in the record and their respective starting positions. The directory is constructed by computer based on cataloging information" (24)?

Perhaps the book is best suited for self-study by those who already have cataloging expertise but want to learn more about cataloging specialized formats and electronic resources. Even they may be disappointed because Hsieh-Yee tends to mention a new technology or means of providing access without going into enough detail to be useful. More explanation of new terminology would be helpful, and a glossary would have been a useful addition to the text.

The suggested readings at the end of each chapter and the extensive bibliography of both print and online resources are helpful sources for further information. In addition, a textbook supplement "to facilitate access to important cataloging tools and recent updates on the treatment of audiovisual and electronic resources" (xiii) is available from the publisher's Web site, at www.lu.com.textsuppl. html. Author/title and subject indexes are included but are sometimes confusing; for example, CORC Project is listed under author/title but not in the subject index.

Hsieh-Yee does not improve on or add to Nancy Olson's classic work, *Cataloging of Audiovisual Materials*, which, for its fourth edition, added "and Special Materials" to its title and now includes guidance on cataloging electronic and Internet resources. Perhaps if Hsieh-Yee had not added the subtitle "A Cataloging Guide" to her book, I would not have been so disappointed in it.—*Linda Behrend (behrend@aztec.lib.utk.edu), University of Tennessee-Knoxville Library.*

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Saving the Time of the Library User Through Subject Access Innovation: Papers in Honor of Pauline Atherton Cochrane. Ed. William J. Wheeler. Champaign, Ill.: University of Illinois Graduate School of Library and Information Science, 2000. 217p. $30 (ISBN 0-87845-108-0).

This volume celebrates fifty years of trailblazing in user access to information. The title is a reference to "Save the time of the reader," the fourth of Shiyali Ramamrita Ranganathan's five laws. In 1970 Pauline Cochrane gave a series of lectures in India in which she offered an American view of Ranganathan's laws (Atherton 1973). There she identified the need for research to match the user's need with the structure of information resources, as reported by Linda C. Smith in this volume (100), so that catalogs that save the time of the reader could be constructed to reflect human search behavior. Twenty years later Cochrane again considered Ranganathan's laws, this time as criteria for information technology assessment (Cochrane 1992), and the need to demonstrate that a system "improves the timeliness, precision and comprehensiveness of information provision to users" (100). One of the few women conducting research in the 1950s, Cochrane was denied the doctorate because the statistical validity of her innovative user-evaluated relevance studies was questioned (65, 77). The topic was controversial in the politically charged environment surrounding the introduction of automated information retrieval systems, often supported by large federal grants. Undaunted, she persevered and produced an enduring legacy of publications and outstanding

students. The underlying focus of her research and teaching has been the goal of establishing empirical methods to enhance end-user subject access.

Some of Cochrane's remarkable early research projects are described by her long-time colleague Donald King in "Blazing New Trails: In Celebration of an Audacious Career." In studies undertaken for the American Institute of Physics (AIP) in the early 1960s, she looked beyond the severely limited capabilities of the available systems to examine the formulation of search queries as though an "ideal information retrieval system" were in place (60). Previously, user expectations were constrained by these limitations. Analysis of 5,000 active search requests obtained from a questionnaire sent to physicists allowed her to develop a comprehensive approach to respond effectively to the institute's actual needs (Atherton and Borko 1965). Author participation was introduced through "Aid-to-Indexing" forms completed before publication. These AIP studies flew in the face of government-contracted automation vendors' approach to system development. At a time when batch-processing retrieval was the norm, Cochrane's evaluation of an interactive Universal Decimal Classification-based system (dubbed AUDACIOUS) demonstrated vastly enhanced efficiency by combining the hierarchical and multifaceted classification with the controlled vocabulary index from the *Nuclear Science Abstracts* (Atherton, King and Freeman 1968). Interactive classification research weighed precision against recall in assessing the "cost" required to achieve various levels of recall—and pointed the way to relevance feedback. The Syracuse University Psychological Abstracts Retrieval System (SUPARS) provided online free-text searching of titles and abstracts. SUPARS was accessed by remote telecommunication terminals located across the campus. Assistance

was provided to users by telephone, three-quarters of whom had never used a computer before. Half reported successful retrieval even though at the time only two years of abstracts were available (Atherton 1971). Cochrane's scorned dissertation research sought to achieve a replicable, statistically valid experiment to evaluate a key process in document retrieval. It involved searches of a test bed of documents reviewed by proxy users to determine their relevance to each query. Intermediaries screened the search outputs using various types of indexing, including natural and controlled vocabulary. Precision and recall of the retrieved document sets were scored against the relevance previously identified by the users. Unlike previous work, such as that of Cyril Cleverdon and the Cranfield group, this experiment demonstrated the possibility of quality control for screening accuracy based on user-relevance judgment (65).

In the 1960s and 1970s, there was an explosion of information retrieval research, largely funded by federal agencies, with much competition among system design approaches. Evaluation methods were a critical issue in the battle for funding. These debates revolved around defining and measuring relevance. Crucial to the evolving model for system-accuracy assessment was the derivation of conditional probabilities from various observed relevance values. Cochrane's unique approach had produced two conditional-probability data concerning screening options, which were incorporated into standard models (72).

The in-depth evaluations of the AUDACIOUS and SUPARS projects were among the first, and for some time the last, such studies of an operational, interactive, online system. Lavish government funding had precipitated a highly competitive and contentious period of development in information retrieval, but by 1980, the

funding dried up; and the work that had been done became virtually unknown until the advent of widespread Internet use. After another twenty years, digital-library initiatives have led us to rediscover information-retrieval research, only to reinvent rather than to build upon the knowledge abandoned only a few years before (77). Although her early work was all on the cutting edge at the time, the issues Cochrane identified eerily foreshadow life as we know it in academic libraries today. One cannot help but wonder how much we have really learned in the last fifty years.

In "Obstacles to Progress in Mechanized Subject Access and the Necessity of a Paradigm Change," Robert Fugmann identifies false assumptions upon which current subject access research is predicated. As information technology has progressed, parallel achievements in subject access have not. The ability to provide unsatisfactory responses faster and cheaper has in fact undermined them (8). He attributes these to the inherent flaws of an overly positivist philosophy. The uncritical acceptance as empirical law of an "inverse relationship between precision and recall" (15) is debunked as an apparent excuse for inadequate systems. Failures in precision are attributed to poor representational fidelity from an absence of specificity in, or unreliable application of, the indexing language. Predictability, the ability of the searcher to select valid search terms in data storage and retrieval controls recall. The effects of "input parsimoniousness" (29) on system failure are detailed, particularly poor indexing grammar and vocabulary structure. Free-text searching of increasingly large files is exposed (11–15) as a fundamental absence of syntactic and semantic structure, rarely justified by user satisfaction, often only by reduced input cost. I have often found Fugmann's style dense; this is not light reading. The analysis is trenchant, his

arguments sharply articulated. Extensive previous literature is cited, if often his own. The careful reader will be amply rewarded for the effort.

Looking back twenty-five years to her initial investigations of mapping controlled vocabularies in support of cross-database searching, Linda C. Smith (one among Cochrane's many distinguished former doctoral students) reviews current developments and identifies directions in research needed to fully exploit newer technologies in her paper "Subject Access in Interdisciplinary Research." Early machine-readable databases were narrowly focused on established disciplines and retrieved document-surrogates from a limited array of controlled vocabulary descriptors and keywords from abstracts (101). Not only have the size and number of databases and related index vocabularies increased continually, so too has the diversity of sophisticated search techniques available, including full-text searching. The Internet may be viewed as an immense multiple-database-retrieval system lacking in unified access tools. Various possibilities for controlled vocabulary integration have been employed, including switching languages to mediate translation, microthesauri consisting of subsets of specialized terms extracted from larger sources, and macrovocabularies that encompass multiple existing languages into a superstructure (105–106). Various techniques for cross searching have been implemented to assist in database selection, to generate online catalog displays linking overlapping subject heading systems such as Library of Congress and medical subject headings, to facilitate interdisciplinary citation indexing and to manually map multiple vocabularies within a single large domain such as medicine or art. Interdisciplinary behavior has not been adequately documented to account for the subjectively constructed meaning of search vocabulary encountered in various contexts.

Classification and thesaurus design must be expanded to conceptualize specific work domains across which searches are conducted (110). New technologies must be exploited to improve the interfaces between users and systems to enhance navigation through large and diverse resources. Information visualization holds great potential as an aspect of system development in the environment of graphic-user-interface software (111). As much as innovations in information retrieval may enhance capabilities for interdisciplinary research, so may the need to support such research serve to reorient theoretical perspectives on knowledge organization.

Not everyone has forgotten the accomplishments of early information science research. Karen M. Drabenstott, another of Cochrane's former students, contributed to this volume "Web Search Strategies," a detailed guide to adapting standard information retrieval search strategies to the functionalities of Internet search tools. She makes the distinction between search strategy (or overall plan) and search tactic, a move made to advance the strategy, and identifies the fundamental role of Boolean algebra in the capacity of automated systems to respond to complex queries not possible before the introduction of computers. The complexity of refinement with which these concepts can be applied was a central issue in preparing librarians to search databases and continues to present a stumbling block to end-user searches (128). The half-dozen most frequently used bibliographic database search strategies were first documented in a form widely known among librarians in the training manual for Educational Information Resources Clearinghouse searchers prepared by Drabenstott and Cochrane (Markey and Atherton 1978). Different Internet search tools have developed as the Web grew in size and diversity of file types, with the use of hyperlinks for navigation as the

uniquely distinguishing feature known as "surfing the Web." Initially home pages linked to other pages recommended by the owner, were developed by "trailblazers," persons expert in a topic who graciously maintain a set of relevant links, into subject directories that systematically guide searchers to sites based on subject content rather than mere personal interest (124). As general and commercial use of the Internet skyrocketed, commercially maintained search engines appeared that continuously retrieve and index large portions of the Web based on words and phrases contained in various portions of the hypertext mark-up language coded files. These are used to retrieve ranked displays in response to search queries. Unless a search is very specific or employs a tightly constructed argument involving Boolean and truncation techniques, search engines routinely retrieve tens—even hundreds—of thousands of citations (126). As the number of search engines proliferated rapidly, metasearch engines appeared to, as it were, search the search engines, either by listing selected search engines with guided query forms for each or by providing a common query form submitted to search engines selected by the metasearch engine based on the terms entered (128). Whereas in the past the searcher's goal was primarily resource recovery, now the most severe problem is rationally sorting and browsing through large response sets. As Gregory H. Leazer has observed, we now inhabit an information economy of abundance rather than scarcity such that "the scarce resource is no longer the information, but people's attention spans" (St. Lifer 1999).

Drabenstott creatively maps basic information-retrieval strategies onto the capabilities of the new Internet search tools (129), to present six new search strategies for Web searchers not previously documented. These are

explained step-by-step with clever, timely scenarios that characterize actual Web-search user behavior (132–5) and are also charmingly illustrated with Stanley the Squirrel cartoons. Catchy titles for the strategies such as "Shot in the Dark" and "Bingo!" epitomize the droll style Drabenstott often uses to good effect in putting across complex, subtle concepts. She draws a marked contrast between Web use and use of early commercial databases that employed a uniformly terse vocabulary, limited to titles or abstracts and thesaurus descriptors. Access was restricted due to the expensive connect time required. Therefore searches were most often performed by a remote intermediary rather than the end user, limiting interaction and relevance feedback within the search process (115–116). What was once the exclusive preserve of professional searchers is now open to literally millions in their own homes because of the explosive surge in access provided by the digital revolution. The resonance with Cochrane's analysis of the user component of the SUPARS project involving interactive, online searches by computer-naive end users now seems truly prescient. In much the same vein, Drabenstott's startling and yet down-to-earth initiatives will be a valuable contribution to bibliographic instruction and digital literacy programs.

Other contributors Raya Fidel, Bjorn Tell, Vinh-The Lam, and Eric H. Johnson present papers built on concepts and methods that Cochrane pioneered. Indeed Pauline Atherton Cochrane is a trailblazing woman, whose life and work are to be celebrated for bringing the helping profession values of librarianship to the high-tech world of online information. Her accomplishments have been far ahead of her time and their relevance has grown exponentially.—*J. Bradford Young (jbyoung@pobox.upenn.edu) University of Pennsylvania Libraries, Philadelphia.*

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