

the basis for innovation. An information service, as the authors suggest, is an important element of any plan to manage change. But change in organizations is sometimes slow and, because people are involved, often difficult. For this reason, there are two points that the book could have stressed further and thus increased its utility to change practitioners and professionals.

First, people are the innovators in organizational transformation processes. While the technology review of chapter 5 was useful, this chapter was an excellent place to explore various *sociocultural* themes of information services in innovative organizations. Though social and cultural issues appear throughout the text, they might have been introduced in the second section of chapter 1, where the various perspectives of innovation are discussed and detailed. Maybe sociocultural themes are woven too tightly with the existing material to unravel into a separate chapter or section, but it would have been interesting to see the result. Pointers to the information technology literature could have provided a sufficient review without loss of continuity.

Second, because the book *itself* is innovative, implementing the design principles or adopting the propositions from chapter 6 might be difficult to achieve in some organizations. Some who wish to use these ideas might find resistance in moving from awareness to adoption of these concepts. The information sources matrix of chapter 4 would have been a useful tool for illustrating how the principles and propositions could be introduced to an organization that seeks to be innovative. This reviewer would have benefited from an illustration of how the principles and propositions could be put into practice using some of the strategies suggested. Maybe other readers would benefit similarly. Nevertheless, this book is a great addition to the Academic Press Library and Information Science Series. I sincerely hope that it is not that last that moves library and information science knowledge into professional domains that are constantly being redefined by the rapid evolution and deployment of infor-

mation technology.—Anthony B. Maddox, *Department of Library and Information Science, University of California, Los Angeles.*

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Using Subject Headings for Online Retrieval: Theory, Practice, and Potential. By Karen Markey Drabenstott and Diane Vizine-Goetz. San Diego: Academic Pr., 1994. 365p. (ISBN 0-12-221570-2). LC 93-42568.

Enhancing a New Design for Subject Access to Online Catalogs. By Karen M. Drabenstott, with the research assistance of Celeste M. Burman and Marjorie S. Weller. Ann Arbor: Univ. of Michigan, School of Library and Information Studies, Nov. 1994. 162p.

Testing a New Design for Subject Access to Online Catalogs. By Karen M. Drabenstott and Marjorie S. Weller, with the research assistance of Jeffrey M. Holden. Ann Arbor: Univ. of Michigan, School of Library and Information Studies, Aug. 1995. 370p.

Karen Drabenstott is the most prolific researcher of *Library of Congress Subject Headings (LCSH)*. *Using Subject Headings for Online Retrieval* synthesizes various studies that she has published, often jointly with other researchers.

The book begins with an introduction to *LCSH*. The intended audience might be library systems programmers who have not studied cataloging. The assumed prior knowledge of the reader is not defined, but the explanation of syndetic structure is inadequate for novices: the codes are defined, but the semantic relationships are not presented clearly.

Chapter 2 provides a detailed description of machine-readable *LCSH*. Experienced catalogers can learn much here about the coding of subject authority rec-

ords. The subsequent chapter includes data on subject terms in bibliographic records covering all fields from which topical terms can be derived. The compatibility of the Library of Congress (LC) subject authority file and bibliographic files is treated in chapter 4, which lists the types of headings found in the latter that are not in the former.

Chapters 5 through 10 describe research on user queries, using the unobtrusive method of transaction log analysis. There are honest accounts of the difficulty of demarcating search sessions and of distinguishing gibberish from serious searches. The authors' use of the term "access point" (p. 246) for "search argument" blurs the distinction between subject terms provided by catalogers and those in *user queries*. Drabenstott and Vizine-Goetz limit their explanation to subject searching because they "are reluctant to generalize these normalization techniques to other access points because [they] encountered so few queries for corporate names and uniform titles in our study" (p. 243); i.e., system designers should put effort into solving *common* problems of searching, not rare ones.

In going through chapters 5 through 10, I found it frustrating to read descriptions of search failure followed by frequent references (e.g., on p. 181) to chapter 11, in which a new approach is described. A more satisfying structure would have been the description of a problem followed by a proposed method for dealing with it. Once you get to chapter 11, the recommendations are not startling. The authors, who earlier described the limitations of browsing alphabetical arrays of subject headings, propose the use of search trees, a sequence for system parsing of queries (first looking for exact matches and reporting the results, then summarizing subdivisions), and finally presenting options for browsing related terms.

The phrase "related terms" (p. 251) covers broader, narrower, and related terms. I disagree with the recommendation that "[i]f twenty or fewer related terms are available, it . . . makes no sense to divide them into separate screens for

narrower, broader, and related terms" (p. 251). A hierarchical display of subject headings helps orient users to the structure of the vocabulary (Weinberg 1993). Numerous search arguments reported in the book are names of broad disciplines. In a high percentage of cases, users actually require terms many levels narrower, but none of the system enhancements proposed addresses multilevel hierarchy.

The excessive number of "related terms" for a single subject heading often emanates from LC's failure to follow thesaurus principles (NISO 1994). For example, "Libraries and Television," a narrower term of "Television" in *LCSH*, fails the "is a" test; the compound expression is not a *type of* television. Numerous cases of search failure reported in the book result from poorly formulated headings or missing cross-references in *LCSH*.

The authors present excellent suggestions for enhancing subject authority records, e.g., to identify headings that follow a pattern. I hope that LC staff members will study the book carefully and make necessary changes to *LCSH*. Some of the recommendations for change, such as refining the coding of subdivisions in *LCSH*, would increase the complexity and hence the inconsistency of MARC databases. These recommendations are made under the rubric "exact approach," which might better have been termed "categorized approach." "The Future of Subject Headings for Online Information Retrieval" is treated in chapter 14; the consensus is that "*LCSH* is here to stay" (p. 332). The authors are not sanguine that the system will be revamped, however.

The book covers the research literature on subject headings well; sometimes the original source of an idea is not credited. For example, the authors cite Chan's 1972 paper, which "suggested modifications to period subdivisions to help automated systems file them in the proper chronological order" (p. 189). Harris (1970, 170-71) proposed such modifications earlier. The authors cite papers from the information science literature that deal with *LCSH* and OPACs. Studies of searching thesaurus descriptors in online serial databases are potentially relevant

but not cited; conversely, Drabenstott's work is relevant to that genre.

In data-rich chapters, information overload is mitigated by the "Synthesis and Summary" at the end of each chapter. Some of the tables present data in strange ways: terms for variable data fields are in the right-hand column of table 2.2, with statistics on the left. The tables summarizing findings on subject searching in various online catalogs show the totals in the center column and data for individual systems on the right (e.g., table 7.2).

The anonymous index is substantial but has numerous flaws. First, it is incomplete: important topics, such as double posting, are not represented. The index is inconsistent in two ways: some topics do not have a complete set of locators, and the arrangement of headings alternates between word-by-word (Form subdivisions; Format integration) and letter-by-letter (Online catalogs; Online catalog use studies).

Many of the problems with subject searching discussed in the text inhere in the index: (a) *excessive postings*: the entry "Retrievals, too many" has 26 locators, including ranges, covering 39 pages—more than 10% of the book; (b) *deblinding cross-references*: the index has chains of references, e.g., "Local formats, see Internal formats; Internal formats, see Processing formats," and many of the headings to which the reader is sent are not exact matches to those in the cross-reference; (c) *lack of access to all words in headings*: "Subject Heading System/Thesaurus Codes" (p. 50) is not indexed under "Thesaurus," the most important term in the string; (d) *poor syndetic structure*: there is no link, for example, between NACO and National Coordinated Cataloging Operations. Also complicating the reader's use of the index is the lack of double posting, the conversion of *see* references to entries for headings with one locator. There are formatting flaws as well, notably bad breaks—pages that begin with sub-headings, without continued lines for headings.

This is an important book with much valuable data. It deserved more careful editing and especially a more thorough

index, to enhance the reference value of the work. I believe that it will be used primarily by researchers to check the prior literature and to compare their methodology with that of the authors. The back cover describes the book as "an indispensable tool for online system designers." I hope this group will read it; Crawford (1996) describes the process of development of the Eureka end-user interface to the Research Libraries Information Network (RLIN): a bunch of people sat around and brainstormed. Consultation of the research literature is not mentioned.

The most recent work cited in the book is 1992. The technical reports describe subsequent research and include more current references. There is something anachronistic about the relationship between the two reports. The earlier one, *Enhancing*, cites the later one, with a 1994 date and a slight variation in title: *Testing a New Design for Subject Searching to Online Catalogs* (p. 87, 101, 146). Logically, testing would precede enhancing. The first report (p. 70) uses enhanced search trees from *Testing* and discusses the later report's results.

Both reports are largely redundant with the book in terms of background and literature citations. *Enhancing* focuses on subject queries for which online systems are unable to produce retrievals, using the same data—and some of the same figures—as in the book, plus new data from MIRLYN, the University of Michigan's online catalog. Some of the old queries are reclassified in the later study (p. 10), underscoring the human interpretation involved.

The authors note the different meanings of postings data in the various systems—bibliographic records or subject headings (p. 20). The variation in the way commercial systems parse queries is a major trap for end-users and librarians. Bruce Croft (personal communication) has observed, however, that such systems should not be standardized while experimentation is still going on.

Table 4.8 includes satisfaction categories, and table 4.9 shows the difference in meaning between what users input and

what they really want, but interviews are not mentioned in the description of research methods. The information seems to be inferred from subsequent search arguments. The book makes this clear in a section called "Match Satisfaction" (p. 145-46). Table 4.18 shows that search arguments frequently match title words, but not *LCSH*, underscoring the need to review the adequacy of that controlled vocabulary.

The authors call for additional research "to help users and systems differentiate queries for subjects . . . from queries for personal names" (p. 91, 100). Borderline cases between subject and personal names, such as eponyms, justify the merger of subject and name authority files—a simple solution that would not require users to do the triage. *Testing* (p. 291-92) reports that when users are prompted to make the distinction between name and subject, they sometimes answer incorrectly. This problem is an extension of user difficulty with divided card catalogs. The authors suggest (*Enhancing*, p. 97) that subject headings for fictional characters be processed in two indexes: personal names and subjects. Merging the indexes would obviate the need to do this.

Classification schemes are discussed in chapter 7 as a means of reducing large retrievals. Captions from the classification scheme were displayed to users, and the number of records retrieved was reduced in accordance with the selection of the appropriate discipline. Statistical association techniques between classification and subject heading systems are of limited value for subject indexing, in my opinion, because *LCSH* and bibliographic classification schemes have such different structures—one has concrete topic as the initial element, while the latter selects discipline as primary facet—the association of the two means little. Furthermore, multiple LC subject headings can be analytical, while a class number designed for shelving cannot be. If you retrieve the most frequent class number, you haven't solved the problem of too many hits, as the authors note for "Pornography"—90% in class HQ. Truncation of class numbers, the authors suggest, retrieves even more

records. The data show how inconsistent the two major schemes are in placing a concrete topic within a discipline: Dewey classes the majority of works on acid rain in the social sciences, while LC puts most of them in technology (*Enhancing*, p. 117). Noting that the titles assigned a subject heading might all have different class numbers, the authors conclude that this is a "hit or miss proposition" (p. 136).

Third-level classification captions are considered as a device for narrowing searches, although first-level narrower terms were the only technique employed for *LCSH*. Using classification to increase retrieval simulates a well-known user strategy: search a term, find a call number, and go to the shelf.

Chapter 8, "Highlights of Project Activities," is followed by numerous appendices listing the class numbers associated with selected subject headings. No feature headings (captions) are provided. Rank order (high to low frequency) would have been more appropriate than alphanumeric order by class number, given the focus of the study.

Testing a New Design for Subject Access to Online Catalogs reports on an experimental online catalog called ASTUTE (A Search Tree Underlying the Experiment), designed to implement Drabenstott's ideas and test their retrieval effectiveness. The catalog included bibliographic records and subject authority records. Diacritics were deleted in the former because they "could adversely affect retrieval" (p. 27); multiscript online catalogs are currently being marketed, but accents on Latin characters still present problems.

The project team had to clean up the records, which included incorrect tags and canceled subject headings. Not correcting these problems would have created a more realistic environment for experimentation: catalog maintenance is seriously neglected today. The researchers created a new category for form subdivisions, separating them from topical subdivisions. They converted coded data from the 008 control field (e.g., illustrations, biography) to English-language equivalents that could be used in subject

searching. They also wrote a program to generate reciprocals of broader terms in LC authority records and add them as narrower terms to the appropriate records. The assumption of the study is in the introductory sentence of chapter 4: "The subject terms users enter into online systems possess certain characteristics that reveal the subject searching approaches most likely to succeed . . ." If this were true, there would be a higher success rate.

Chapter 5 enumerates the desired features of the relational database management system sought for ASTUTE, with speed of retrieval the main consideration. FoxPro 2.0 was selected. ASTUTE was composed of two catalogs: the Blue Test System, governed by search trees, and the Pinstripe System, in which subject searching approaches were selected randomly. The flow diagrams for search trees found in the book are reproduced in the report. In ASTUTE, *broader term* and *narrower term* relationships are misleadingly called "synonyms" (figure 5.3). The handling of *related terms* is not described. The term *specialized subtopics*, which is used for subdivisions (p. 69–70), implies narrower terms.

In contrast to the prior studies based only on transaction log analysis, in ASTUTE, users were informed that they were participating in an experiment. They were asked three presearch questions relating to their frequency of use of computer systems and their major field of study, as well as eleven postsearch questions comparing the performance of the Blue Test and Pinstripe systems. The authors review prior studies that compare online systems, and they detail the reasons for rejecting human intermediaries as interviewers—essentially cost (p. 102). Librarians as well as end-users tested the system; the former were interviewed. Users were given three values for relevance rating: "useful," "possibly useful," and "not useful" (p. 111). Elsewhere the values "very useful" and "somewhat useful" were given (p. 167), which could be interpreted differently.

A pretest of the comparison search experiment was conducted on library sci-

ence students (not representative of end-users), and changes were made to the interface and questionnaires. Owing to user tampering, the system crashed soon after installation at the first site. This affected the reliability of the data, and a second, less tamperable system was installed (p. 123–24). At the second site, users also played with the system; many searches were considered corrupted, and the data from the first collection period was disregarded. The life of a researcher is not easy.

The second data collection period resulted in 50% usable queries (p. 127). Quite late, it was discovered that when users typed an *r*, the system interpreted it as an *i*, resulting in many erroneous terms. Numerous postsearch responses were suspect: users repeatedly hit the Enter key, selecting the same number for all questions. Many queries were unusable because they were out of scope: one test site was limited to works on science and engineering; the second, to history. This detracts from the real-world nature of the experiment: the challenge of information retrieval using *LCSH* is finding relevant documents in a multidisciplinary database. The problem of homographs is much smaller in a database limited to one discipline.

The researchers' honesty about their errors and failures is laudable. They admit having "erroneously included main- and added-entry fields for personal names" (p. 134), when only names as subjects were within the scope of the project. Still, users rated such records "very useful," indicating that they were not sure of the difference between an author and a subject. Users selected names unrelated to those they had input and rated the records "very useful" (p. 134, 146), indicating the complexity of user-based relevance measures.

The researchers in fact categorized many queries as "playing" and "meaningless" (p. 135–36). The early Cranfield experiments were criticized for not having real users' questions. The disheartening reports of vandalism of an experimental system and meaningless queries that waste a researcher's time almost warrant a return to artificial tests on serious users.

The usable data for this study increased when library staff participated.

The examples on page 147 show that users selected personal name headings other than those in the query, but in the same alphabetical neighborhood. At an ASIS Annual Meeting, Drabenstott observed that if users don't find the term they are seeking, they think that the one alphabetically adjacent to it will deal with the desired topic. (Bring back the human intermediary!) The researchers express their discouragement and skepticism about the reliability of end-users' relevance assessments (p. 149).

One possible reason for the preponderance of "very useful" assessments is the ease of pressing the Enter key. Alternative methods of eliciting a deliberate selection of a rating are suggested (p. 150). Users also repeatedly selected the first-listed response on the postsearch questionnaire and even on the presearch questionnaire; the researchers found the number of computer science majors searching the history database suspect (p. 156).

The finding that "the longer queries were, the less likely the experimental systems would make a match" (p. 163) contrasts with studies of indexing and searching that have found that the more words you put in, the greater the likelihood of hits. The reason for the opposite in the online catalog environment must be the implied Boolean AND. Other interesting findings: users displayed more titles when fewer were retrieved (p. 166) and gave inconsistent relevance assessments for titles displayed twice. The assessments were more positive when the records were redisplayed, and it was decided to accept the final one.

Chapter 9 explains calculation of the precision ratio: the number of "very useful" ratings divided by the number of displayed titles. Results were higher for the Blue System at one site and for Pinstripe at the second. For those defending human indexing, this finding is significant: precision scores for controlled vocabulary were much higher than for free text in both systems. The estimated recall statistics are suspect, but the authors could not exam-

ine every document in the collection to get a true measure. From an analysis of the postsearch questionnaire it was found that most users preferred the Blue System.

Failure analysis of searches is discussed in chapter 10. User display of too few titles is one cause; another is that users terminated searches too early, before all the exact search options were pursued. The researchers speculate that the results were too complex for users to understand, and they were confused about which option to pursue (p. 205). On pages 214-17, user frustration with a series of searches that took 30 seconds each is described.

In discussing specificity of user queries, the researchers express surprise that titles containing the term in the query received negative relevance assessments. They speculate that "the topic that users had in mind was not quite the same as the subjects of the queries" (p. 206). Underlining a point made above, I recommend that the hierarchy of subject headings be displayed *before* the exact match. A case in point is on page 267: A user searching "heat transfer" gave negative ratings to all 42 titles displayed for an exact match on this cross-reference, but rated as "useful" a high percentage of titles for the narrower term "Heat exchangers." I believe that many users don't understand that *LCSH* does not provide detailed indexing. *Enhancing*, table 5.3, presents data on multiword searches in subject-specific databases, such as Medline, but the authors note that some queries still got no hits.

After analyzing searches that failed as a result of vocabulary problems, the researchers call for automatic truncation, best match, and removal of punctuation. The discussion of search failures attributable to multiple factors is particularly interesting. It is commendable that the researchers admit that an alphabetical display of subject headings adjacent to the search argument would be better in some cases than search trees (p. 213), and recommend that some of the exact-search option menus be skipped—just show the user some titles (p. 217). The authors' admission of an oversight in the design of

the experimental catalogs—double posting of hyphenated words was not implemented (p. 312)—is in contrast to the glowing reports one generally reads of such systems.

Repeatedly, the authors express surprise that users did not select the "Display titles general works" menu option after the system led them to a specific term that seemed right on target. I think users misinterpreted this option as taking them back to the beginning, rather than as a heading without subdivisions. In the table summarizing the reasons for unsuccessful searches, "Vocabulary of user queries" (p. 231) has the highest percentage after database failure (i.e., topic out of scope) in the system based upon controlled vocabulary. The authors recommend adding a go/see list bearing alternative terminology (p. 316). *The Art & Architecture Thesaurus* (1994) includes variant word forms in its syndetic structure; so could *LCSH*.

Displaying titles was the most frequently selected browsing option; few users took advantage of the offer of broader and narrower terms or subdivisions (p. 259). The researchers admit that the Expand option might have been misinterpreted by some users (p. 268); they recommend experimenting with understandable terminology and the design of simple menus (p. 272). The authors observe that users might not have known how to backtrack; a general principle of interface design is that such instructions should always be displayed.

I think it was a mistake not to separate the results for librarians from those for end-users. In any case, the librarians' comments and suggestions are very interesting. Particularly notable is the observation, "'Expand' capability seems like a 'black box.' I sure would like to know what it is doing" (p. 300). This is another basic principle of search interface design: tell users how they got there. The recommendation for automatic spelling correction (p. 307) violates this principle.

This report is must reading for anyone designing a study of end-user searching. The "suggested system improvements" (p. 303-4) serve in part as a list of what not to do in a study. Chapter 12 concludes with

redesigned search trees, except for personal-name subject queries.

The spiral-bound, desktop published reports are attractively formatted, with well-positioned running heads. With few editorial flaws, they are easier to read than the typeset book. Regrettably, however, neither of these reports is indexed, and they both have only end-of-chapter references. Few people read technical reports, and Drabenstott recognizes the need to republish such gray literature in order for the work to get attention.

One of the goals of the project was to disseminate the research findings through publications in the professional literature. The *Testing* project was described by Drabenstott and Weller (1994) before the testing was actually done. A paper called published by Drabenstott in 1996, cites *Testing* but not the *Enhancing* report. That journal article does not seem to be a summary of the report with the same title because it does not deal with classification. When research is republished in multiple versions, it is important to indicate when a paper is a summary of a technical report (and, if so, cite it), whether it reports new information, etc.

Drabenstott and her coauthors present a detailed analysis of subject heading structure and display in the published works. These works show how complex a single general precoordinate system is. Linking it to multiple specialized thesauri designed for postcoordination is extremely complex. As the Internet grows, I hope that this research will be applied to enhance end-user subject searching, without eliminating the human cataloger, indexer, or search intermediary.—*Bella Hass Weinberg, Division of Library and Information Science, St. John's University, Jamaica, New York.*

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Geographic Information Systems and Libraries: Patrons, Maps, and Spatial Information. Papers presented at the 32nd Annual Clinic on Library Applications of Data Processing, 1995, Urbana-Champaign, Ill.: Ed. Linda C. Smith and Myke Gluck. Champaign, Ill.: Graduate School of Library and Information Science, Univ. of Illinois at Urbana-Champaign, 1996. 240p. \$30 (ISBN 0-87845-097-1).

Librarians looking for a textbook introduction to the main issues involved in providing information services using geographic information system (GIS) technology will want to look elsewhere before tackling this volume. With some exceptions, this is a book that will best serve those with prior knowledge of GIS. At its best, it makes a valuable contribution to the advanced literature of digital libraries and fills a gap in the literature for the more experienced practitioner, whether librarian, GIS specialist, or other interested party. At its weakest, it suffers from the same faults as many edited proceedings; overall, the chapters do not come together to form a cohesive whole, and there are a couple of papers that contribute little to the volume. The chapters include reports of original research, accounts of practical experiences, and descriptions of important initiatives. The contributors include some of the top names in the field.

Thanks to last year's flurry of publishing activity, both newcomers and more seasoned veterans to GIS services in libraries have an array of resources from

which to choose to increase their knowledge of this burgeoning field. As editors Linda Smith and Myke Gluck acknowledge in their introduction, the Thirty-Second Annual Clinic on Library Applications of Data Processing coincided closely with the publication of three special journal issues related to the same topic (p. 1). Of these three journal issues, papers appearing in special issues of *Information Technology and Libraries* (Lutz 1995b) and in *The Journal of Academic Librarianship* (Hernon 1995) provide the basic introduction to GIS and libraries necessary for an appreciation of many of the chapters in the volume under review. All these sources define the basic terms and concepts needed to understand GIS technology.

Geographic Information Systems and Libraries opens with the clinic's keynote address by Mark Monmonier. Author of the 1985 book *Technological Transition in Cartography*, Monmonier looks back at each chapter of his book. In doing so, he gives a concise and clever overview of cartographic advances and policy issues, and he reiterates his frequently on-the-mark predictions related to the impacts of technology and policy on mapping. In addition to being an advocate of getting people to realize that the main product of mapping is information, not a printable image, Monmonier is one of the few people to mention the challenge of preserving electronic cartography. This is an issue of much concern to archivists, but little discussed in the GIS literature related to libraries. Monmonier states, "I am not aware that any library or archive is systematically preserving late twentieth-century electronic cartography. Yet the challenge is enormous because an adequate historical record would include not only maps, data, software, and other artifacts but also information on how people . . . are using cartographic data" (p. 12). Archivists do understand the challenge Monmonier describes, and this is an area ripe for cooperation between librarians and archivists. Like some other papers in the volume, Monmonier's chapter reads like the script of an oral presentation, which, unfortunately, does not always make for an