered in seeking sources for documents and documentary information; methods for discovery, location, and acquisition.

Chapter 5. Display Media : 91

Effective media for the presentation of IR databases.

Chapter 6. Documentary Units : 103

Appropriate size of documentary units to be presented to users; parts of documents versus complete documents and collections of documents.

Chapter 7. Indexable Matter : 111

Portions of documentary units to be analyzed for indexing.

Chapter 8. Analysis and Indexing Methods : 117

Nature of, and appropriate use of, automatic computer-based text analysis and indexing methods versus human intellectual analysis and indexing of messages.

Chapter 9. Exhaustivity : 177

Appropriate level of detail in the indexing of documentary units.
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Chapter 10. Specificity : 185
Appropriate level of specificity in indexing vocabulary.

Chapter 11. Displayed Versus Non-Displayed Indexes : 197
Support for multiple search modes: displayed indexes for browsing and visual inspection of headings; non-displayed indexes for machine matching of search statements with message, text, and document representations or full text.

Chapter 12. Syntax : 205
Creating intelligible index headings for browsing and visual inspection; syntactic support for user creation of search statements for computer matching.

Chapter 13. Vocabulary Management : 297
Assistance in dealing with alternative and variant terminology, multiple meanings, and conceptual relations among terms.

Chapter 14. Surrogation : 365
Representing messages, texts, and documentary units within the IR database.

Chapter 15. Locators : 373
Links between representations and full documentary units.

Chapter 16. Surrogate Displays : 383
Options for the display of representations in different contexts.

Chapter 17. Arrangement of Displayed Indexes : 391
Options in the display of browsable indexes: alphanumeric versus classed/relational arrangements.

Chapter 18. Size of Displayed Indexes : 441
Estimating the size of indexes when constraints are present (mainly for printed back-of-the-book indexes).

Chapter 19. Search Interface : 447
Presenting IR databases to users; displaying content and search options.

Chapter 20. Record Format : 495
Size and structure of documentary unit records for supporting design features.
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Chapter 21. Full-Text Display : 521

Options for analysis, encoding, and display of full-text documentary units.

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Bibliography : 567

This is the comprehensive bibliography for the book. Each citation concludes with references to the sections where the item is cited, so the bibliography can be used as an index to discussions of cited works.

Index : 591

The alphabetical subject index was compiled using the NEPHIS system, which is described in chapter 12 on syntax, section 12.2.2.3. Index headings refer to sections or paragraphs, not to page numbers.

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0.2. Preface, by James D. Anderson.
0.3. Acknowledgments, by James D. Anderson.
0.4. Special Thanks to Scholars and Practitioners of IR for the Use of Their Work.
0.5. Bibliographic Citations.
0.6. Dedication.

0.1. Foreword, by Jessica Milstead.

Users of information retrieval databases generally have no idea of the complexity of these databases, or of the effort that goes into development of their structure. This is as it should be; the design of the database should not have to be the users’ problem.

Once upon a time, in the days when the most sophisticated information retrieval databases were library card catalogs (which many users of this book probably don’t remember), the issue of just how much users should be expected to learn in order to satisfy their needs from the database was actually a lively one. Today all that has changed. Willingly or not, designers of information retrieval databases and the access systems that support them have come to recognize that users just want the information they need. The less effort required of the users, the happier they will be, and the more likely they are actually to use the database – and therefore the more likely they are to support its continuation and growth.

There is another side to the question, of course. The effort has to be undertaken somewhere. The easier a given database is to use, the more effort is required behind the scenes to assure that its use will be transparent. And the number of decisions to be made and issues to be resolved in the design of an information retrieval database is certainly not obvious to anyone who has not actually undertaken such a task. It’s not just a matter of dumping in some text and citations and turning a search engine loose – at least not if the information is valuable and you desire quality results.

Twenty years ago I wrote a small book (Subject Access Systems: Alternatives in Design, published by Academic Press) that discussed some of the major issues in information retrieval database design, but I didn’t even try to cover every aspect. Jim Anderson has now undertaken this daunting task, and in the online environment, which barely existed when I wrote my book. We had online databases, but they were hard to use, requiring the skills of trained searchers to exploit them fully.

Prof. Anderson has distilled his decades of experience in teaching and design of information retrieval databases to produce a work that covers every aspect of design. He spent a number of years as the chair of a National Information Standards Organization committee charged with revising the standard for indexes. His experience with that committee has enriched this, his magnum opus.
0. Prefatory Material (Section 0.2)

Sound textbooks for information retrieval database design have been very few, and none have been as comprehensive as this. I particularly enjoyed the practice of defining some examples, and following them as example cases in every chapter. With these example cases it becomes possible to see how the principles discussed in the chapter would be applied in an actual database.

Prof. Anderson’s work will serve a variety of users. It synthesizes much that is known, while bringing to bear its author’s insights on issues. The case studies make the work particularly useful as a textbook, but it will also serve as a refresher for those already in the field, and as a reference for all audiences.

0.2. Preface, by James D. Anderson.

This book is for our students, and for others who aspire to design the best possible information retrieval (IR) databases for every type of clientele and every type of message, in whatever medium or format. The overall objective is maximum effective retrieval of useful messages for each particular user.

The scope of this book is determined by the features of modern IR databases. The term “information retrieval database” or “IR database” is used in the broadest sense. Increasingly IR databases are designed for and implemented in digital media, but the design principles addressed in this book apply just as much to all media, including print on paper, microfilm or fiche, or even card catalogs. They certainly apply to modern digital libraries. The basic definition for the term “IR database” as used in this book is any database in any medium designed or created for the purpose of discovering and retrieving messages, texts and documents. Thus, it includes the whole gamut of IR databases presented to users via online connections, the world-wide web, CD-ROMs, or in print on paper: indexing and abstracting services (regardless of medium), library catalogs (including OPACs: online public access catalogs), bibliographies, and indexes, including back-of-the-book indexes (which can now be presented electronically with electronic books!). This and related definitions are expanded in the first part of the book.

This book is organized around twenty fundamental design issues in IR database design. See the table of contents for a summary of these issues. These are issues that I have identified during twenty-five years of investigation, teaching, design, evaluation, and creation of IR databases. These issues were further refined between 1991 and 1997 by Committee YY of the National Information Standards Organization (NISO). This committee, which I chaired, focused primarily on indexing and indexes, which are fundamental components for all IR databases. But in fact, the committee addressed all of the fundamental design issues for IR databases.

NISO had charged Committee YY with developing a new standard for indexes that would cover every type of index:

- whether produced by human intellectual analysis or machine algorithm;
- whether presented in print or electronic media;
- whether designed for searching by human visual inspection of index headings or by electronic computer matching of search terms against document records or full text; and
0. Prefatory Material (Section 0.2)

- regardless of the code, medium or format of the messages being indexed (linguistic, musical, pictorial, mathematical; visual, aural, tactile; print, microform, film, video, electronic, digital, etc.; monographic or serial; in any genre or format).

- NISO technical report on design of indexes : 5

The results of the work of this committee, based on input from the NISO member organizations most concerned about the design of IR databases as well as hundreds of individual information professionals, was published in a technical report: Guidelines for indexes and related information retrieval devices (Anderson 1997a).

- publications related to this book : 6

This NISO technical report covers the scope of this book in a highly compressed format. Another even briefer presentation of the issues covered in this book, but in a less technical and more discursive style, is contained in my encyclopedia article: “Organization of knowledge,” in the International encyclopedia of information and library science (Anderson 1997b, revised 2002).

- views of Milstead (Jessica L.) on IR database design : 7

This book rests on the foundations of research and practice in information retrieval, IR database design, indexing and cataloging by persons too numerous to mention. Some of their publications are cited in the bibliography at the end of this book. Here I want to acknowledge one book in particular, which has served as a precursor and exemplar for this book: Subject access systems: alternatives in design by Jessica L. Milstead (1984). Like this book, Milstead’s emphasis and purpose were to foster intelligent design of IR databases. Although organized differently, Milstead covers many of the same points as we do, and we hardly ever disagree! I highly recommend her book. It has aged very well!

- views of Bates (Marcia J.) on IR database design : 8

I also want to pay special tribute to the work of Marcia Bates. One of her earliest articles, “Rigorous systematic bibliography” (1976) got me started in my analysis of IR database design principles. In that article, she focused on attributes of scope and documentary domain, and also on explicit criteria for selectivity. Since then, she has been a leader in research and commentary on essential aspects of the design and use of IR databases. She summarizes much of her work, and that of others, in “Indexing and access for digital libraries and the internet: human, database, and domain factors” (1998). Here she discusses such essential issues as human factors, indexing and searching terminology and structures, statistical distribution properties of documents in collections and databases, and subject domain-oriented indexing. In this book, her work has been especially influential in the chapters on scope and domain, vocabulary management, and interface design.

- views of Chowdhury (Gobinda G.) on information retrieval : 9

Most books on information retrieval focus on particular approaches to this broad field, such as human indexing, library cataloging and classification, or automatic indexing. A recent book that adopts the same kind of broad view as this book is G. G. Chowdhury’s Introduction to modern information retrieval (1999). The organization and focus of our two books is different, but readers who desire another viewpoint can benefit from Chowdhury’s book.

- Pérez-Carballo (José) as co-author: 10

Dr. José Pérez-Carballo, my former colleague in the School of Communication, Information, and Library Studies at Rutgers University, has joined me as co-author of this book. He has helped with the entire book, but he has taken special responsibility for sections on automatic indexing and interface design.
0. Prefatory Material (Section 0.3)

I hope that this detailed concentration on the fundamental decision points of IR database design will help members of the information professions to consider all the options, and then to design and create better IR databases. Our society needs the best possible IR databases to cope with the ever growing explosion of information on the internet and the world-wide web, as well as in older print formats, video, film, audio, and electronic formats.

0.3. Acknowledgments, by James D. Anderson.

Many thanks go to my students who have used and critiqued drafts of this book: Debbie Abrams, Jane Achola, Michael Angeles, Shawn Armington, Robert Barbanell, Frances Berman, Michele Lisoski Bond, Elana Broch, Linda Brown, John Burchard, Dorothea E. Clark, Susan Clark, Lisa Coats, Kathleen Creegan, Thomas M. Dolan, Lisa Ellis, Olga Evanusa-Rowland, Loisann Griglak, Ted E. Hamer, Lonnie Johnson, Mary Kearns-Kaplan, Richard K. Kearney, Michael Knies, Scott Kushner, Mariann E. Lucas, Marygrace Luderitz, Ruth Eleanor Lufkin, Mary Marks, Sal Mazzola, Mary McMahon, Antonio M. Pasqualoni, Beth Patterson, José Fernando Peña, Fran Pfeffer, Frances Pinto, Laura Poll, Jill Ratzan, Robert Rittman, Vivian Thiele, Regan L. Tuerff, Susan Turkel, David Utz, Mary O. Walker, Renee Watson, Karen Wenk, Melissa Yonteck, and Zhu Xuening (Sean). Terry Edwards was an especially careful reader, checking not only text for sense and typos, but also the embedded index strings! Jill Ratzan gave parts of the final text a rigorous perusal.

I thank them for their valuable editorial assistance. As they worked with earlier drafts of this book, they were very good at pointing out defects.

Special gratitude goes to my long-term colleagues and primary mentors in the world of indexing, information retrieval, and information science, Dr. Jessica Milstead and Dr. Hans Wellisch, who read intermediate drafts of this book and made many excellent suggestions, most of which I endeavored to implement. I also thank the members of NISO Committee YY, who worked closely with me for many years (1991-1997) on the issues addressed in this book: Barbara Anderson, Knight-Ridder Information, Inc.; Catherine Grissom, U.S. Department of Energy, Office of Scientific and Technical Information; Nancy Mulvany, Bayside Indexing Service; Barbara Preschel, Public Affairs Information Service; Deborah Swain, IBM and Society for Technical Communication; and (again) Hans Wellisch, University of Maryland; and also (again) Jessica Milstead, our liaison from the NISO Standards Development Committee, and Patricia Harris, NISO executive director, both of whom shepherded our work with expertise, care and compassion!

0.4. Special Thanks to Scholars and Practitioners of IR for the Use of Their Work.

This book rests squarely on the work of hundreds of colleagues in the world if IR and IR database design. Every author and every published work is listed in the bibliography, but here we want to give special thanks to those colleagues and organizations whose work we have used most extensively, sometimes with extensive quotes. I trust that our use has been within the bounds of
0. Prefatory Material (Section 0.5)

scholarly “fair use,” but beyond the legalities of use and attribution, we want to express our sincere appreciation for and dependence on their work — indeed, these authors and organizations are co-authors of this work with us:


We also give special thanks to the students of James D. Anderson who shared their design work to help illustrate concepts in chapter 19:


0.5. Bibliographic Citations.

All publications cited in this book are listed in alphabetical order in the bibliography at the end of the book. Citations are presented in accordance with the U.S.A. national standard ANSI/NISO Z39.29-1979. Bibliographic references (American National Standards Institute 1979). A revision of this standard was approved in 2003. The only significant change for our purposes was moving the placement of dates for periodical articles from the end of the citation, after volume and issue numbering and pagination, to prior to the volume and issue numbering (National Information Standards Organization 2004?). We did not adopt this small change.

0.6 Dedication.

We dedicate this work to Rafael and Dwayne, the wind beneath our wings.