versions of papers on Z39.50, minutes of the Z39.50 Implementers Group (ZIG), and many other resources.

It might be a service to the library community to see either the authors or others working with the standard follow up this book with a series of essays, preferably made available online, that present in a relatively non-technical way some of the issues and design considerations that have arisen during more recent work. Some subjects worthy of discussion include the digital collections profile, the Computerized Interchange of Museum Information (CIMI) profile, ranked list query, the Inter-Library Loan (ILL) protocol, and structured vocabulary browse proposal. Beyond these, of course, lie the larger questions: in a world of creative, new, non-library-based indexing and retrieval services such as Alta Vista, Excite, Lycos, and the many others to come—services with huge composite megaindexes that will in due course include a great deal of bibliographic information—will there still be a need for Z39.50's approach to intersystem communication? Further, when document ordering, browsing, reading, and "microcharging" can all take place over the Web, directly at the publisher's Web site, will there still be a role for Z39.50 at all?—*Stephen Paul Davis, Columbia University*

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Knowledge-Based Systems for General Reference Work: Applications, Problems, and Progress. By John V. Richardson, Jr. San Diego: Academic Press, 1995. 355p. (ISBN 0-12-588460-5). LC 94-31851.

Two monographs on the subject of expert systems for reference services were published before this book. The first, entitled *Expert Systems In Reference Services,* was originally published as a special issue of *Reference Librarian* in 1989. It contains eleven articles that describe the potential of expert systems and document

several microcomputer-based prototypes (Roysdon & White, 1989). Alberico and Micco (1990) share a scope similar to that in Richardson's book. Both provide a general introduction to artificial intelligence and expert systems, and address the modeling of reference services. Although both books include surveys of expert system applications in reference services, Alberico and Micco's is more a broad overview, while Richardson treats the subject in more depth.

In the first half of chapter 1, Richardson systematically explores the history of reference teaching and the reference paradigm. Richardson does so by examining the tools for teaching: its textbooks. Individual textbooks are considered in chronological order, and Richardson devotes a separate section to each one discussed; the name of the textbook writer serves as the section heading. Each section begins with brief background information about the textbook writer followed by an analysis of the book itself. The fact that Richardson almost always begins each section with a biographical note on the textbook writer lends his study a decidedly historical flavor. In analyzing the textbooks, Richardson looks for answers to three questions: (a) How are reference works arranged (i.e., format)? (b) How is reference work described (i.e., method, or so called procedural knowledge)? and (c) How does the reference librarian interact with the user (i.e., mental traits)? By considering these questions, Richardson is able to explore the three basic facets of a paradigm for teaching reference work. That paradigm is discussed in detail in the second half of the chapter.

Chapter 2 defines an expert system by briefly outlining its major aspects: its history, types of knowledge, inference engine, system interface, the major AI (artificial intelligence) programming languages, and knowledge elicitation methods. Richardson justifies the role of expert systems in library and information science (LIS) in the final section of this chapter, by pointing out all groups of people who should have vested interests in expert system development.

In chapter 3 Richardson argues that reference work is a viable domain for rule-based expert systems. On one side of the rule (i.e., condition) reference questions are broken down by category. On the other side (i.e., conclusion) answers are provided according to formats of reference sources. Richardson relies heavily on speculation when discussing boundary considerations, likelihood of success, and the philosophical and ethical issues of expert system development.

A flowchart model of general reference transactions is the theme of chapter 4, "Modeling the Reference Transaction." This model is explained in detail and is heavily supported by another excellent historical study on research in reference transactions.

Chapter 5 develops a blueprint of an expert system for general reference work; this is based on the procedural-rule model introduced in chapter 3. Richardson takes the time to explain not only the basic-level rules for various formats of reference sources but also the tree structure of subordinate-level knowledge for each format of reference sources. Although Richardson presented the tripartite paradigm of reference work in chapter 1, the blueprint presented here primarily utilizes the format facet of that paradigm.

Chapter 6, written by three former Richardson students, deals with a peripheral topic of this book: the criteria used to evaluate expert system shells. It begins with a very brief introduction to expert system shells, and proceeds to give a list of criteria for selecting an appropriate expert system shell. These criteria are grouped into the following sections: knowledge base, methods of reasoning, interface, update and editing, end-user interface, software, hardware, training, documentation, and cost. This chapter builds on the introductory text in chapter 2 and addresses the application level of expert system research.

The issue of user interface in a reference expert system is the topic of chapter 7, written by Karen Howell. Early in the chapter, Howell reviews research on user interface and identifies some misconceptions about user interface design. This is followed by specific suggestions on user interface design for a general reference expert system.

Chapter 8, complements the discussion in chapter 6 on the application level of expert system research by providing a catalog of prototype and commercial expert systems in reference services. A total of fifty-seven projects are described, with each project given a separate section. Information about each project includes the name of the project's principal investigator, staff, and domain experts. Richardson also provides detailed information about the hardware, software, scope, system size, user interface, special features, perceived benefits, and cost. This extensive catalog is followed by an essay that evaluates recent progress. The typical knowledge-based system in reference service, Richardson summarizes, "has been built by one or two people using a shell" for an academic library environment; "it is a relatively uninspired system, not based on a theoretical model of reference transactions." He concludes that "it is much easier to create a first-generation prototype than it is to put an operational KBS [knowledge-based system] into place," and calls for the research and development of second-generation expert systems (p. 294). However, Richardson does not clarify in this chapter what might distinguish first- and second-generation expert systems from one another.

The final chapter emphasizes the future of expert systems for reference services and its constraints and consequences. At the core of this chapter is an attempt to describe past constraints, dispel current doubts, and provide optimism for the future. An appendix gives a checklist of criteria for selection and an annotated listing of more than 20 available expert system shells.

Richardson's monograph is a record of several research projects he has conducted in the past few years that had the purpose of further understanding the teaching and practice of reference work. The numerous awards that chapters of this book have received show the strengths of this book: comprehensive scope; in-depth and well-documented reviews; and superb, systematic organization. Many chapters of the book can serve

as excellent sources for different groups of readers: educators studying reference textbooks, researchers modeling reference transactions, and students with advanced knowledge in the development of expert systems in general and application of reference services in particular. Researchers and advanced students who study expert systems in other areas, such as cataloging and classification, will find individual chapters valuable for surveying the subject area. Readers will be delighted to find the extensive reference notes at the end of individual chapters and the bibliography at the end of the book.

Having said that, however, it is necessary to point out several of the book's weaknesses. Richardson's overall arrangement is problematic. The division of chapters into three headings (applications, problems, and progress) seems arbitrary, and the explanation of this tripartite structure in the preface (p. xii) is confused and unconvincing. Chapters 2 and 3 appear to be out of place in relationship to the book's other theoretical discussions on reference work. Richardson's own recommended teaching order (p. viii) is further evidence that the chapters are not arranged in logical order. The arrangement of chapters contributes to another problem in the book: the lack of a smooth transition between chapters. This problem might be due partially to the fact that some chapters were written as independent research papers, although Richardson could have solved it by giving users more help in his introduction. Finally, the historical research in this book, while contributing to the strength of chapters 1, 4, and 8, also contributes to an imbalance in the depth of perspective on the subject areas treated. The comprehensive, well-documented historical reviews contrast sharply with the weaker generalizations and speculations on the future of expert systems. One wonders whether Richardson is as confident in, and positive about, the future of expert system research as he is about its history.

Research on expert systems enjoyed almost a decade of popularity among LIS researchers since its introduction to our field by Smith, who wrote her dissertation in 1979. Like much technology-related work, this research began with high hopes and enormous potential, and stimulated numerous experiments and prototypes. Researchers and advanced students spent countless hours reading textbooks on expert systems and learning about artificial intelligence programming languages. The common purpose among many designers of expert systems in LIS was, in most cases, to identify a very narrow domain of library operations and to codify what many saw as the simple rules and procedures of those operations into procedural knowledge of an expert system. But because the researchers studied narrow domain and simple routine library tasks—and made no attempt to study the formidable issue of knowledge acquisition and representation—it proved impossible to transform their prototypes into successful operational systems. As the majority of projects faded or were forgotten near the end of 1980s, many researchers concluded that expert systems offered more limitations than possibilities and thus moved on to other topics. One of the few traces left from LIS expert system research is the keen awareness, among some researchers, of the need to study the conduct and learning process of LIS professional knowledge and skills. Richardson provides an important contribution to the area of LIS expert system research by analyzing reference teaching and reference transactions through historical studies and surveys.—*Ling Hwey Jeng, School of Library and Information Science, University of Kentucky*

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